July 10, 1995

FINAL AGENDA

51st WIPP QUARTERLY REVIEW MEETING
July 13, 1995

EMNRD 2nd Floor Conference Room
2040 S. Pacheco Street
Santa Fe, NM

8:30 a.m.	Introduction and Opening Remarks	10 min.	C.Wentz Task Force
8:40 a.m.	U.S. Department of Energy: Status/Activity Report[1]	40 min.	G.Dials, DOE/CAO Manager
9:20 a.m.	Environmental Evaluation Group: Status/Activity Report[2]	30 min.	R.Neill, EEG Director
9:50 a.m.	N.M. Environment Department: Status/Activity Report[3]	20 min.	K.McKamey/ S.Zappe, NMED
10:10 a.m.	N.M. Radioactive Waste Task Force: Status/Activity Report	15 min.	C.Wentz Task Force
10:25 a.m.	BREAK		
10:35 a.m.	Augmented Draft Compliance Certification Application (DCCA)[4]	25 min.	R.Bills, DOE/CAO
11:00 a.m.	Status of PA Models and their QA	30 min.	J.Mewhinney, DOE
11:30 a.m.	LUNCH		

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[1] To include "System Prioritization Method-2: Resulting Management Decisions" and "WIPP Supplemental Environmental Impact Statement-II" presentations.

[2] To include summary of Oil/Gas Technical Workshop.

[3] To include update on status of WIPP RCRA Part B permit.

[4] To include information on Performance Assessment activities undertaken in preparation for the July 1995 DCCA supplemental sumbmittal to EPA.

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FINAL AGENDA
(continued)

51st WIPP QUARTERLY REVIEW MEETING
July 13, 1995

EMNRD 2nd Floor Conference Room
2040 S. Pacheco Street
Santa Fe, NM

1:15 p.m.	National TRU Waste Integration	30 min.	Cliff C.Holman, DOE
1:45 p.m.	Safety Analysis ~~Report (SAR)~~: Status ~~and Issues~~ Scheduled for a later focus meeting.	45 min.	Bill B.Bartlett, EEG
2:30 p.m.	BREAK		
2:45 p.m.	Radiological Survey of Surface Contamination at the Gnome Site	30 min.	Jim J.Kenney, EEG
3:15 p.m.	"Action Item" Commitments/Closeout	10 min.	C.Wentz
3:25 p.m.	ADJOURN		

WIPP Quarterly 7/13/95

Chris — Opening – suggest new method for developing agenda.
George – in light of budget cuts, meetings need to be more focused (travel, etc)

George Dials CAO — Constrained resource environment. Having to consider schedule speedup of LWA Amendment if passed. NMVP final submittal 6/96, decision by 12/97 (not 6/97). NEPA SEIS ~~schedule~~ may bog down, but have more control over FSAR & Operational Readiness Report.
Skeen Bill hearings 7/21.
SEIS Scoping meetings held in 5 locations – technical concerns w/ disposal activities, not siting.
Q.– will SEIS include dose calculations & not just cumulative release? – Not sure, but probably, since it is a full disclosure document.
SPM-2 considered interactions between experiments, eng. alternatives, etc.
"Mitigation requirements are unnecessary, fleecing America"

Bob, Neil EEG — Introduced Dr. Wendy Rice – geo/hydrol/petrol. eng.
DOCA disappointing because calculations unavailable for review.
How can EEG better assist others with technical questions (input)?

Lokesh — See handout.

Keith McKenney — Poor bond seals in boreholes.

George Dials – LDR's very expensive because of handling, air emissions

Questions about RCRA – public meetings prior to draft permit?

Chris Wentz — Governor's WIPP resolution - updated from 89. Release of $20M in Roswell, Santa Fe, & leftover to Carlsbad & Artesia. Task Force meeting 9-12, 7/14 at Round House. Sept 6-7 NACEPT meeting in Alb.

Handed out Transportation Safety Program Implementation Guide - Draft

72B Cask certification protocol — concern over public perception if only modeling, & not full scale tests, is conducted.

Bob Bills — DCCA Augmentation

Purpose of DCCA was to get format & content guidance from EPA. Identify critical issues requiring additional work.

PA Status - significant discussion about NQA 2.7 verification & validation

Cliff Holman NTP — Idaho privatization initiative - treatment of wastes to deal with unknown & TRU wastes

Bill Bartlett CEG — May 90 RSMR - will be total rewrite. Continuing concerns: Host issues/requirements, anal. of accident scenarios, use of backfill, operations of CAMs, maintenance of existing excavations, CH waste flammability, containment issues, waste retrievability.

Schedule meeting late August, early Sept

Jim Kenney — Grame site rad survey

NEW MEXICO ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

July 6, 1995

Mr. George Dials
Manager
Carlsbad Area Office
U.S. Department of Energy
P.O. Box 3090
Carlsbad, NM 88220-3090

Mr. Benito Garcia, Chief
Radioactive and Hazardous
Materials Bureau
N.M. Environment Dept.
P.O. Box 26110
Santa Fe, NM 87502

Mr. Robert H. Neill
Director
Environmental Evaluation Group
7007 Wyoming Boulevard, N.E.
Albuquerque, NM 87109

Mr. Lindsay Lovejoy, Jr.
Assistant Attorney General
Attorney General's Office
P.O. Drawer 1508
Santa Fe, NM 87504-1508

Gentlemen:

A revised FINAL AGENDA for the 51st WIPP Quarterly Review Meeting among DOE, EEG and New Mexico State agencies is attached. The attached agenda has changed slightly from the proposed version I mailed out on June 27, so please take time to look it over. The meeting will still occur on Thursday, July 13, beginning at 8:30 a.m. in our (EMNRD) 2nd Floor Conference Room, located at 2040 S. Pacheco Street in Santa Fe.

See you all on the 13th!

Sincerely,

Chris J. Wentz
Coordinator
N.M. Radioactive Waste Consultation Task Force

Attachment (1)

c: Jennifer A. Salisbury, Task Force Chairman
Heidi Snow, EMNRD
John Parker/Steve Zappe/Pat McCasland/Keith McKamey, NMED

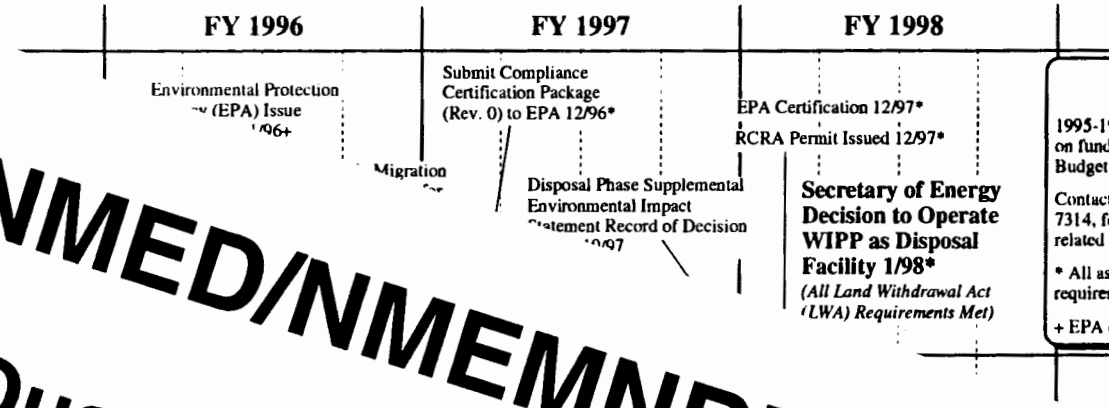
EEG/NMED/NMEMNRD

51st Quarterly Meeting

George Dials, Manager
Carlsbad Area Office

July 13, 1995

WIPP Disposal Decision Plan



DDP MILESTONES COMPLETED

- Draft NMVP to EPA 5/95
- RCRA Part B application to NMED 5/95

795R

NO-MIGRATION VARIANCE PETITION

- Draft submittal *5/95*
- Final submittal *6/96*
- Expected EPA decision *12/97*

795R:6793e

RCRA PART B APPLICATION

- Order issued by New Mexico Environment Department Secretary, 9/2/94
- Final application submitted to New Mexico Environment Department on 5/31/95
- Permit expected to be issued 7/96

795R:6793f

COMPLIANCE CERTIFICATION APPLICATION

- Draft compliance certification application submitted 3/95
- Draft compliance certification application will be augmented 7/95
- Final compliance certification application will be submitted 12/96
- EPA review of compliance certification application to be completed 12/97

795R:6793d

UPCOMING DDP MILESTONES

- Final models to PA *9/95*
- Remote-handled study *10/95*
- Sealing systems design report *10/95*

795R:6793c

OPERATIONAL ACTIVITIES

- Supplement to Environmental Impact Statement
- Operational Readiness Report
- Final Safety Analysis Report

795R:6793g

WIPP SEIS MANAGEMENT COUNCIL

- Chaired by CAO manager
- Formed to assure team approach to SEIS preparation and review consistent with June 1994 Secretarial Policy on the National Environmental Policy Act
- Composed of a CAO assistant manager, the CAO NEPA compliance officer, and HQ reviewers from the offices of Environmental Management; Environment, Safety and Health; and General Counsel

Harold Johnson

parallel review, not serial

- Management Council will resolve issues early and facilitate expedited HQ review and approval of the WIPP SEIS

795R:6793s

WIPP SEIS SCHEDULE

- Schedule was accelerated due to potential passage of the Skeen bill
- Accelerated schedule would complete the SEIS in 17 months, close to secretarial target of 15 months for environmental impact statements
- Record of Decision in March 1997, instead of October 1997

795R:6793t

WIPP SUPPLEMENT ENVIRONMENTAL IMPACT STATEMENT ACCELERATED SCHEDULE KEY DATES

● Notice of Intent published in Federal Register	*8/95*
● Public scoping meetings Carlsbad Alb. Santa Fe Denver Boise.	*9/95*
● Draft Supplement Environmental Impact Statement distributed	*4/96*
● Public hearings on the draft Supplement Environmental Impact Statement	*6/96*
● Final draft Environmental Impact Statement distributed	*1/97*
● Record of Decision issued	*3/97*

795R:6793v

COMPARISON OF BASELINE AND ACCELERATED SEIS SCHEDULES

Baseline	Accelerated	DDP	Date
		Draft compliance NMP/RCRA	Pre 6/95
Preplanning 4 months	Preplanning 2 months		6/95
	NOI/scoping 2 months		
		Final models	9/95
NOI/scoping 4 months	IP 2 months		
	Draft SEIS 5 months		12/95
IP 2 months			
		Final CCDF	3/96
Draft SEIS 6 months			
	Hearings 2 months		
			6/96
	Final SEIS 7 months		
			9/96
Hearings 4 months			
		Final compliance	12/96
Final SEIS 5 months	ROD 2 months		
			3/97
			6/97
ROD 4 months			
			9/97

795R:6793u

OPERATIONAL READINESS REPORT

- Begin preparation of plan-of-action *12/95*
- Plan-of-action approved by EH *9/96*
- ORR final report *11/97*

795R:6793w

FINAL SAFETY ANALYSIS REPORT

- Establishes/documents safety basis for CH-TRU waste operations
- FY95 update ensures continued compliance with
  - DOE Order 5480.23
  - Consultation and Cooperation Agreement
  - Land Withdrawal Act
- Phased submittal of preliminary draft chapters

795R:6793x

FINAL SAFETY ANALYSIS REPORT

Chapter		
3	Principal Design and Safety Criteria	*3/95*
4	Facility Design and Operation	*3/95*
5	Hazards and Accident Analysis	*6/95*
6	Technical Safety Requirements	*7/95*
7	Radiation, Hazardous Material, and Operational Safety	*8/95*

795R:6793y

FINAL SAFETY ANALYSIS REPORT

Chapter		
1	Executive Summary	*9/95*
2	Site Characteristics	*9/95*
8	Management, Organization, and Conduct of Operations	*9/95*
9	Quality Assurance	*9/95*
10	Decontamination and Decommissioning	*9/95*

795R:6793z

FINAL SAFETY ANALYSIS REPORT

- Complete draft *10/95*
- Final report *4/96*

795R:6793aa

SPM-2

- Results delivered 3/31/95
- Results available to stakeholders 5/95
- CAO used results to decide which program activities to pursue for compliance demonstration
- SPM results will not be used for compliance demonstration
- Performance assessment will be used for final compliance certification application

795R:6793h

WHAT SPM DID

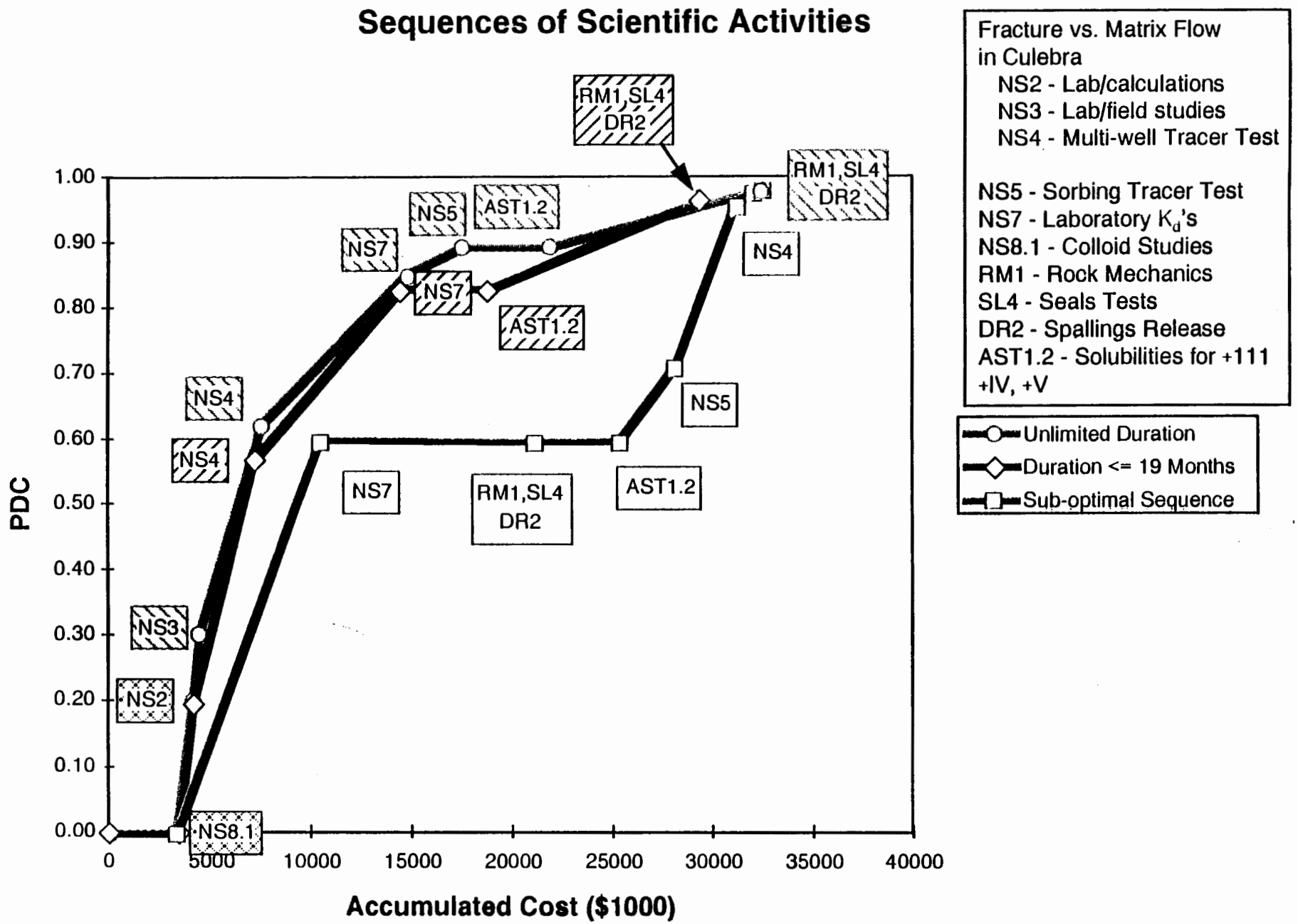
- Evaluated experiments, EAs, and PBWACs for their mutual value in demonstrating compliance
- Considered duration, cost, and probability of demonstrating compliance

795R:6793i

EXPERIMENTAL ACTIVITIES BEING PURSUED

Activity set #27,190

795R:6793j


Sequences of Scientific Activities
PDC
Accumulated Cost ($1000)
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0
5000
10000
15000
20000
25000
30000
35000
40000
RM1,SL4 DR2
RM1,SL4 DR2
NS5
AST1.2
NS7
NS7
AST1.2
NS4
NS4
NS4
NS5
NS7
RM1,SL4 DR2
AST1.2
NS3
NS2
NS8.1
Fracture vs. Matrix Flow in Culebra
NS2 - Lab/calculations
NS3 - Lab/field studies
NS4 - Multi-well Tracer Test
NS5 - Sorbing Tracer Test
NS7 - Laboratory Kd's
NS8.1 - Colloid Studies
RM1 - Rock Mechanics
SL4 - Seals Tests
DR2 - Spallings Release
AST1.2 - Solubilities for +111 +IV, +V
Unlimited Duration
Duration <= 19 Months
Sub-optimal Sequence

EXPERIMENTAL ACTIVITIES BEING PURSUED

- Colloids
- Culebra fracture/matrix flow
- Multi-well tracer
- Rock mechanics
- Seals studies
- Blowout releases
- Actinide source term
- Chemical retardation in the Culebra

795R:6793k

EXPERIMENTAL ACTIVITIES TERMINATED

- Gas generation
- Salado two-phase flow
- Salado field tests in halite
- Halite lab/field properties
- Brine flow in anhydrites
- Non-blowout releases
- Dewey Lake studies
- Culebra fracture/matrix in field
- Enhanced colloid program

795R:6793I

PERFORMANCE ASSESSMENT MILESTONES FOR COMPLIANCE CERTIFICATION APPLICATION

(WIPP Disposal Decision Plan)

9/95 Upgrade computer codes to Quality Assurance Level A

9/95 Final computer models to Performance Assessment for the 9/96 complementary cumulative distribution function (CCDF)

3/96 Final data input to computer models for the 9/96 CCDF

9/96 Final CCDF calculations to compliance packages

10/96 Final performance input

12/96 Submittal of compliance certification package

DEPARTMENT OF ENE

MAJOR INCREASES BE

Dollars in millions

	FY95	FY96	FY97	Inc
Program allocation:				
Waste Isolation Pilot Plant	156	150	171	+21
Site operations	75	80	88	+8
- Contact-handled Operational Readiness Review				+2
- Emergency response/carrier contract				-
- Site technology and operations				+1
- Waste handling staffing				+5
Experimental	59	51	60	+9
- Completion of performance assessment experiments				-9
- Undertake engineered alternatives/peer reviews				+18
Management/stakeholders	22	19	23	+4
- Expanded support to Western Governors' Association and New Mexico Emergency Response				+1
- Increased support to Carlsbad Environmental Research and Monitoring Center and the Advanced Manufacturing and Innovation Training Center				+1
- New Federal Building				+2
National TRU Program	17	23	23	0
Total Carlsbad Area Office	174	173	194	+21

795R:6793p

Note: Does not include CAO program direction

CARLSBAD AREA OFFICE

FY 1997 Budget Request

		($ in millions)
● Spring review request		193.4
● HQ environmental management mark		-18.0
- Cost of full SEIS process instead of accelerated process *Impact:* none - CAO will do accelerated process	(2)	
- Implement engineered alternatives using various backfill methods *Impact:* HQ directed that this activity be completed from within remaining funding; CAO is identifying lower priority scope reductions	(7)	
- Scientific peer review panel *Impact:* depends upon final language of 40 CFR 194	(1)	
- Detailed waste characterization *Impact:* depends upon final language of 40 CFR 194	(8)	
● CAO request to Office of Management and Budget		175.4
● CAO program direction for federal employees		7.5
● Total revised budget request		182.9

795R:6793o

PROJECT STATUS SUMMARY

- We are meeting the challenge of compliance
  - Meeting Disposal Decision Plan milestones
  - Submittal of compliance documents on schedule
  - SPM-2 results used to focus activities
- The current and proposed budgets support the DDP
- We will achieve the goal of disposal

795R:6793r

ENVIRONMENTAL EVALUATION GROUP

AN EQUAL OPPORTUNITY / AFFIRMATIVE ACTION EMPLOYER

7007 WYOMING BOULEVARD, N.E.
SUITE F-2
ALBUQUERQUE, NEW MEXICO 87109
(505) 828-1003
FAX (505) 828-1062

EEG STATUS/ACTIVITY REPORT

Robert H. Neill and Lokesh Chaturvedi

Environmental Evaluation Group

51st WIPP Quarterly Review Meeting
Santa Fe

July 13, 1995

Providing an independent technical analysis of the Waste Isolation Pilot Plant (WIPP), a federal transuranic nuclear waste repository.

CONTENTS

- Compliance/Performance Assessment
- Engineered Barriers
- Continuing Dialogue on Outstanding Issues
- Oil/gas Activities Effects Workshop

40CFR191 COMPLIANCE/PERFORMANCE ASSESSMENT

- The DOE response (DOE/WIPP-95-2053) to the EEG comments on the 1992 P.A. is incomplete. The responses are to the EEG 9/13/1993 preliminary comments on volumes 1,2, and 3 only, and not to the more comprehensive 9/1994 (EEG-57) comments that included comments on volumes 4 and 5.

DOE agrees w/ EEG to be decided by EPA

- The SPM process has resulted in a predictable decision to continue to fund several experimental and field activities. It is not clear, however, why some activities, such as the field sorbing tracer test, will not be funded.

- Several important input parameters used in the SPM analysis and in the Draft 40 CFR 191 Compliance Certification Application (DCCA) are "expected outcome of experiments that are currently under way". The results of the calculations are therefore not valid. In the PA to show compliance, only experimental data should be used for parameter values, not elicited ones.

- The April, 1995 DCCA provides insufficient information to understand how the reported results on undisturbed performance were obtained.

- Availability of the computer codes remains a serious issue. The codes that are used in the DCCA should be available promptly to review the application. *All* of them, *same* versions as used, and *with* the application, not later.

ENGINEERED BARRIERS

- A DOE focus group discussion on June 27, 1995, on the question of engineered barriers, provided an opportunity for the EEG to develop a position paper on this important issue. The salient points of our position are as follows.

- The EPA standards 40 CFR 191 *require* engineered barriers {see 40 CFR 191.14 (d)}.

- 40 CFR 191 definition of *barrier* provides three examples of engineered barriers: a canister, a waste form, or a backfill (*a material placed over and around waste*),

- Note that the EPA definition does not use shaft and panel seals as examples of engineered barriers. The EEG position is that the seals are required to undo the damage done to the natural environment by excavation and cannot improve on the natural rock barrier, and thus may not be considered engineered barriers.

- Engineered barriers are needed at WIPP because the WIPP waste is not fixed; existing containers are expected to disintegrate in a few years; because of its location in a mineral rich area, the probability of human intrusion is high; and, large uncertainty is likely to remain in the compliance with the containment requirements. Also, the C & C Agreement commits DOE to use backfill.

CONTINUING DIALOGUE ON OUTSTANDING ISSUES

- We presented "General Recommendations for the WIPP Project" at the 45th Quarterly Meeting on 1/12/1994, "Status" of those recommendations at the 49th Quarterly on 1/24/1995, and "Outstanding Issues for WIPP Disposal Decision" at the NAS WIPP Committee meeting in Washington, D.C. on 2/9/1995. The DOE discussed these items at the 50th Quarterly meeting on 4/20/1995, and provided a written response dated 6/9/1995.

  A summary of the DOE position on several outstanding issues is provided in the following viewgraphs.

DOE POSITION ON WASTE CHARACTERIZATION
(June 9, 1995 letter)

- No additional waste characteristics are required for long-term risk assessment. CAO will ensure that only waste that fits in the P.A. envelope of acceptable waste characteristics is accepted at the WIPP.

- Existing facilities at ORNL may be sufficient to certify and load RH-TRU waste for *initial* disposal in 2002.

- CAO is working on a Waste Characterization Strategy Plan to identify facilities to characterize all CH and RH TRU waste for the lifetime of WIPP.

- For heterogeneous waste, the use of process knowledge is more accurate than sampling and analysis.

- The CAO disagrees with many aspects of the waste characterization requirements of the draft 40 CFR 194.

DOE POSITION ON SITE CHARACTERIZATION
(June 9, 1995 letter)

- The feasibility of performing hydraulic tests in the Dewey Lake (Redbeds) using recently completed well WQSP-6a is being investigated; however, knowledge of the Dewey Lake (Redbeds) hydrology is not considered critical for the Culebra performance assessment modeling.

- A chemical retardation model will be developed based on the results of non-sorbing tracer test and semi-empirical crushed core column tests, and will be confirmed through results of the core column retardation tests.

- Agree (with EEG) that there has been no resolution of the Salado brine-flow mechanism issue. There is perhaps no need for such a resolution. The PA models are currently using permeability ranges which cover the full uncertainty range of the various models.

- Oil and gas production, secondary recovery and simulation, water floods, and deep injection are not expected to influence supra-Salado hydrology.

DOE POSITION ON PA/SPM
(June 9, 1995 letter)

- The purpose of SPM-1 was proof of concept and not for results, hence the results were not published.

- In reply to the EEG request for a new version of PA with realistically conservative assumptions and expression of not being clear as to what the DCCA would contain, the DOE reply simply states that the DCCA has been issued. (But the DCCA does not contain PA!)

DOE POSITION ON OPERATIONAL READINESS
(June 9, 1995 letter)

- CAM usage is being completely re-examined including operational requirements and placement.

- DOE did not commit to more frequent inspections and maintenance of the hoist.

- Regarding the feasibility of maintenance operations in Panel 1 rooms during waste emplacement, "feasibility of maintenance necessarily cannot be addressed until maintenance is necessary".

- Regarding the EEG desire to see the sequencing and scheduling of new excavations in the Safety Analysis Report (FSAR), "There will be no plans or schedules in the SAR".

- The WIPP SPM baseline is based on no backfill, but the SPM included two activity sets with addition of backfill. EA cost/benefit study will take a further look at backfill.

DOE POSITION ON MISCELLANEOUS ISSUES
(June 9, 1995 letter)

- The shaft sealing system will utilize empirical and modeled values from the existing tests to demonstrate that the permeability performance requirements will be achieved.

- The decision on engineered barriers will be made after the cost/benefit study is completed in September, 1995.

- The CAO will discuss concepts of long-term monitoring, and active/passive markers design with the EPA.

- Since DOE made a decision not to store or have radioactive waste experiments in WIPP until after the EPA certification for disposal operations, there is no further need for retrieval activity.

OIL/GAS ACTIVITIES EFFECTS WORKSHOP

- EEG organized a technical workshop on the potential effects of oil and gas drilling, production, water flooding for secondary recovery, and brine injection for oil-field brine disposal, on the integrity of the WIPP repository and the WIPP site on June 13, 1995. The workshop was attended by representatives from the DOE, SNL, WID, BLM and relevent state agencies, viz., AG, NMED, EMNRD, NMBMMR, and several other individuals.

- The EEG position is that the potential for flooding of the repository and/or the marker beds in the Salado Formation or the overlying strata exist due to oil and gas production related activities around the WIPP site. An effect may already be seen in anomalous water level rises in most of the wells at and in the vicinity of the WIPP site since 1988. This will require analysis of new scenarios in Performance Assessment of WIPP.

- The EEG plans to publish a report on the workshop in September, 1995

Engineered Barriers at the Waste Isolation Pilot Plant
(A position paper submitted for the focus group discussion on the engineered alternatives cost/benefit study)

June 26, 27, 28, 1995

Environmental Evaluation Group
7007 Wyoming Boulevard N.E.
Albuquerque, N.M. 87109

Introduction

The Waste Isolation Pilot Plant (WIPP) is a planned geologic repository for defense transuranic waste. The concept of geologic disposal involves multiple barriers, natural as well as engineered. Engineered barriers are required by the Environmental Protection Agency (EPA) standards, and the Department of Energy (DOE) should make a commitment to use them in the WIPP.

What is an Engineered Barrier?

The EPA environmental standards for WIPP (40 CFR 191)[1] defines a "barrier" as follows:

> *Barrier* means any material or structure that prevents or substantially delays movement of water or radionuclides toward the accessible environment. For example, a barrier may be a geologic structure, a canister, a waste form with physical and chemical characteristics that significantly decrease the mobility of radionuclides, or a material placed over and around waste, provided that the material or structure substantially delays movement of water or radionuclides.

Thus, according to this definition, a robust container that would not easily degrade or corrode, a modified waste form, and backfill that would substantially delay movement of water or radionuclides, are engineered barriers.

Requirement for Engineered Barriers

The WIPP Land Withdrawal Act[2] requires the Secretary of Energy to use both engineered and natural barriers at WIPP to isolate transuranic waste, to the extent necessary to comply with the EPA standards. The Assurance Requirements of the EPA standards (40 CFR 191)[1] require disposal systems to use both engineered and natural barriers to isolate the wastes from the accessible environment, over and beyond the provisions of the Containment Requirement. Thus, the potential contribution of engineered barriers is not to be measured simply by

improvements in compliance with the Containment Requirement of the standards; they are required in order to provide additional assurance in the integrity of the disposal system.

Status of Engineered Barriers at WIPP

The transuranic waste to be emplaced at the WIPP are contained in drums and boxes. The waste forms are contaminated rags, gloves, machinery parts, and sludges, in contrast to highly durable UO_2 or glass in high-level waste. The contact-handled transuranic waste containers are drums and boxes which only meet the U.S. Department of Transportation Type-A requirements (49 CFR 173.412) for packaging. In contrast, high-level waste containers consist of several centimeters thick metal and may be overpacked with additional steel or copper. The overall hazards of transuranic waste are comparable to that of high-level waste, hence the geologic disposal standards apply to both.

Panel and shaft seals have also been suggested as engineered barrier at the WIPP. While these seals are anticipated to be compacted salt-concrete mixtures, the designs have not been finalized, and no full-scale tests of seals have been done.[3] In any case, the seals are required to undo the damage done to the natural environment by excavation and cannot improve on the natural rock barrier. Hence, they do not satisfy the concept of engineered barriers.

While the consultation and cooperation agreement between the DOE and the State of New Mexico requires backfill, the recent performance assessment calculations for the draft compliance certification application assume no backfill.[4]

The DOE's comments on the EPA draft compliance criteria[5] state:

> The DOE does not intend to incorporate any additional barrier beyond those needed for compliance. The results of the (engineered barriers benefit/detriment) study will only be one factor in the selection process. ...the DOE would not use the benefit/detriment study as the basis for selecting such barriers for the WIPP [p. I-24, I-25].[6]

Why are engineered barriers needed at WIPP?

1. The waste is not fixed. The WIPP Waste Acceptance Criteria[7] allows up to 1% of the radioactivity to exist at particle size less than 10 μm. Plutonium is at its most hazardous at this size range, being an aerosol. The waste drums are not welded. Thus there is a likelihood that plutonium could be dispersed in an accident during the operational period. The unfixed waste also has implications for the long term. Untreated waste will produce gas from microbiological reactions, α-radiolysis and corrosion. The prediction of gas production over 10,000 years is one of the great challenges in the WIPP performance assessment. Fixing the waste will help alleviate the problem.

2. For CH-TRU waste in 55-gallon drums, there is no longer even a 20-year longevity

requirement. The Waste Acceptance Criteria required a 20-year life for these drums until June, 1994. This requirement has since been dropped because many of the extant containers have been in use for more than 20 years. For classes B and C low-level waste, the Nuclear Regulatory Commission requires:

> waste forms or containers should be designed to be stable, i.e. maintain gross physical properties and identity, over 300 years.[8]

In the high-level waste programs around the world, the containers are designed for thousands to a million years of integrity.

3. WIPP is unique in being located in an area where there has been an exponential growth in oil and gas drilling activities.[9] This violates one of the fundamental principles of site selection for geologic repositories. For the WIPP, past performance assessments have dealt with only one disruptive event---human intrusion by drilling.[10] Engineered barriers should therefore be employed at the WIPP to compensate for its location in a resource-rich area that increases the probability of human intrusion.

4. The high-level waste programs in different countries are placing increasing reliance on engineered barriers as shown in the table below.

Country	Japan	Finland	Sweden	Switzerland
Container				
Material	Carbon steel	Copper and steel	Copper	Cast steel
Thickness	30 cm	copper 6 cm steel 5.5 cm	5 cm	15 cm
Backfill				
Material	bentonite	bentonite	bentonite	bentonite
Thickness	1 m	0.35 m	0.75 m	> 2 m
Waste Form	Glass	Spent Fuel	Spent Fuel	Both
Reference	11	12	13*	14

* The copper container thickness has been reduced from the original 10-cm to 5 cm in 1995.

Intermediate-level waste in Switzerland are contained in drums similar to those destined for the WIPP, but have the radioactivity immobilized with cement.

Figure 1a shows the release from one waste package in the Japanese high-level waste program, and Figure 1b shows the transport of released radioactivity through the geosphere.

Plots like these would enable allocation of isolation between the engineered barrier system and the natural barriers. Such work has not been done for the WIPP. Without such partitioning of isolation credit, it is not possible to deny the contribution of engineered barriers.

Public Confidence

What gives the public confidence in waste disposal systems? One can suggest that the analysis of engineered barriers flow from a well-established set of scientific and engineering principles, which can be extended to several hundred years. However, the analysis of natural systems over geologic time is much more challenging. Even if one designs a system to last hundreds of thousands of years, the demonstration of its long-term performance lacks public confidence. Hence, public confidence will increase if engineered barriers are incorporated in WIPP.

EEG's recommendations

- Adopt the philosophy of using engineered barriers over and beyond the containment requirements of the EPA standards (40 CFR 191).

- Develop performance objectives for the engineered barrier system similar to the Nuclear Regulatory Commission (NRC) requirements for high-level waste (10 CFR 60.113).[15]

- Develop decisions based on the 1991 Engineering Alternatives Task Force report and the cost/benefit study in progress.

These actions are likely to result in increased public confidence.

References

1. U.S. Environmental Protection Agency, 1993, "Environmental Radiation Protection Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level & Transuranic Radioactive Waste," Title 40 *Code of Federal Regulations*, Part 191, 58 *Fed. Reg.*, 66398.

2. 106 Stat. 4778, Public Law 102-579, 1992.

3. F. Hansen, et al., 1995, *Systems Prioritization Method - Iteration 2 Baseline Position Paper: Repository Seals Program*, USDOE-CAO.

4. Sandia National Laboratories, 1995, *SPM-2 Report*, vol. II.

5. 40 CFR 194, 60 FR 5791, 1995.

6. U.S. Department of Energy, Carlsbad Area Office, 1995, *Comments on 40 CFR Part 194 Proposed, April 20, 1995.*

7. U.S. Department of Energy, 1991, *Waste Acceptance Criteria for the Waste Isolation Pilot Plant,* WIPP-DOE-069, Rev. 4, Draft 6.

8. U. S. Nuclear Regulatory Commission, *Code of Federal Regulation* #10, Part 61.7(b)(2).

9. New Mexico Bureau of Mines and Mineral Resources, 1995, *Evaluation of Mineral Resources at the WIPP Site*, four volumes.

10. Sandia WIPP Performance Assessment Department, 1992, *Preliminary Performance Assessment for the Waste Isolation Pilot Plant*, December 1992, five volumes, SAND92-0700.

11. Power Reactor and Nuclear Fuel Development Corp., 1992, *Research and Development on Geological Disposal of High-Level Radioactive Waste*, PNC TN1410 93-059.

12. Nuclear Waste Commission of Finnish Power Companies, 1992, *Safety Analysis of Spent Fuel Disposal, YJT*-92-33E.

13. SKBF/KBS, 1983, *Final Storage of Nuclear Fuel*, KBS-3.

14. NAGRA, 1985, *Project Gewahr*, 1995. Baden.

15. U.S. Nuclear Regulatory Commission, Code of Federal Regulations #10, Part 60.

Figure Caption

Fig. 1a. Radionuclide release rate from the engineered barriers as a function of time [from ref. 11].

Fig. 1b. Radionuclide transport rate from engineered barriers [from ref. 11].

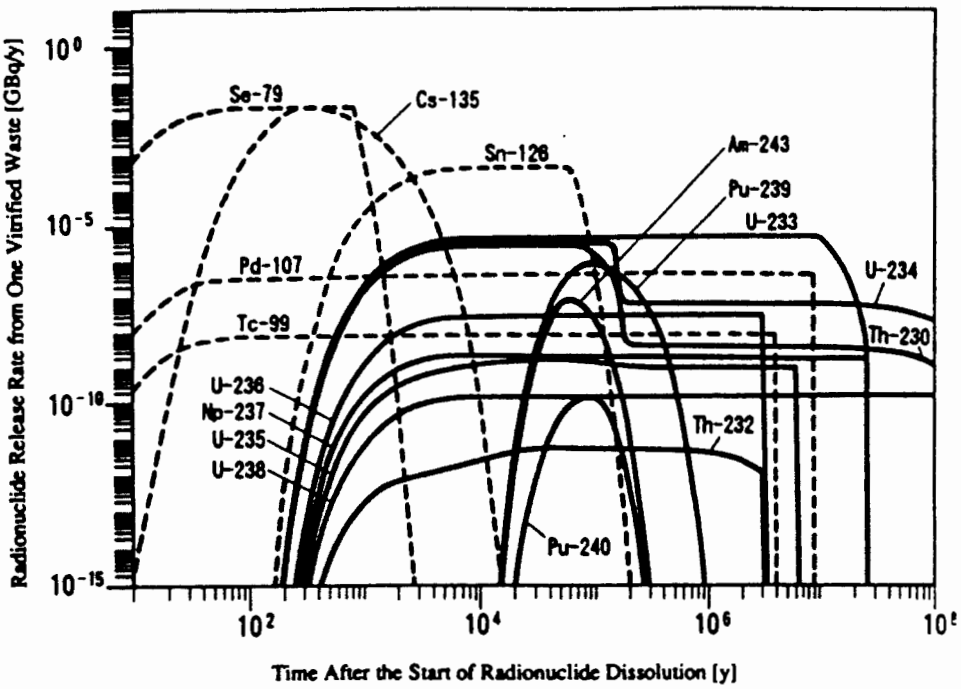


Figure 1a. Radioactivity release rate from the engineered barrier of one waste package.

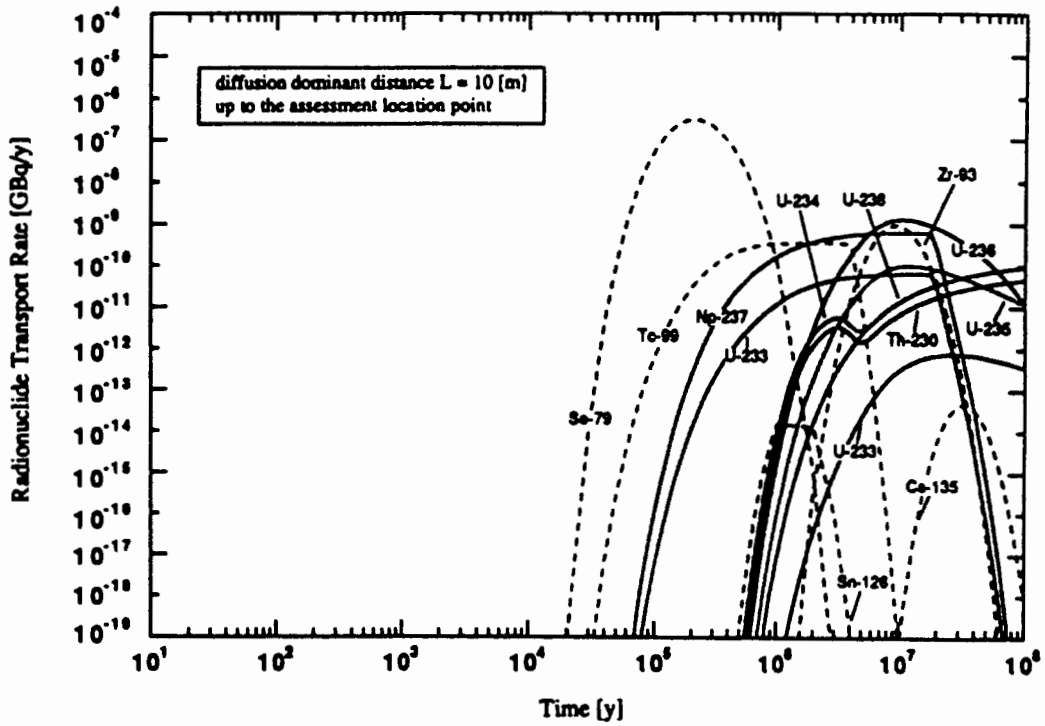
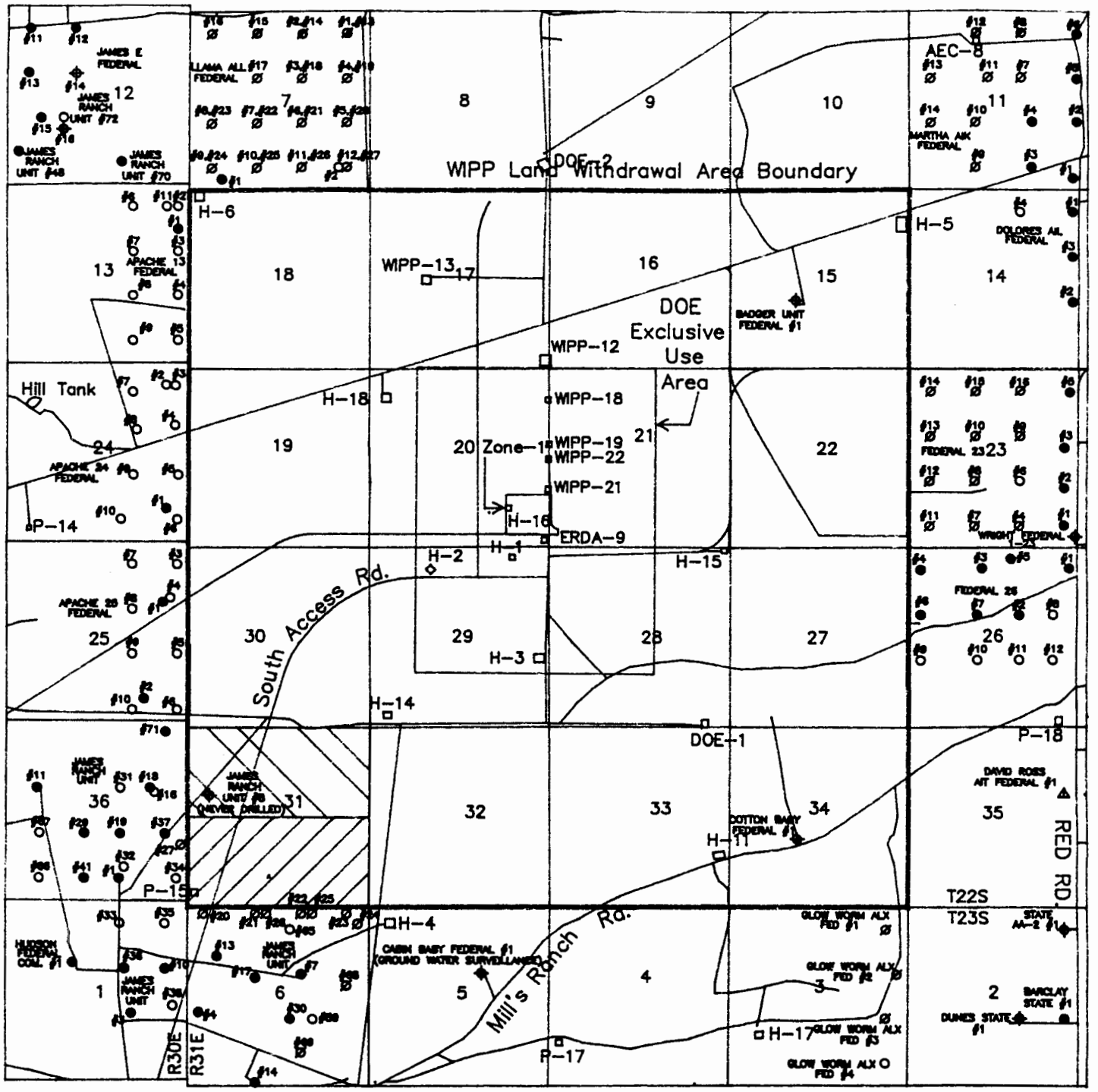


Figure 1b. Radioactivity release rate from the engineered barrier of a whole repository. [Source: PNC 1992]



OIL AND GAS WELLS WITHIN ONE MILE OF THE WIPP LAND WITHDRAWAL AREA

(AS OF 12/05/94)

-N-

- ⌀ APPLICATION DENIED
- ✦ ABANDONED (PERMANENT OR TEMPORARY)
- ▲ SALT WATER DISPOSAL WELL
- ● PRODUCING OIL AND/OR GAS WELL
- ○ LOCATION (SURVEYED, APPLICATION PENDING OR APPROVED)

FEDERAL LEASE NM-02593

FEDERAL LEASE NM-02593-C

Keith McKamey, NME

WEDGE WIRELINE INC.

CEMENT BOND / GAMMA RAY LOG

COMPUTALOG

GAMMA RAY

API-UNITS/DIV.

CASING COLLAR

Depth

AMPLITUDE CURVE

MILLIVOLTS

TRANSIT TIME

MICRO SECONDS

ALL READINGS ARE ON TRUE DEPTH

Face Pipe Sectored

w/o R.S.I.

Composite

No Bond

Poor Bond

Good Bond

LAMAR

BELL CANYON

Good Bond

Acoustic Cement Bond Log

VDL **Gamma Ray**

DRESSER

FILE NO. H-160

API NO.

P.O.# 59WDR 65333 15D

COMPANY WESTINGHOUSE ELECTRIC CORPORATION

WELL D O E - 1

FIELD WIPP SITE

COUNTY EDDY STATE NEW MEXICO

LOCATION: 608' FEL & 180' FSL

SEC 28 TWP 22S RGE 31E

Other Services

Permanent Datum GROUND LEVEL Elev. 3465

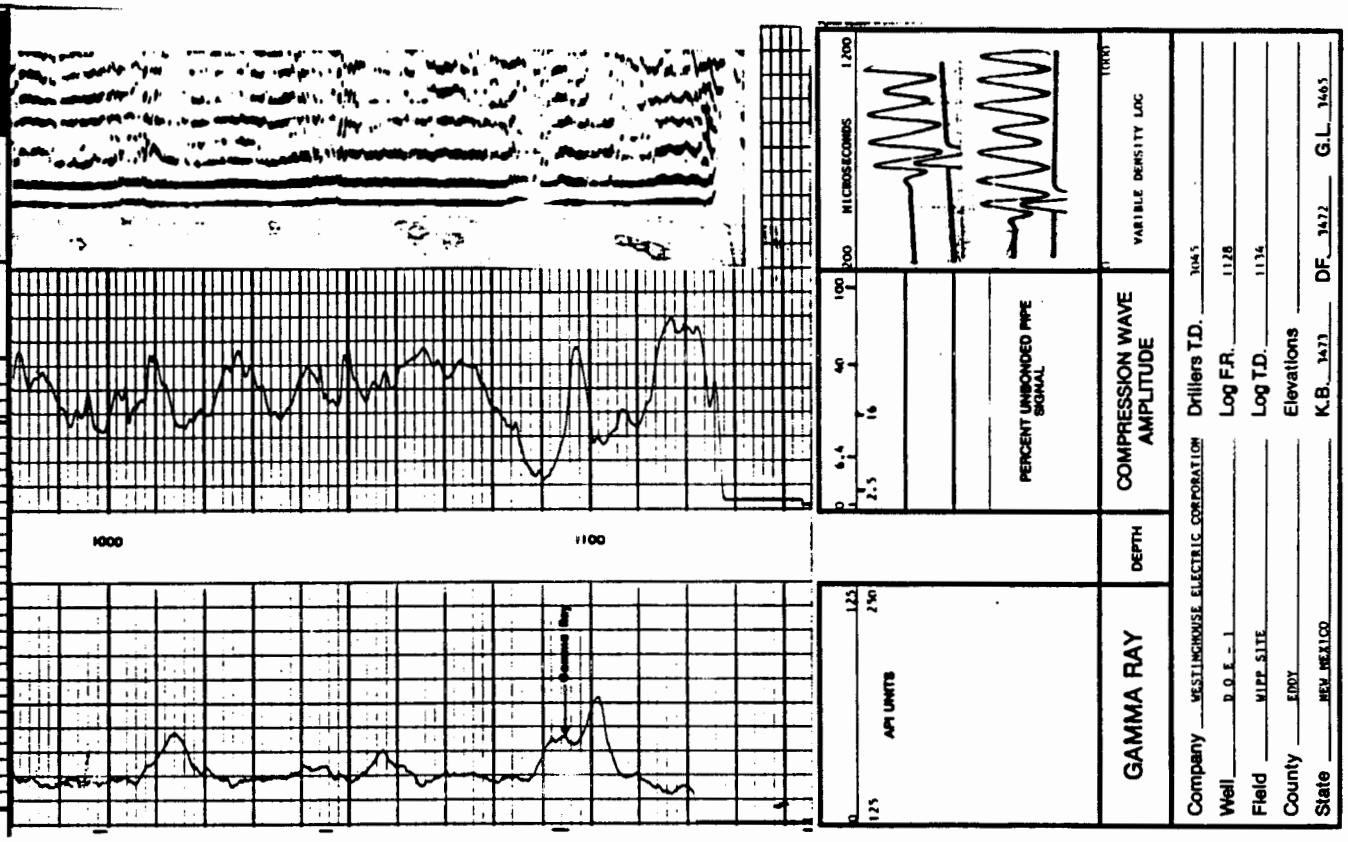
Log Measured from K.B. 8 Ft. Above Permanent Datum

Drilling Measured from K.B.

Elev. KB 3473 DF 3472 GL 3465

Date	7/28/82	ONE RECORD	Surface	Protection	Production	Liner
Run No.	ONE	Size			10 3/4	7 7/8
Service Order No.	66710	Wt./Ft.			*	*
Depth — Driller	3045	Grade			*	*
Depth — Logger	1136	Type Joint			*	*
Bottom Logged Int.	1128	Top			SURF.	1100
Top Logged Interval	SURF.	Bottom			1130	T.D.
Ft. Measured	1128	PRIMARY CEMENTING DATA				
Type Fluid in Csg.	BRINE	Type Cement	HALIBURTON-LITE-		CIRC. TO	SURF.
Fluid Level	FULL	Vol. of Cement				
Max. Temp. Deg. F.	87	Additive				
Tool Series No.	1415	% Additive				
Tool Diam.	3 5/8	Retarder				
Standoff Size	CENT.	% Retarder				
Logging Speed	30 FPM	Slurry Wt.				
RA Log Type	SCINT	Water Loss				
T.C.	32	Drlg. Mud Type				
Sens. Setting	358	Drlg. Mud Wt.				
API Unit/Div.	12.5	PRIMARY CEMENTING PROCEDURE				
Truck or Unit No.	6286	Started Pumping	HR.	DATE	Preceding Fluid	
Location	HOBBS	Plug on Bottom			Vol.	Bbls.
Opr. Rig Time	2.0	Pres. Released			Returns: Full Partial None	
Recorded by	CHERRY	Started Bond Log	2145	7/28/82	Pipe Rot. During Pumping: Yes No	
Witnessed by	BLACK	Finished Bond Log	2200	7/28/82	Pipe Rot. After Plugdown: Yes No	

7/82



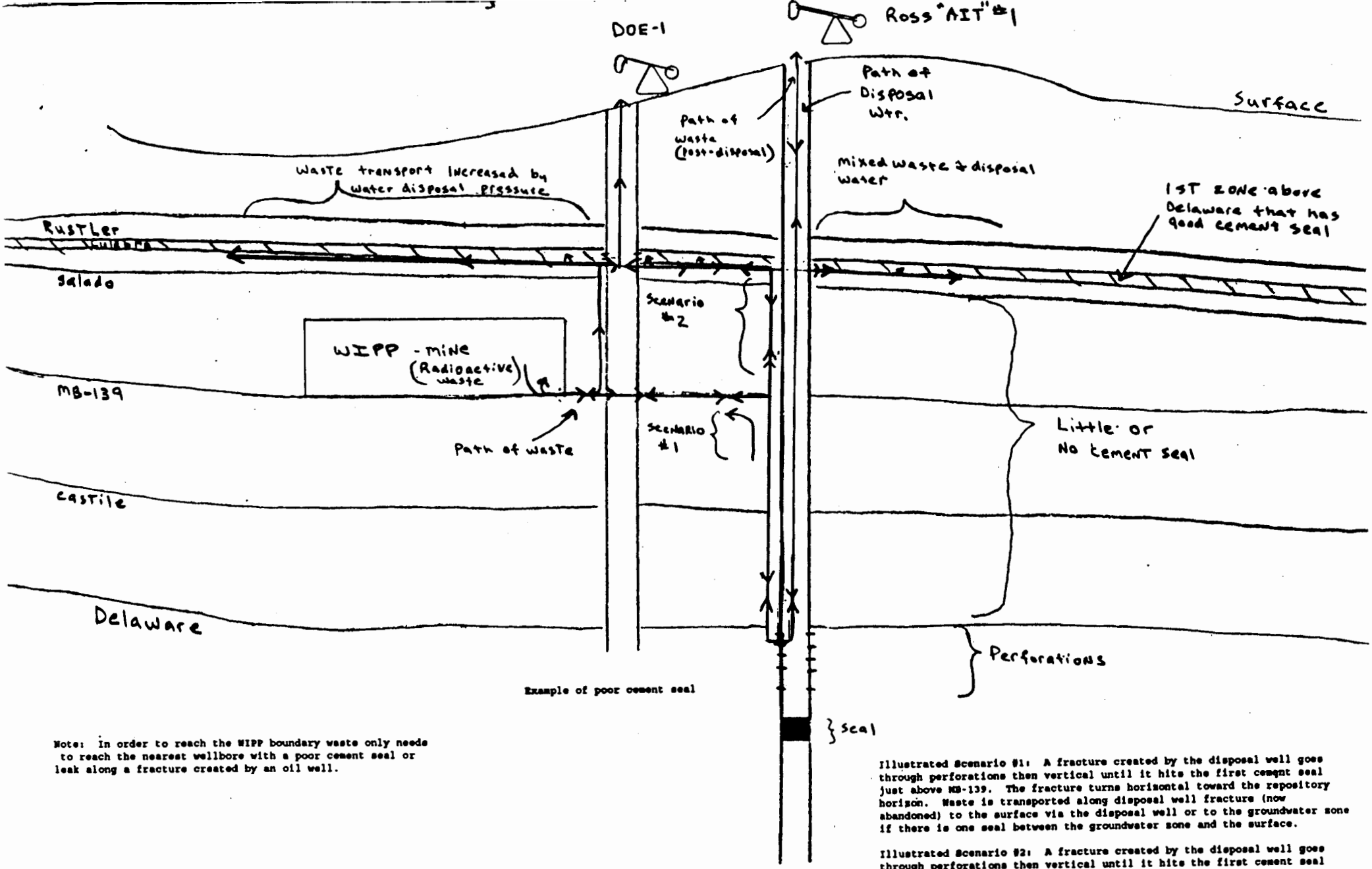
Company WESTINGHOUSE ELECTRIC CORPORATION Drillers T.D. 3045

Well D O E - 1 Log F.R. 1128

Field WIPP SITE Log T.D. 1134

County EDDY Elevations

State NEW MEXICO K.B. 3473 DF 3472 G.L. 3465



Note: In order to reach the WIPP boundary waste only needs to reach the nearest wellbore with a poor cement seal or leak along a fracture created by an oil well.

Example of poor cement seal

Example of hydraulic fracture created by oil well

Illustrated Scenario #1: A fracture created by the disposal well goes through perforations then vertical until it hits the first cement seal just above MB-139. The fracture turns horizontal toward the repository horizon. Waste is transported along disposal well fracture (now abandoned) to the surface via the disposal well or to the groundwater zone if there is one seal between the groundwater zone and the surface.

Illustrated Scenario #2: A fracture created by the disposal well goes through perforations then vertical until it hits the first cement seal such as the zone above the ground water aquifer. The fracture turns horizontal toward the repository and speeds flow through the groundwater zone. Waste leaks along MB-139 to the nearest wellbore and goes vertical along pipe with no seals until it reaches the groundwater zone where it mixes with the groundwater and the disposal water. Waste is then transported to the WIPP boundary faster than usual due to the pressure from the disposal well.

KEM: 6-20-95

WIPP Quarterly Review
July 12, 1995

Activities Update for NMED's RCRA Permits Program

1. RCRA Part B Permit Application

   - Received on May 26, 1995, prior to the May 31 deadline imposed by NMED Secretary order of September 2, 1994.
   - NMED issued a letter closing the order on June 20, 1995.
   - Public notice concerning receipt of Part B was published June 15, and notification mailed to over 1100 stakeholders.

2. Public Availability of Permit Application

   - DOE's decided to limit distribution of the application.
   - Public notice listed locations for public review.
   - HRMB has an extra copy available for copying, and selected portions in WordPerfect 5.2 format on 3.5" floppy.

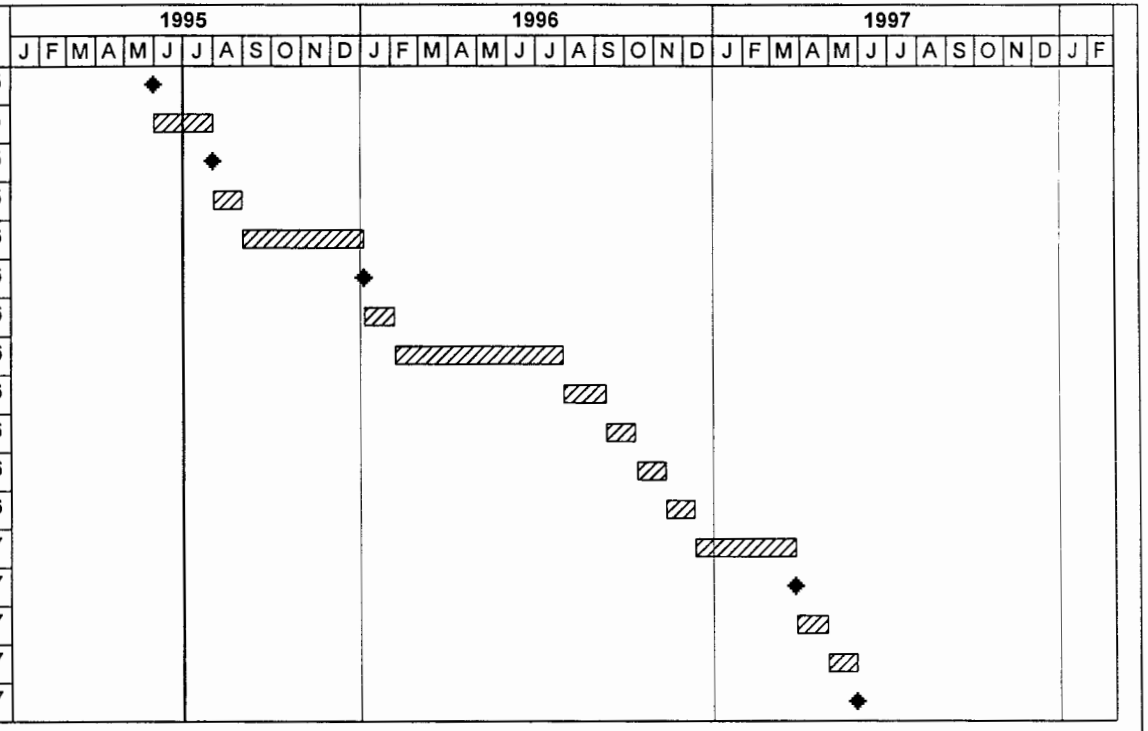
3. Contractor Selection Process

   - Received 115 inquiries to RFP by May 25, 1995.
   - Received bids from three contractors: Camp Dresser & McKee, Inc.; A.T. Kearney, Inc.; Belfort Engineering.
   - Awarding contract to A.T. Kearney; contract will be finalized around end of July.

4. Permit Review Schedule

   - Proposed two-year schedule of tasks and activities distributed to DOE, GAO, and NMED Secretary's office.
   - Currently conducting administrative completeness review without contractor.

ID	Name	Duration	Sched Start	Sched Finish
1	Receive Part B, Rev 5	0d	5/31/95	5/31/95
2	Administrative Review	44d	6/1/95	8/1/95
3	Issue Administrative NOD	0d	8/1/95	8/1/95
4	Administrative NOD Response	22d	8/2/95	8/31/95
5	Technical Review	90d	9/1/95	1/4/96
6	Issue Technical NOD	0d	1/4/96	1/4/96
7	Technical NOD Response	22d	1/5/96	2/5/96
8	Develop Draft Permit	125d	2/6/96	7/29/96
9	Public Notice/Comment	32d	7/30/96	9/11/96
10	Public Meetings	22d	9/12/96	10/11/96
11	Response to Comments	22d	10/14/96	11/12/96
12	Public Hearings	22d	11/13/96	12/12/96
13	Finalize Permit	75d	12/13/96	3/27/97
14	Submit to NMED Secretary	0d	3/27/97	3/27/97
15	Permit Review by Secretary	23d	3/28/97	4/29/97
16	Permit Notice of Decision	23d	4/30/97	5/30/97
17	Final Permit Decision	0d	5/30/97	5/30/97



Notes to WIPP RCRA Permit Schedule:

1) Scheduled dates and durations are estimates as of 6/30/95, and do not reflect discussions with technical contractor.

2) Duration days are working days, not calendar days.

3) Some activities may not occur (e.g., Public Hearings), but have been included for completeness. Other activities may occur more than once (e.g., Issue Technical NOD).

4) Some activities may occur simultaneously (e.g., Public Notice/Comment and Public Meetings).

5) Some activities have relatively certain durations (e.g., Public Notice/Comment) due to regulatory requirements. Other activities have highly uncertain durations (e.g., NOD Responses) due to the initial adequacy of the application and the applicant's ability to fully respond in a timely fashion.

Project: WIPP RCRA Permit
Date: 6/30/95

Critical | Progress | Summary
Noncritical | Milestone | Rolled Up

Western Governors' Association
Resolution 89-006 (Revision 4)

Originally Adopted July 18, 1989
Long Beach, California
Readopted June 26, 1995
Park City, Utah

SPONSOR: Governor Johnson
SUBJECT: U.S. Department of Energy Waste Isolation Pilot Plant (WIPP)

A. BACKGROUND

1. Over the past 45 years, the United States has developed, produced, and tested nuclear weapons using a national network of facilities, including U.S. Department of Energy (DOE) sites in six western states. As a result, large quantities of radioactive and hazardous chemical wastes have accumulated. These wastes now pose serious immediate and long-term threats to the environment and the public health and safety.

2. At DOE facilities in western states, millions of cubic feet of transuranic wastes, some mixed with hazardous chemical wastes, await permanent disposal. Some is in retrievable temporary storage, but, prior to 1970, much was buried in shallow trenches or discharged as liquid, resulting in considerable contamination of soil and groundwater. More waste will be generated as the result of continuing weapons research, environmental remediation, and the decommissioning and decontamination of aging facilities.

3. The Waste Isolation Pilot Plant (WIPP) in New Mexico is intended to serve as a permanent repository for selected defense-related transuranic wastes. Although major construction activities at the WIPP are largely complete, the opening of the facility has been delayed by a number of yet unresolved technical, administrative, safety, and environmental issues. Originally scheduled to open in late 1988, the WIPP may not be available for disposal until 1998 at the earliest.

4. The cleanup, transport, and permanent disposal of radioactive and hazardous chemical wastes at DOE facilities are issues of vital concern to the western states. In recognition of the scope of the waste problems and the risks they pose to the public and the environment, the western governors have urged the President and Congress to take prompt action to establish a comprehensive national program (WGA Resolution 89-004). As the only permanent repository for defense-related transuranic wastes, the WIPP is critical to the success of the cleanup effort sought by the governors.

B. GOVERNORS' POLICY STATEMENT

1. In keeping with the policies of WGA Resolution 89-004, it is the objective of the western governors to secure, through the expeditious resolution of outstanding technical, administrative, safety, and environmental issues, the earliest possible opening of the WIPP. The western governors are committed to working cooperatively with the Congress, DOE, and the U.S. Environmental Protection Agency (EPA) to achieve this objective.

2. The western governors believe that strict DOE compliance with the provisions of the WIPP Land Withdrawal Act (Public Law 102-579) will ensure that key issues relating to the opening and operation of the WIPP are satisfactorily resolved. Accordingly, the western governors urge DOE to demonstrate as expeditiously as possible compliance with both the letter and intent of the WIPP Act which contains the following provisions:

   a. DOE must comply with all applicable federal and state environmental laws and regulations during WIPP's operational life, including the applicable environmental standards for the disposal of transuranic radioactive waste, 40 CFR Part 191, Subparts B and C.

   b. The U.S. Environmental Protection Agency (EPA) must issue, by rule pursuant to Section 553 of Title 5, United States Code, final criteria for the EPA Administrator's certification of WIPP compliance with the applicable disposal standards. Congress directed that these final criteria be issued no later than October 30, 1994; therefore, the western governors urge EPA to move expeditiously toward issuance of the final WIPP compliance criteria.

   c. EPA must certify whether the WIPP facility is in compliance with the applicable disposal standards.

   d. DOE must comply with the applicable requirements of the Resource Conservation and Recovery Act (RCRA) and all corresponding regulations under the authority of EPA and the State of New Mexico.

e. DOE must submit to Congress:

(1) Plans for decommissioning WIPP and for post-decommissioning management of the WIPP land withdrawal area. These plans must be prepared in consultation with the Secretary of the Interior and the State of New Mexico.

(2) Comprehensive recommendations for the disposal of all transuranic waste under DOE's control, including a timetable for disposal of such waste.

f. DOE must complete, with notice and an opportunity for public comment, a survey identifying all transuranic waste types at all sites from which wastes are to be shipped to WIPP.

g. DOE must provide economic assistance and miscellaneous payments to the State of New Mexico for costs incurred as a result of its role as host of the WIPP repository.

h. DOE must provide in-kind, financial, technical and other appropriate assistance to any State or Indian tribe through whose jurisdiction transuranic waste will be transported to or from WIPP for the purpose of planning, developing, and implementing WIPP-specific transportation safety programs. Key components of such programs include:

(1) Accident prevention measures for the safe and uneventful transport of transuranic waste;

(2) Emergency preparedness for and response to transuranic waste transportation incidents; and,

(3) Public information, participation, and other activities to enhance confidence in the safety of WIPP shipments.

Federal funding must continue until all shipments have been completed.

The western governors endorse the elements, principles, and approaches contained in the "WGA 1995 WIPP Transportation Safety Program Implementation Guide" for application to the WIPP shipping campaign.

i. DOE must not at any time transport high-level radioactive waste or spent nuclear fuel to WIPP, or emplace or dispose of such waste or fuel at WIPP.

j. The transuranic radioactive waste to be disposed at WIPP:

(1) Must not exceed the applicable surface dose rate, curie content, and total repository capacity limits prescribed by federal law; and,

(2) Must be transported to or from the repository in packages that have been certified for use by the U.S. Nuclear Regulatory Commission.

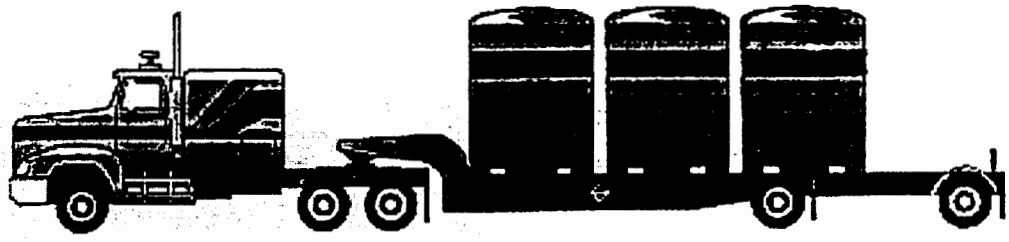
C. GOVERNORS' MANAGEMENT DIRECTIVE

1. WGA shall convey this resolution to the appropriate members and committees of the Congress, Department of Energy, Nuclear Regulatory Commission, and the Environmental Protection Agency.

2. In accordance with the policy established by this resolution, and WGA Resolutions 88-001 and 89-004, the WGA and its Technical Advisory Group for WIPP Transport are directed to work cooperatively with the Congress, DOE, NRC, and EPA to facilitate the earliest possible opening of the WIPP for disposal operation through the prompt resolution of outstanding technical, administrative, safety, and environmental issues.

Western Governors' Association

WIPP Transportation Safety Program Implementation Guide



Prepared by:

WGA Technical Advisory Group
For WIPP Transport

Lead States
State of Wyoming
State of Oregon

June 1995

Statement of Purpose

The Western Governors' Association (WGA) Technical Advisory Group for Waste Isolation Pilot Plant (WIPP) Transport, in cooperation with the U.S. Department of Energy (DOE), developed this *WIPP Transportation Safety Program Implementation Guide* (Guide). It presents the overall transportation issues, objectives, approaches and procedures which were agreed to by the ten western corridor state Governors and DOE through a Memorandum of Agreement signed in 1995. These issues, objectives, approaches and procedures govern the conduct of the transport of contact handled transuranic waste through the western states to WIPP near Carlsbad, New Mexico.

This Guide is based upon WGA policy resolutions, enhanced safety standards, DOE orders and guidelines, and a carrier contract agreement. It includes procedures developed cooperatively by the WGA Technical Advisory Group and the DOE Carlsbad Area Office. It was prepared under a DOE–WGA Cooperative Agreement. WGA, through its Technical Advisory Group, provides a forum in which the ten western corridor states, the Carlsbad Area Office and the DOE Headquarters staff cooperatively work to coordinate the implementation of programs and activities focused on the safe and uneventful transport of transuranic waste from DOE facilities to WIPP.

This Guide, and supporting documents, address accident prevention, medical preparedness, emergency response preparedness, public information, and route designation. The states, the Carlsbad Area Office and DOE Headquarters prepared specific procedures to implement the principles and objectives. These are referenced at the end of each section. Remaining documents, standards and procedures necessary to conduct the program will be completed as part of the Cooperative Agreement between WGA and the Carlsbad Area Office before shipments begin in 1998.

WGA, the ten western corridor states, the Carlsbad Area Office and DOE Headquarters will routinely evaluate the procedures and standards contained in this Guide. Procedures and standards will be revised as necessary to reflect the changing context over the ramp up for initial shipments in 1998 and during the thirty year shipping campaign. An annual review of the Guide will also be performed to incorporate changes and modifications made in the procedures and standards. WGA will distribute updated materials to participating western state officials, the Carlsbad Area Office, DOE Headquarters and other appropriate agencies.

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List of Acronyms

CH	Contact Handled
CMR	Central Monitoring Room
CVSA	Commercial Vehicle Safety Alliance
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOE–CAO	U.S. Department of Energy Carlsbad Area Office
DOT	U.S. Department of Transportation
EPA	U.S. Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
Guide	WIPP Transportation Safety Program Implementation Guide
HRCQ	Highway Route Controlled Quantities
OSHA	U.S. Occupational Safety and Health Administration
PPE	Personal Protective Equipment
REAC/TS	Radiation Emergency Assistance Center/Training Site
RH	Remote Handled
TCC	TRANSCOM Control Center
SCBA	Self Contained Breathing Apparatus
STEP	States Training and Education Program
TETRA	Transportation Emergency Training for Response Assistance
TRANSAX	Transportation Accident Exercise
TRANSCOM	Transportation Tracking and Communications System
TRU	Transuranic
TRUPACT–II	Transuranic Packaging Transporter
WGA	Western Governors' Association
WIEB	Western Interstate Energy Board
WIPP	Waste Isolation Pilot Plant
WIPPTREX	Waste Isolation Pilot Plant Transportation Emergency Exercise

Introduction

Western Governors' Association WIPP Transportation Safety Program

The Waste Isolation Pilot Plant (WIPP) shipping campaign will include over 30,000 transuranic waste shipments to the WIPP repository in southeastern New Mexico during its 30-year operational life. These shipments, originating at ten U.S. Department of Energy (DOE) sites throughout the United States, will traverse at least 23 states and the lands of at least 30 sovereign Tribal governments. Because of the large number of shipments, the considerable mileage to be logged, and the hazardous nature of the cargo, every reasonable precaution must be taken to ensure adequate protection of public health and the environment. Moreover, public confidence in the safety of the WIPP shipping campaign requires the highest standards for incident prevention and emergency preparedness.

Recognizing that corridor states have substantial responsibility in ensuring the safety of their residents and for responding to any incident which might occur, the western Governors unanimously adopted policy Resolution 92–004 in 1992. This resolution states: "The objective of the Western Governors' Association (WGA) is the safe and uneventful transportation of nuclear waste from current temporary storage facilities to more suitable interim or permanent repositories. The western Governors are committed to working with Congress and DOE to achieve this objective."

In 1989, WGA established its Technical Advisory Group for WIPP Transport (Technical Advisory Group) to work toward achieving this objective. The Technical Advisory Group originally consisted of representatives from the seven states along the initial transportation corridor to WIPP: New Mexico, Colorado, Wyoming, Utah, Idaho, Oregon, and Washington. The group was later expanded to include California, Nevada, and Arizona, states through which shipments to WIPP will begin after 1998.

Initial funding was provided through a 1988 Cooperative Agreement with the U.S. Department of Transportation (DOT). In 1989 the Technical Advisory Group prepared a *Report to Congress* describing the needs of the states to prepare for WIPP shipments in the following areas:

Accident Prevention

- High–Quality Drivers and Carrier Compliance
- Independent Inspections
- Bad Weather and Road Conditions
- Safe Parking During Abnormal Conditions
- Advance Notice of Shipments
- Access to Information on Shipment Status

Emergency Preparedness

- Mutual Aid Agreements
- Emergency Response Plans and Procedures
- Training and Retraining
- Emergency Response Equipment

Public Involvement and Information

The Secretary of Energy agreed with the conclusions in the 1989 *Report to Congress* and directed DOE to enter into a five–year Cooperative Agreement with WGA. Working with DOE, the states developed a model program to help ensure that WIPP shipments are "safe and uneventful." The elements of this program are described in this Guide, and generally follow the outline from the *Report to Congress*. The Technical Advisory Group updated the *Report to Congress* with a 1991 *Report to the Western Governors and Secretary of Energy*. The Technical Advisory Group identified Medical Preparedness and Highway Routing as additional areas to be addressed. These are included in this Guide.

In 1995, the ten western corridor state Governors and the Secretary of Energy for Environmental Management signed a Memorandum of Agreement to implement the principles and standards contained within this Guide. These principles and standards are designed to help achieve the Governors' objective of the "safe and uneventful transportation of nuclear waste" through the western states. They were cooperatively developed by the western corridor states, the DOE Carlsbad Area Office (CAO), and DOE Headquarters.

Each section of the Guide contains a summary context statement describing the issue, the objective, the approach and the evaluation used by DOE and the WGA corridor states for each program element. A summary table which provides information about the key documents and associated reference materials is included in each section.

Transuranic Waste

Transuranic wastes are discarded materials that have been generated from nuclear weapons production, research and development since the 1940s. This waste is contaminated with man–made radioactive materials with atomic numbers greater than uranium, such as plutonium, americium, and curium.

Transuranic waste is officially defined as waste contaminated with alpha–emitting radionuclides, having atomic numbers greater than 92 and with half–lives greater than 20 years in concentrations greater than 100 nanocuries per gram of waste. These wastes include such materials as laboratory clothing, tools, glove boxes, plastics, rubber gloves, wood, metals, glassware and solidified waste water sludges contaminated with transuranic materials. Some of these wastes contain hazardous chemical constituents (*e.g.*, carbon tetrachloride, lead, toluene, xylene). These wastes are called "mixed" transuranic waste.

Transuranic waste shipments pose a range of potential hazards with inhalation being the primary hazard. Inhalation of certain transuranic materials, such as plutonium, even in microgram quantities, could deliver significant internal radiation doses to the body. The principal focus of the Technical Advisory Group is to reduce the chance and severity of an incident through stringent transportation safety procedures.

Waste Isolation Pilot Plant

DOE constructed WIPP in southeastern New Mexico, 26 miles east of Carlsbad. The WIPP underground facility, which is 2,150 feet below the land surface in a 3,000 foot–thick bedded salt formation, was constructed as a research and development facility to demonstrate the safe disposal of transuranic waste from DOE defense facilities and private contractor sites. The surface facilities needed to initiate operations are complete, with underground preparations continuing for initial waste emplacement. The waste proposed to be disposed of at WIPP is waste generated after 1970 from defense-related plutonium reprocessing and fabrication and defense-related research activities at DOE facilities.

The greatest percentage of waste planned for disposal at the WIPP site, by volume (95 percent), is contact handled (CH) waste, which primarily emits alpha radiation. This type of radiation cannot penetrate human skin. Therefore, external exposure to alpha radiation from contamination is usually not serious because of the protection by the skin. CH waste has radiation dose rates at the package surface of 200 millirem per hour or less and can be safely contact–handled.

Transportation System

All CH waste will be transported to WIPP in the Transuranic Packaging Transporter (TRUPACT–II), a reusable shipping package shown in **Figure 1**. A cut–away view of the TRUPACT–II is shown in **Figure 2**. The U.S. Nuclear Regulatory Commission (NRC) certified that this is a Type B Package according to 10 CFR 71. As part of the certification process, full–scale TRUPACT–II prototypes were subjected to actual drop and fire tests to prove their ability to survive severe incident conditions. The test results were also used to improve the design of the closure seals.

Photo not available

Figure 1 – TRUPACT–II

The TRUPACT–II is a cylindrical metal container with a flat bottom and a domed top that is transported in an upright position. A multi–layered wall design increases the package strength and provides the ability to withstand potential transportation incidents. Inside the TRUPACT–II, the CH waste will be sealed in 55–gallon steel drums or standard waste boxes. Each TRUPACT–II can hold up to 14 55–gallon drums or two standard waste boxes. The loaded TRUPACT–II containers will be mounted on specially designed trailers and pulled by conventional diesel–powered tractors. Once regular operations begin, three TRUPACT–II containers mounted on a trailer will make up a full shipment as shown on the cover of this document. Some shipments may, however, consist of one or two TRUPACT–IIs.

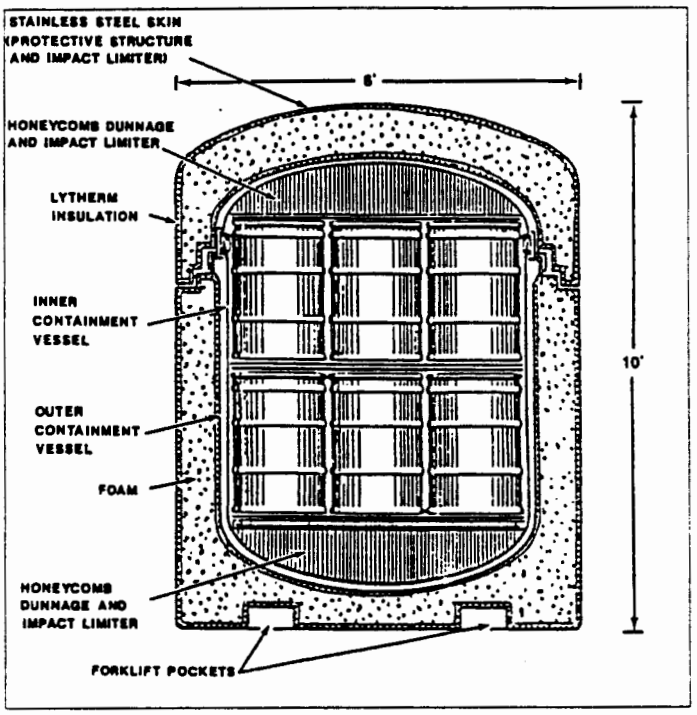


Figure 2 – Cut–Away View of TRUPACT–II

In 1988, DOE awarded a five–year contract to a commercial carrier for truck transport of transuranic waste to WIPP. This is a dedicated contract carrier. In 1995, DOE awarded a new contract to Colorado All State Trucking.

An important feature of the WIPP transportation system is the Transportation Tracking and Communications System (TRANSCOM), a combination of navigation, satellite communication and computer network technologies to monitor the movement of transuranic waste shipments to WIPP.

The currently proposed routes to be used for truck transport of transuranic waste from the ten defense facilities to WIPP are shown in **Figure 3**. In selecting these routes, DOE voluntarily agreed to use applicable DOT regulations (49 CFR 397). The routes are predominantly Interstate System highways. Where available, shipments will use beltways around urban areas. These routes are subject to change since some states may designate alternate preferred routes prior to WIPP shipments in their state.

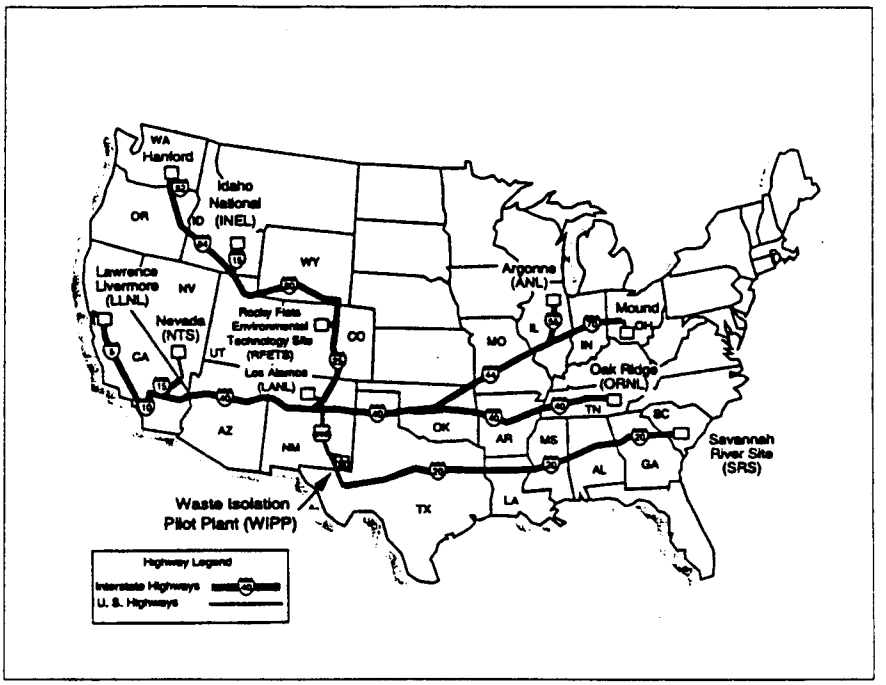


Figure 3 - DOE's Proposed Truck Routes

Five percent of the WIPP waste is classified as remote handled (RH) waste, which contains isotopes that emit beta and gamma radiation and also alpha radiation. This waste has a package surface radiation dose rate exceeding 200 millirem per hour and must be remotely handled. RH waste requires heavy shielding for safe handling and storage. The procedures and standards presented in this Guide were developed for CH waste. Additional work will be required to address safe transportation issues related to RH shipments.

WIPP transportation safety planning to date has been based on the assumption that all waste shipments will be by truck. However, WIPP is accessible by rail, and the 1992 WIPP Land Withdrawal Act required DOE to evaluate the feasibility and impacts of shipping transuranic wastes to WIPP by rail. If DOE should decide to ship either waste type by rail, the transportation safety program would have to be significantly revised.

Introductory Materials

Documents	Responsible for Updates	Status
Documents included in Guide		
Western Governors' Association Resolution 92–004, WGA, 1992.	WGA	Final
Western Governors' Association Resolution 89–006 (Readopted 1993), WGA, 1993.	WGA	Final
Report to Congress–Transport of Transuranic Wastes to the Waste Isolation Pilot Plant: State Concerns and Proposed Solutions, WGA Working Group on Nuclear Wastes, June 1989.	WGA	Final
Report to the Western Governors and Secretary of Energy, WGA Technical Advisory Group, June 1991.		
Documents to be prepared		
Report to the Western Governors and Secretary of Energy, 1995.		
Reference material		
WGA/DOE Cooperative Agreement, No. DE–FC04–90AL65416, as amended.	WGA/DOE	Final

Draft

Section 1: High–Quality Drivers and Carrier Compliance

Lead States: Colorado, New Mexico

The Issue: Highly qualified, well–trained drivers; diligent vehicle maintenance; carrier compliance with regulations; and enhanced carrier and driver performance requirements can greatly reduce the risk and consequences of truck incidents.

The Objective: Establish, implement and maintain of an enhanced carrier contract and management plan for the WIPP carrier focussing on high quality drivers and vehicles.

The Approach: Although the possibility of incidents cannot be eliminated, it can be significantly reduced by requiring stringent driver qualifications and training; through strict adherence to all applicable laws and regulations; and provisions in the carrier transportation contract to enhance safety and performance.

In 1988 DOE, through their facility management contractor, Westinghouse Waste Isolation Division, awarded a five–year contract to a commercial carrier for truck transport of transuranic waste to WIPP. DOE subsequently extended this contract through 1995. DOE awarded a new contract to Colorado All State Trucking in 1995. This is a dedicated contract carrier. A long–term contract with one carrier using dedicated drivers and equipment will best ensure compliance with safety procedures and enhance public confidence. Because of federal procurement requirements and program schedule changes, different carriers and different contracting approaches may be used by DOE in the future. DOE has stated, however, that future carrier contracts will include the same safety requirements regarding drivers, equipment, facilities, records, plans, and procedures.

The Technical Advisory Group prepared suggested requirements for the WIPP transportation contract and the carrier's management plan. The contract and management plan include enhancements for driver qualifications, driver performance requirements, driver training, carrier requirements, inspection requirements, and vehicle maintenance requirements. These and other safety requirements are described in detail in *Model Safety Elements in the WIPP Transportation Contract and Corresponding Carrier Management Plan.*

The Technical Advisory Group will participate in any future carrier selection process (*i.e.*, through solicitation review and the evaluation of responses), the development of contract requirements, and development and revision of the carrier's transportation management plan. The western states are committed to ensuring DOE–contractor compliance with the letter and intent of all transportation safety requirements governing the campaign.

Evaluation: The Technical Advisory Group established a Compliance Audit Program to verify compliance by DOE and its contract transportation carrier with all applicable laws, regulations, and other requirements. This program involves regularly scheduled site visits to the carrier's

facilities by a designated state authority where record keeping audits and other inspection functions are performed. Audit checklists that identify applicable statutory, regulatory, and contractual requirements, were developed for use during the audit process. These checklists have been reviewed, modified and approved by the Technical Advisory Group and by the DOE and the contract carrier.

In the past, the New Mexico Motor Transportation Division conducted compliance audits on a semi–annual basis on behalf of the other states. With the award of the contract to Colorado All State Trucking, Colorado will conduct the audits. The frequency of the audits and the check lists will be reassessed periodically by the Technical Advisory Group. Consultation and coordination with DOE, its contractors/subcontractors, DOT, and other interested and affected entities will remain an important, integral component of the *Compliance Audit Program.*

As described in the next section, the Commercial Vehicle Safety Alliance (CVSA) is conducting a pilot study on inspection of vehicles carrying radiological materials. For vehicles included in the study, drivers complete the *DOE/CVSA Pilot Study Point of Destination Driver Interview Form* at the end of each trip. This form is included in this Guide.

On an annual basis the lead states will review whether revisions are required to the checklists to incorporate any changes in the applicable transportation requirements. Proposed revisions will be presented to the Technical Advisory Group, DOE and its carrier for their consideration and approval. Upon approval, the checklists will be revised accordingly and used during subsequent compliance audits.

The lead states will prepare and analyze all audit reports. These reports will be analyzed both individually (on a semi–annual basis) and collectively (on a biennial basis). A summary of the results of each semi–annual audit will be presented at the first quarterly meeting of the Technical Advisory Group following each such audit. Audit exceptions, along with recommendations for correcting identified deficiencies, will be discussed at the meeting. Appropriate corrective actions will be pursued based on the consensus of the DOE and the Technical Advisory Group.

Table 1: High–Quality Drivers and Carrier Compliance

Lead States: Colorado, New Mexico

Documents	Responsible for Updates	Status
Documents included in Guide		
Model Safety Elements in the WIPP Transportation Contract and Corresponding Carrier Management Plan, New Mexico, March 1995.	NM	Draft
WIPP Driver Checklist, New Mexico Motor Transportation Division (NM MTD).	NM MTD	Final
WIPP Vehicle (Tractor/Trailer) Checklist, New Mexico Motor Transportation Division.	NM MTD	Final
DOE/CVSA Pilot Study Point of Destination Driver Interview Form, CVSA, November 1991.	CVSA	Final
Reference material		
Subcontract for the Transportation of Transuranic Waste to the WIPP, Subcontract No. 75WTD629269MZ, Westinghouse Electric Corporation/Waste Isolation Division, Carlsbad, New Mexico, November 1994.	DOE	Final
Management Plan for the Transportation of Transuranic Waste to the WIPP, Revision XVI, Dawn Enterprises, Inc, Farmington, New Mexico, October 1994.	DOE	Final
WIPP contract Carrier Evaluation Results from the U.S. Department of Energy/Transportation Management Division's Motor Carrier Evaluation Program, Westinghouse Hanford Company, Richland, Washington.	DOE	Final
WIPP Contract Carrier Audit Results using the WIPP Vehicle and Driver Checklists from the WGA Technical Advisory Group's Compliance Audit Program, New Mexico Taxation and Revenue Department/Motor Transportation Division, Santa Fe, New Mexico.	NM MTD	Ongoing

Section 2: Independent Inspections

Lead States: Washington, New Mexico

The Issue: A quality, independent inspection program assures that drivers and vehicles perform at optimum levels and that radiation levels are within allowable limits.

The Objective: Reduce the chance of incidents from mechanical failure or human error by identifying and correcting defects before they pose a threat to shipment safety.

The Approach: Inspection and enforcement activities for radioactive material transportation are shared by federal and state agencies. Implementation of the inspection program by state personnel will provide independent verification of regulatory compliance, enhancing public confidence in the safety of the WIPP shipping campaign. DOE selected the CVSA, an organization of international officials responsible for the administration and enforcement of motor carrier safety laws, to develop the inspection and enforcement program. CVSA has since developed the uniform inspection procedures and a model agreement for inspection reciprocity for radioactive material shipments.

These inspection procedures were developed with the assistance of the Conference of Radiation Control Program Directors. The procedures provide uniform standards for radiation surveys, inspection of drivers, shipping papers, vehicle, and package. The standards also provide for vehicle inspections at points of origin and destination, which minimize the need for en route inspections. The enhanced inspection procedures also require a higher level of out–of–service criteria than the North American Inspection Standards. CVSA has trained state inspectors on these procedures. State inspection officers must be equipped with radiation detection instruments to complete the radiological portion of the CVSA enhanced inspection.

CVSA will continue to evaluate the recommended procedures and provide training. Other radioactive waste shipping campaigns (*e.g.*, cesium) are also being used as part of the pilot study.

A comprehensive interstate inspection program should be based on a process which is consistent from state to state in training, procedures, and application. The CVSA Enhanced Inspection Criteria meet these consistency requirements. The WGA WIPP corridor states will inspect WIPP shipments using the CVSA Enhanced Inspection Criteria. DOE has agreed that WIPP transport vehicles will comply with the out–of–service standards of these criteria.

Evaluation: Evaluation criteria are necessary to ensure that the personnel completing the WIPP shipment inspections are competent and the inspections completed are of high quality. The validity of the CVSA Enhanced North American Inspection Standards will be tested using appropriate DOE shipping campaigns, including the cesium capsule return campaign. The CVSA will conduct an evaluation of the technical data from the various shipping campaigns and

provide this information to WGA. In addition, the lead states will prepare a summary report at the conclusion of the various shipping campaigns based upon a survey of participating states. This report will include:

- Number of shipments inspected
- Dates and times of inspections
- Anomalies in the vehicle and driver inspection record
- Consistency in procedure and application
- Identified problems in procedure and application
- Identified shortfalls in training and equipment

This information will be used to help prepare recommended frequency and locations for the inspections other than point of origin and point of destination. The Technical Advisory Group will review the CVSA technical data and the after action–report prepared by the lead states. Findings will be used to improve the inspections of WIPP shipments.

Table 2: Independent Inspections

Lead States: Washington, New Mexico

Documents	Responsible for Updates	Status
Documents included in Guide		
CVSA Pilot Study Summary, CVSA, 1995.	CVSA	Final
CVSA/DOE Spent Fuel/Transuranic/High Level Radioactive Waste Pilot Study Inspection Form, CVSA.	CVSA	Final
Listing of State Inspection Requirements, Responsible Agencies, and Location of Inspection Stations, Washington, March 1995.	WA	Draft
Reference material		
Washington/Oregon MOU for Inspection of Radioactive Waste.	WA/OR	Final
Washington/Oregon Procedures for Implementing the MOU.	WA/OR	Final
Washington Inspection Coordination Procedures.	WA	
Recommended National Procedures for the Enhanced Safety Inspection of Commercial Highway Vehicles Transporting Transuranics, Spent Fuel, and High-Level Radioactive Wastes, CVSA, May 1993.	CVSA	Final
CVSA Training Course Information.	CVSA	Final

Section 3: Bad Weather and Road Conditions

Lead States: Wyoming, Oregon

The Issue: Bad weather and road conditions create hazardous travel conditions.

The Objective: Ensure that WIPP shipments avoid bad weather and hazardous roads by carefully monitoring road and weather conditions and restricting travel when adverse conditions pose a threat to shipment safety.

The Approach: Before dispatch, the WIPP Central Monitoring Room (CMR) operator, the shipper and both vehicle drivers must agree that travel conditions are acceptable for a WIPP shipment. If not, the vehicle may not be dispatched until conditions improve.

Current weather conditions, the weather forecast, and road conditions must be acceptable before dispatching a shipment. Conditions at the point of origin and along the entire route should be considered. A shipment should not be dispatched if the forecast predicts severe weather or bad road conditions which would affect the safety of the shipment when the shipment is anticipated to be in that area.

States should monitor the status of WIPP shipments using the Transportation Tracking and Communications System (TRANSCOM) when adverse weather and road conditions are occurring. This will allow states to notify DOE that a shipment should not be dispatched or that a shipment should be diverted to a safe parking location to avoid bad weather or road conditions. This cooperative effort among DOE, its contractors, and the states will provide additional safeguards which allow WIPP shipments to avoid adverse road and weather conditions without causing undue delay to the shipments. DOE and each State must develop standardized procedures to carry out these policies.

Evaluation: Standards governing dispatch of the shipments and continued travel while en route must be evaluated to confirm that they achieve the objective without being unduly restrictive. The CMR, TRANSCOM Control Center (TCC), and each state must have specific procedures in place.

The evaluation of these procedures will consist of two parts: an evaluation of the process to get information and make the decision to dispatch a shipment and an evaluation of the procedures to avoid bad weather and road conditions while a shipment is en route. To complete this evaluation, exercises will be conducted using actual trips of the TRUPACT–II transport vehicle. Bad weather or road conditions may be simulated during the exercises to ensure complete evaluation of the procedures. The lead states will prepare specific evaluation criteria and reporting forms for each exercise. The exercise described in *Evaluation of Bad Weather and Safe Parking Procedures: Cesium Transportation Plan* provides an example of this evaluation process. Upon the conclusion of each exercise, the lead states will prepare a report for that

exercise with suggested corrective actions for TCC, CMR, and each participating state to consider.

On an annual basis, lead states will evaluate the effectiveness of the standards based upon the exercises and a survey of participating states, DOE, and the carrier. All contact names and telephone numbers will be verified and updated as necessary. A revised and updated procedures document will be prepared and distributed.

An evaluation should be conducted in each state along the route before actual shipments begin. Once shipments begin, an evaluation along the initial route should be conducted before the onset of winter weather. Each bad weather or road condition event that occurs during actual shipments should also be evaluated. Participating states should complete a *TRANSCOM Operators Report of Unusual Conditions* whenever bad weather or road condition procedures are implemented. These reports will be evaluated by the lead states when they are submitted to ensure that the standards and procedures were effective for the incident reported. The lead states will prepare suggested changes or improvements to the procedures to correct any critical problems encountered.

Table 3: Bad Weather and Road Conditions

Lead States: Wyoming, Oregon

Documents	Responsible for Updates	Status
Documents included in Guide		
Procedures and Protocols for Bad Weather and Road Conditions for WIPP Shipments (Revision 2), Richard C. Moore, Cheyenne, Wyoming, January 1992.	WY	Final
TRANSCOM Operators Record of Unusual Event, Wyoming, January 1992.	WY	Final
Reference material		
Guidance for Development of State Procedures for Implementing Procedures and Protocols for Bad Weather and Road Conditions for WIPP Shipments, Richard C. Moore, Cheyenne, Wyoming, January 1992.	WY	Final
Model State Procedures for Implementing Procedures and Protocols for Bad Weather and Road Conditions for WIPP Shipments, Richard C. Moore, Cheyenne, Wyoming, January 1992.	WY	Final
Evaluation of Bad Weather and Safe Parking Procedures: Cesium Transportation Plan, Richard C. Moore, Cheyenne, Wyoming, November 1994.	WY	Final

Section 4: Safe Parking During Abnormal Conditions

Lead States: Wyoming, Oregon

The Issue: Shipments may be delayed en route due to mechanical problems, bad weather or hazardous road conditions or other unanticipated problems.

The Objective: Identify and designate safe parking locations and criteria for selecting safe parking if a predesignated location cannot be reached.

The Approach: Under a contract with WGA, the Western Interstate Energy Board (WIEB) developed criteria for safe parking areas for WIPP shipments. DOE has agreed to carry out these criteria. A hierarchy has been developed to incorporate two factors: 1) the *desirability* of a particular type of parking area; and 2) the driver's *ability* to reach that parking area.

1st Choice: Department of Defense (DOD) & DOE facilities are the most desirable parking areas for WIPP shipments. However, it may not be possible for the driver to safely reach a DOD or DOE facility. The driver should then proceed down the hierarchy to select a parking area.

2nd Choice: Specific types of facilities (*e.g.* Ports of Entry) are likely to be more common than DOD or DOE facilities. State-specific information on the types of facilities that are acceptable has been identified. If the driver cannot reach one of these facilities, the driver should use the *3rd Choice* criteria.

3rd Choice: If facilities listed in the first or second tier cannot be reached safely, a series of avoidance factors are applied to select a parking area. No priorities have been assigned to these factors. It may not be possible to select a parking site that meets all of the criteria listed in the third tier. Compromises may be necessary.

The State of Wyoming prepared a detailed report describing the safe parking locations, preferred routes to these locations, and criteria for selecting parking locations for each state along the route. This report is included in this Guide.

Evaluation: The criteria used to select safe parking locations and the number, type, and location of predesignated safe parking locations must be evaluated. CMR, TCC, and each state must have procedures in place to carry out the safe parking criteria. These procedures must also be evaluated. The *Safe Parking Areas for WIPP Shipments* report contains maps, specific routes, and contacts for each predesignated safe parking location. The use of these predesignated parking locations must also be evaluated to ensure that the drivers can obtain permission to use the safe parking location and proceed along the designated route to reach it.

The evaluation process for safe parking will consist of two parts: an evaluation of the criteria to select a safe parking location and the ability of the drivers to obtain safe parking at predesignated locations. To complete this evaluation, exercises will be conducted using actual trips of the TRUPACT–II transport vehicle. Bad weather or road conditions may by simulated during the exercises to initiate the need for safe parking. The lead states will prepare specific evaluation criteria and reporting forms for each exercise. The exercise described in *Evaluation of Bad Weather and Safe Parking Procedures: Cesium Transportation Plan* provides an example of this evaluation process.

In the Fall of 1994, DOE and the states along the cesium corridor conducted an evaluation of safe parking criteria and the use of DOD facilities for safe parking. The procedures developed for that evaluation will be modified for WIPP shipments. The lead states will work with DOE to identify trips of the WIPP Transport Vehicle that could be used to evaluate the safe parking criteria.

An evaluation should be conducted in each state along the route before actual shipments begin. Exercises should include the use of each DOD facility and other predesignated locations along the route. Once shipments begin, an evaluation along the initial route should be conducted before the onset of winter weather. These evaluations can be conducted as part of the evaluations for bad weather and road conditions. Each event that requires the use of safe parking that occurs during actual shipments should also be evaluated. CMR, TCC, and participating states should complete a *Safe Parking Event Evaluation Form* whenever the safe parking criteria are implemented. These reports will be evaluated by the lead states when they are submitted to ensure that the criteria for selecting safe parking locations were effective for the particular incident reported. The lead states will prepare suggested changes or improvements to the safe parking criteria to correct any critical problems encountered.

Table 4: Safe Parking During Abnormal Conditions

Lead States: Wyoming, Oregon

Documents	Responsible for Updates	Status
Documents included in Guide		
Safe Parking Areas for WIPP Shipments, Richard C. Moore, Cheyenne, Wyoming, May 1994.	WY	Final
Interagency Agreement Between DOE & DOD for Safe Parking at Military Installations, DOE/DOD, August 1989.	DOE	Final
Use of U.S. DOE and DOD Facilities as Safe Parking Areas Memorandum, DOE Transportation Management Program, June 1991.	DOE	Final
Documents to be prepared		
Safe Parking Event Evaluation Form.	WY	
Reference material		
Predesignated Parking Areas for WIPP Shipments, WIEB, September 1990.	N/A	Final
Guidelines for Selecting Parking Areas for WIPP Shipments, WIEB, January 1991.	N/A	Final
Criteria for Safe Parking Areas for WIPP Shipments, WIEB, June 1990.	N/A	Final

Section 5: Advance Notice of WIPP Shipments/Shipment Status Information

Lead States: Idaho, Wyoming

The Issue: States need annual shipment schedules, advance notice of shipment dates, the status of shipments en route, and the ability to communicate directly or indirectly with the drivers.

The Objective: Provide States with advance shipment schedules, an easy, reliable method to obtain shipment information and a means for communication with the drivers.

The Approach: Advance notice of WIPP shipment dates, ongoing status of on–the–road shipments and other pertinent information is required. This information is necessary for emergency response, implementing bad weather and road condition procedures, selecting safe parking when needed, scheduling inspections, conducting public information programs, and communicating with the driver of the WIPP transport vehicle.

States have identified a need for long range forecasts of the number of shipments from each DOE site. These forecasts are needed for planning, training, and public information programs. An overall schedule will be developed by CAO. An annual shipment schedule will be provided to the states by January 31 of each year. A midyear update will also be provided. A six–week projection will be provided through the advance notice section of TRANSCOM.

TRANSCOM is a satellite communications system designed to provide tracking and communications for DOE shipments of radioactive materials. The system enhances safety during transportation and assists in emergency preparedness and response. The TCC receives and distributes information to authorized users. TCC acts only as a conduit of information and does not make decisions regarding the movement of a shipment. The CMR at the WIPP site is a TRANSCOM "Designated User" and has full TRANSCOM communications capabilities with the vehicle. CMR coordinates all decisions regarding movement of shipments.

States will use TRANSCOM as the primary method to receive advance notice for individual WIPP shipments instead of requiring written notification. The Technical Advisory Group developed advance notice information requirements. These are included in this Guide. TRANSCOM will also be used to track shipments. The Technical Advisory Group developed and maintains backup procedures for shipment notification and tracking in the event of problems with the TRANSCOM system. These backup procedures include contacts for each state.

States along the initial corridor obtained computer systems to use the TRANSCOM system. DOE provided training for identified TRANSCOM users in each of these states. States not on the initial transportation corridor must obtain computer systems and training before shipments begin.

Evaluation: The information provided through annual shipment schedules, the accuracy of the six–week projections, and the use of TRANSCOM for notification of pending shipments will be evaluated. The TRANSCOM system will be evaluated for ease of use, system stability, and effectiveness. TCC procedures that affect the states' ability to track shipments and their status will also be evaluated.

The lead states will conduct an annual survey of the states to obtain information on the effectiveness of the advance notification and shipment tracking program. The information requested through this survey is included in the *Advance Notice and Shipment Tracking Evaluation Form* included in this section. Results from this survey will be presented to the Technical Advisory Group to determine if their needs are being met.

DOE and the states will continue to work together to enhance TRANSCOM and to identify the information to be provided by TRANSCOM. States should include an evaluation of TRANSCOM in the reports prepared for exercises or evaluations that use TRANSCOM as part of the exercise (*e.g.* safe parking evaluation, WIPPTREX).

Table 5: Advance Notice of WIPP Shipments/Shipment Status Information

Lead States: Idaho, Wyoming

Documents	Responsible for Updates	Status
Documents included in Guide		
Advance Notice of TRU Waste Shipments, Idaho, 1995.	ID/WY	Draft
Advance Notice Information Requirements, Idaho.	ID/WY	Draft
Back–up Procedures When TRANSCOM Is Not Working, Oregon, 1992.	ID/WY	Final
Documents to be prepared		
Advance Notice and Shipment Tracking Evaluation Form.	ID/WY	
Reference material		
TRANSCOM Control Center Procedures.	DOE	Final
Central Monitoring Room Procedures.	DOE	Final
TRANSCOM Requirements Specification, Prepared for Transportation Technologies Group, Engineering Coordination and Analysis Section, Chemical Technology Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee, December 12, 1994.	DOE	Draft

Section 6: Medical Preparedness

Lead States: New Mexico, Colorado, WGA

The Issue: Effective medical response to a WIPP transportation incident requires a clear understanding of radiological response plans and procedures by emergency medical personnel in the field and at hospitals, adequate training, and the necessary supplies and equipment.

The Objective: Establish and maintain an effective emergency medical response capability along the WIPP transport route.

The Approach: Medical personnel along the WIPP route are an important and integral component of the comprehensive emergency response system for the WIPP shipping campaign. The Technical Advisory Group has developed a *Regional Medical Preparedness Action Plan* for the WIPP shipping campaign. This plan identifies key elements and activities for emergency medical preparedness for WIPP transportation incidents. These include assessments of hospital readiness; development and refinement of radiological response plans and procedures; training, drills and exercises; and the identification and purchase of appropriate radiological and non-radiological supplies and equipment. States will use the Action Plan as the basis for developing the emergency medical preparedness program that best meets their respective individual needs, and will strive for consistency among state programs wherever possible.

To initiate the Action Plan, WGA coordinated an assessment of the medical facilities in the five states between the Idaho National Engineering Laboratory and WIPP. This assessment included recommendations for strengthening medical preparedness for WIPP shipments. These states are now carrying out the recommendations, as appropriate. Medical preparedness assessments in those western states not included in the initial survey will be performed well before shipments through their jurisdictions.

Western states on the WIPP transportation corridor are also working with potentially affected medical facilities and personnel to ensure the development of adequate, up-to-date radiological response plans and procedures. These plans and procedures must include provisions for the protection of emergency medical responders and also for the treatment of incident victims who may have been exposed to or contaminated by radioactive materials. Several plans and sets of procedures are available to serve as models. These reflect guidance provided by such organizations as the American Medical Association, American College of Emergency Physicians, and the Joint Council on the Accreditation of Hospital Organizations.

Training for both pre–hospital and hospital emergency medical personnel is another important element of the WIPP Emergency Medical Preparedness Program. Emergency medical technicians, paramedics, and hospital emergency department personnel who may be required to handle and treat WIPP transportation incident victims must be prepared to do so in a safe, effective manner. Training encompasses classroom courses, in-hospital drills, and field

exercises. The Radiation Emergency Assistance Center/Training Site (REAC/TS) is providing the requisite hospital personnel training under contract to Westinghouse, the management and operations contractor for the WIPP facility. DOE committed to providing for the REAC/TS training to states in its Cooperative Agreement with WGA.

Several states have expressed an interest in providing emergency medical training similar to that offered by REAC/TS, but which would be presented within their respective borders. Such State–directed training may offer greater flexibility in terms of course structure, content and availability, and may be more cost–effective. New Mexico is investigating this option on behalf of the other states.

For states conducting emergency response field exercises such as a WIPPTREX, emergency medical personnel should be involved in the exercise and should be provided REAC/TS training or its equivalent before the exercise. Pre–hospital and hospital emergency medical personnel are key players in any comprehensive WIPP emergency preparedness program.

States should assess if Emergency Medical Technician and Paramedic training includes hazardous materials response in the appropriate curricula. That assessment should specifically include radioactive materials, and patient care related to potential exposure or contamination from radioactive materials. The continuity of pre–hospital and hospital training response procedures should be assessed. New Mexico's assessment of its curricula indicated a significant deficiency relative to EMS response to a radioactive materials or other hazardous materials incident. The lead states will identify and assess options for providing the requisite pre–hospital training.

Finally, states are working to ensure emergency medical personnel are properly equipped to handle a WIPP transportation incident. The Action Plan lists recommended supplies and equipment for hospitals.

Evaluation: Key elements and activities needed for an effective response are identified in the Action Plan. This Action Plan will serve as the basis for assessing the adequacy of the regional emergency medical response capability for a WIPP incident. It will be reviewed, updated, and revised as appropriate by the lead states, in consultation with other members of the Technical Advisory Group, on a biennial basis.

Each state will be responsible for evaluating the effectiveness of the WIPP emergency medical preparedness capability within its borders. Specific evaluation criteria will be developed. State evaluations, in–hospital drills and various field exercises such as WIPPTREX will be used in the evaluation. The adequacy of emergency medical response plans, procedures, and equipment; the effectiveness of training; and the performance of emergency medical personnel will be evaluated. Areas for improvement will be identified.

Those individuals involved in evaluating the medical care component of a WIPP emergency response drill or exercise will constructively review and discuss with the participants all findings and recommendations. For each DOE sponsored WIPP exercise, a report documenting the exercise and its evaluation will be prepared and distributed to the Technical Advisory Group. Quarterly meetings of the Technical Advisory Group will be used as a forum to discuss relevant findings and recommendations for enhancement of the states' emergency medical response capability. Areas identified for improvement will then be addressed and incorporated in biennial revisions of the *Regional Medical Preparedness Action Plan.*

Table 6: Medical Preparedness

Lead States: New Mexico, Colorado, WGA

Documents	Responsible for Updates	Status
Documents included in Guide		
Regional Medical Preparedness Action Plan (Revision 6), WGA Technical Advisory Group, August 1993.	Technical Advisory Group	Final
Initial WIPP Transportation Corridor Regional Medical Preparedness Assessment, Prince and Associates, Denver, Colorado, June 1993.	WGA	Final
Documents to be prepared		
Medical Preparedness Evaluation Criteria.	CO, NM	
Reference material		
State of New Mexico's Emergency Medical Response to WIPP Action Plan, New Mexico Department of Health/Emergency Medical Services Bureau, Santa Fe, New Mexico, 1991.	NM	Final
Report of the Governor's WIPP Emergency Response Medical Training Advisory Committee, New Mexico Department of Health/Emergency Medical Services Bureau, Santa Fe, New Mexico, September 1994.	NM	Final
Radiological Medical Emergency Training Materials, Radiation Emergency Assistance/Training Site, Oak Ridge, TN.	REAC/TS	Final
WIPP Transportation Incident Emergency Medical Response Guide, New Mexico Department of Health/Emergency Medical Services Bureau, Santa Fe, New Mexico, 1995.	NM	Draft

Section 7: Mutual Aid Agreements

Lead States: Idaho, Wyoming

The Issue: WIPP transport incidents may occur near state borders or exceed state and local emergency response capabilities. State and local officials must be able to access the closest emergency response resources, whether they are in an adjoining state or part of a federal agency.

The Objective: Ensure a swift response by capable responders, regardless of jurisdiction.

The Approach: A mutual aid agreement helps ensure the availability of adequate resources and the necessary protocols to call upon those resources to accomplish an efficient and effective response. Some states have entered into mutual aid agreements with DOE. These are listed in the *Listing of Mutual Aid Agreements for WIPP Transportation* included in this Guide.

To assist in the development of state–to–state agreements, the Technical Advisory Group developed a model mutual aid agreement. Some states have entered into such agreements. The agreements include a listing and the location of each state's resources. These mutual aid agreements can be activated anytime an incident occurs, but would most likely be used when the incident is in an area near a state border. This is because the adjoining state's resources may be closer to the incident. The mutual aid agreements need to provide for the pooling of emergency response resources when a state or local jurisdiction's own resources are exceeded. The agreement should also provide for a mechanism for setting the response in motion.

Interstate mutual aid agreements may supplement existing local agreements. Many local agencies along state borders already have formal or informal agreements to assist across state lines. Since these responders are more likely to handle the initial response to an accident, a good working relationship at the local level is crucial. The states should encourage the establishment of strong local relationships across state lines. The Technical Advisory Group will develop guidance on how to relate the model mutual aid agreement to local agreements.

Evaluation: Existing mutual aid agreements will be reviewed annually. Contact names and telephone numbers need to be verified and updated. The lead states will also periodically review the model mutual aid agreement to ensure it accurately reflects current conditions and requirements.

The most effective method of evaluating existing mutual aid agreements is through exercises such as WIPPTREX. States with mutual aid agreements with DOE should include an evaluation of the agreement as part of the exercise program. States considering WIPPTREX exercises should try to schedule joint exercises with neighboring states to evaluate existing agreements or the need for an agreement if one is not already in place. The after action report for each exercise should include a discussion of the effectiveness of any mutual aid agreements.

Every two years, the lead states will conduct a survey of the states to determine the status of mutual aid agreements. The information requested through this survey is included in the Mutual Aid Evaluation Form included in this section. Based upon the results of the survey, the lead states will develop proposed changes to the model agreement. Results from this survey and proposed changes to the model agreement will be presented to the Technical Advisory Group at their next meeting.

If a mutual aid agreement is activated due to a transportation incident, a detailed after action–report should be prepared. Lead states will review the after action–report to determine if changes in the model agreement are required.

Table 7: Mutual Aid Agreements

Lead States: Idaho, Wyoming

Documents	Responsible for Updates	Status
Documents included in Guide		
Model Mutual Aid Agreement, Idaho.	ID/WY	Final
Listing of Mutual Aid Agreements for WIPP Transportation, WGA.	WGA	Draft
Documents to be prepared		
Mutual Aid Agreements Evaluation Criteria.	ID/WY	

Section 8: Emergency Response Plans & Procedures

Lead States: Arizona, Nevada, WGA

The Issue: Emergency response plans and procedures help ensure coordinated, timely, and effective incident response.

The Objective: Develop effective emergency response plans and procedures for responding to WIPP transport incidents along the entire shipping corridor.

The Approach: Many state, local and federal agencies have responsibilities for response to an incident involving a WIPP shipment. Each response organization must know which other organizations are involved and who is responsible for each task. This helps ensure all key response actions are covered. In case of an incident involving a shipment to WIPP, DOE and the carrier should be familiar with the specific plans and procedures in the state where the incident occurred.

Emergency response plans describe the organizations and their responsibilities. Emergency response procedures tell how the plan will be implemented. Each state's emergency response plan and procedures should have provisions for response to a WIPP incident. If a state develops a plan or procedures specific to a WIPP incident, it is essential they be consistent with other state and local emergency plans, especially those for radiological emergencies and hazardous materials incidents.

Each state along the WIPP shipping corridor has taken its own individual approach to transportation emergency response planning. This is especially true regarding division of responsibilities between various state agencies. Some states have developed emergency response plans especially for radiological transportation incidents (*e.g.*, Wyoming). These plans could be used as a model for other states, should they wish to develop their own plan. There are many other guidance documents that can be used to determine the key components of an emergency response plan. These documents are referenced in the attached table.

Oregon developed model field procedures both for response to a radiological transportation incident and response specifically to an incident involving transuranic materials. Other states have used the generic model to develop their own procedures. A copy of the generic procedures is included in this guide.

The states also reviewed DOE's plans and procedures for response to a WIPP incident. The review was to ensure consistency of federal actions with state and local actions. Some of these procedures are included in this Guide.

Evaluation: Each state will review and update its own plans and procedures on a yearly basis. This is done to keep the plans and procedures current and to include lessons learned from exercises.

Exercises are used to test the plan and to train responders. Comments from exercise participants and evaluators who observe the exercise are used to identify ways the plan and procedures can be improved. Lead states will review corrective actions identified and lessons learned for WIPPTREX exercises and summarize significant findings in a brief report. WGA will distribute this report to the other states.

DOE's plans and procedures will also be tested during WIPPTREX exercises. Lead states will prepare suggested changes or improvements to correct any problems identified. These recommendations will be provided to the other states and DOE.

Table 8: Emergency Response Plans & Procedures

Lead States: WGA, Arizona, Nevada

Documents	Responsible for Updates	Status
Documents included in Guide		
Oregon Field Procedures (Revised), Oregon, February 1993.	OR	Final
Emergency Planning, Response, and Recovery Roles and Responsibilities for TRU–Waste Transportation Incidents (DOE/CAO–94–1039), DOE Albuquerque Operations Office and Carlsbad Area Office, January 1995.	DOE	Final
Recovery Guide for Packaging (DOE/CAO–94–1007), Carlsbad Area Office, January 1995.	DOE	Final
Incident/Accident Response Team Guide (DOE/CAO–94–1008), CAO, September 1994.	DOE	Final
Documents to be prepared		
Listing of State Emergency Response Plans.	AZ, NV	
Reference material		
Guidance for Developing State, Tribal, and Local Radiological Emergency Response Planning and Preparedness for Transportation Accidents, FEMA–REP–5, Revision 1, June 1992.	FEMA	Final
Criteria for Review of Hazardous Material Emergency Response Plans, National Response Team, NFT–1A.		
Planning Guide and Checklist for Hazardous Materials Contingency Plans, FEMA–10.		
Guide for the Review of State and Local Emergency Operations Plans, CPG 1–8A.		

Section 9: Emergency Response Equipment

Lead States: Idaho, Utah

The Issue: Emergency responders need specialized equipment to respond to a WIPP shipment incident.

The Objective: Acquire and maintain adequate equipment to respond to a WIPP shipment incident.

The Approach: Responders need proper equipment for response to an incident involving a WIPP shipment. Proper equipment includes primarily radiation detection equipment and personal protective equipment (PPE).

These equipment needs vary depending on the role of the responder. For example, first responders would likely enter the immediate incident scene only to conduct lifesaving rescue. The "bunker gear" and self contained breathing apparatus (SCBA) that most fire departments have is sufficient for this task. This entry could be conducted without radiation detection equipment, if none is immediately available.

Secondary responders, such as State Response Teams, have the responsibility of assessing the nature and extent of the incident and identifying contaminated individuals. These tasks would require PPE such as Tyvek suits and respirators. These tasks would also require radiation detection equipment . They would also require even more sensitive instrumentation to complete their tasks of area radiation and contamination surveys and ensuring a thorough cleanup. The organizations responsible for each of these tasks varies by state.

Each state has approached the issue of equipment acquisition and distribution in a different manner. Most states have extremely limited amounts of radiation detection equipment capable of detecting the alpha radiation emitted by transuranic waste. Some states have chosen to purchase alpha detection instruments and provide them to secondary responders in preparation for WIPP shipments.

There is a wide range of equipment types and brands available to meet these needs. In selecting which equipment to purchase, states considered such issues as cost, effectiveness, portability, reliability and durability under field conditions.

The lead states will develop a report describing the equipment necessary to respond to a WIPP incident. This report will include a description of the equipment needed to meet the requirements found in 29 CFR 1910.120 and NFPA 472–473 for the protection of those involved with incident response. These regulations prescribe specific equipment that is necessary to respond to incidents involving the types of material found in a WIPP shipment. The report will also describe the equipment necessary to provide the ability to safely access the incident, provide

protection to responders and to determine if victims or responders are contaminated. Equipment needed for training and exercises will also be discussed.

Evaluation: Exercises will be used to evaluate whether responders have the proper equipment for response to an incident involving a WIPP shipment. Each state will consider this as a key objective during a WIPPTREX or other exercise involving a transuranic waste shipment. States should evaluate whether responders have adequate radiation detection equipment, that it is properly calibrated, and whether the responders are properly trained in its use. States should also evaluate whether responders have proper PPE. States may also elect to conduct evaluations on specific types or brands of equipment.

If a state is involved in an actual response to a WIPP transportation incident, the after–action evaluation should consider these same issues. The evaluation should also review whether any injuries occurred as a result of inadequate equipment or inadequate training on the use of equipment.

Each year, lead states will compile lessons learned from all of the states. A summary of this information should then be provided to the other states and DOE.

Table 9: Emergency Response Equipment

Lead State: Idaho, Utah

Documents	Responsible for Updates	Status
Documents included in Guide		
Recommended Equipment to be used by First Responders.	ID/UT	Draft
Recommended Equipment for State Police Responders, Inspectors and Radiological Response Teams.	ID/UT	Draft
Documents to be prepared		
Equipment Report.	ID/UT	
Recommended Maintenance/Calibration of Detection Equipment.	ID/UT	
Equipment Required for Training.	ID/UT	
Reference material		
Evaluation Survey of Victoreen Model 190, Oregon State University, Corvallis, Oregon, January 1994.	OR	Final

Section 10: Training and Exercises

Lead States: Colorado, Utah

The Issue: An incident involving a WIPP shipment poses unique problems for emergency responders not usually addressed as part of their hazardous materials training.

The Objective: Provide appropriate training, drills and exercises to emergency responders to help ensure a coordinated, timely and effective incident response along the WIPP transport route.

The Approach: The amount and types of radiological response training varies tremendously from state to state. As a result, each state has specific and unique training needs. Most states do not have the resources to conduct training for a specific hazard such as transuranic waste.

DOE developed the States Training and Education Program (STEP) emergency responder training courses for WIPP shipments in consultation with the western states. DOE's original plans called for limited shipments from Idaho National Engineering Laboratory and Rocky Flats to conduct tests at WIPP. As a result, initial training was focused along these shipping corridors in the states of Idaho, Utah, Wyoming, Colorado, and New Mexico. These states made extensive use of the STEP training classes. Current courses include First Responder, First Responder Refresher, and Command and Control. The Technical Advisory Group will continue to provide input on additional course development and the direction of the training program to ensure the needs of the target audience are addressed.

Some states intend to eventually have state personnel deliver the STEP course material, rather than rely on DOE and its contractors. Some states are also interested in incorporating the STEP training into their existing hazardous material response training programs. Since emergency responders are already inundated with training requirements, this would allow for a more efficient use of limited training time.

The STEP courses are available upon request of the states. To determine its needs for these courses, each state will evaluate the capabilities of its emergency response personnel. The evaluation should determine the current radiological response capabilities and training necessary to maintain and improve those capabilities to allow personnel to respond to a WIPP shipment incident.

Each state will develop a plan to accommodate training needs based on the results of the evaluation. Once a state has identified its training and exercise requirements, state representatives will meet with each other and DOE to review and coordinate the available training classes and exercises. This coordination will become increasingly important as additional states begin to prepare for shipments.

Exercise programs are an integral part of any training program. Exercises can enhance learning, test systems, increase awareness, and provide information to evaluate the effectiveness of training. Exercises should begin small and build to functional and full–scale exercises.

DOE developed an exercise program that provides an opportunity to evaluate local and state capabilities. The WIPP Transportation Emergency Exercise (WIPPTREX) program was designed to determine the local and state response capabilities to a WIPP incident. WIPPTREX exercises are held twice a year on a rotational basis among states. Transportation Accident Exercises (TRANSAX) test DOE response capabilities and local and state systems. TRANSAX exercises are held about once every two years.

Evaluation: Changes in regulations, procedures, policies, and other factors may result in different training and exercise requirements. Changes may be needed in courses to ensure they are accurate, current and appropriate.

Under the Land Withdrawal Act, the U.S. Occupational Safety and Health Administration (OSHA) is required to evaluate the STEP courses. OSHA decided this evaluation will be conducted every two years. The next evaluation is scheduled for mid–1995. Lead states will work with DOE and Westinghouse–WIPP to evaluate, review, and update the course material prior to submittal to OSHA for review. This evaluation will include a periodic sampling of course students to assess the usefulness of the training material and the students' retention of the information.

Each state will need to evaluate whether it is providing sufficient training and exercise opportunities to its responders. States may wish to set goals to train a certain percentage of emergency responders. States will also need to ensure that responders all along their portion of the route have been trained, and eliminate "gaps" where no or few responders have received training. States will also need to evaluate whether responders are receiving refresher training on a regular basis.

States should share any important lessons learned from their individual evaluations with the lead states. A summary of this information should then be provided to the other states and DOE.

Table 10: Training and Exercises

Lead States: Colorado, Utah

Documents	Responsible for Updates	Status
Documents included in Guide		
WIPP Training Fact Sheet, WIPP.	WIPP	Final
WIPP Training Planning Procedures, Colorado.	CO	Draft
WIPPTREX Planning Procedures, WIPP.	WIPP	Final
Training Capabilities Evaluation, CAO.	CAO	Draft
Documents to be prepared		
Training Report.	CO/UT	
Reference material		
First Responder, United States Department of Energy, Waste Isolation Pilot Plant, Carlsbad, New Mexico, Revision Three.	DOE	Final
First Responder Refresher, United States Department of Energy, Waste Isolation Pilot Plant, Carlsbad, New Mexico, Revision Three.	DOE	Final
Command and Control, United States Department of Energy, Waste Isolation Pilot Plant, Carlsbad, New Mexico, Revision Three.	DOE	Final
U.S. Department of Labor letter by David Zeigler, 4/27/93 and U.S. Department of Labor letter by Frank Frodyma, 7/19/93 regarding OSHA review of WIPP Training, OSHA.	OSHA	Final
DOE Nevada Operations Emergency Management Training Course Listing, DOE Nevada Operations Office, January 1995.	DOE	Final

Documents	Responsible for Updates	Status
Report on the Emergency Response Training and Equipment Activities through Fiscal Year 1993 for the Transportation of Transuranic Waste to the Waste Isolation Pilot Plant, USDOE/WIPP 93–061, April 1994.	DOE	Final

Section 11: Public Information and Participation

Lead States: Oregon, Nevada, New Mexico

The Issue: The public and news media have a heightened concern about the transport of radioactive materials.

Objective: Clearly communicate to the media and public the actual risk of the shipments and the safety measures in place. Encourage continued public involvement in program planning and review.

Approach: The goal of the western Governors is the safe and uneventful transport of transuranic waste to WIPP. This will not be possible unless the public and media have confidence that the WIPP shipping campaign requires the highest reasonable standards for incident prevention and emergency preparedness.

A coordinated effort is needed among corridor states, WGA, and DOE to clearly communicate the safety measures in place and the actual risk that shipments present. The public must have complete, timely, accurate and unbiased information and the opportunity to judge the merits of the safety program on its own. They should be provided opportunities to participate in the development and evaluation of the program whenever possible.

The states and WGA will develop accurate information materials about the transportation safety program and about other issues of local and regional significance generated by the transportation program. These products must conform to high standards for clarity and meet the needs of the public, the news media, and others.

Communications with the public and media will vary depending on the interest of the audiences. It will likely include the following:

- Publications/direct mail materials, including brochures, pamphlets, handbooks, newsletters, fact sheets, etc;
- Media work, including meetings with editorial boards, guest articles, news releases, newspaper ad copy;
- Public Service Announcements (Radio and TV);
- An informational video;
- Public presentations to civic groups, schools, etc.;
- Public meetings; and
- Public displays (WIPP Road Show Trailer)

Because the transport of radioactive materials generates such strong emotions, those who speak to the media and the public about the transport program should have training in risk communications.

Evaluation: Evaluation of the Public Information and Participation program will include reviews of the public information products and materials, the effectiveness of public meetings and other events, whether the focus of public and media activities is directed in the most effective manner, and whether states are following the Regional Communications Plan.

Public information products, such as fact sheets, brochures and informational videos, will be reviewed by focus groups of representative target audiences. The lead states will work with WGA and DOE to conduct small focus groups in at least three states at least every two years to review these materials. The materials will be evaluated for accuracy and clarity of information, and to ensure that the information is presented in a fair, unbiased manner.

Evaluation forms will be provided to participants at public meetings. These forms will ask questions to help the states gauge the effectiveness of the meetings. These forms will be reviewed by the lead states on an annual basis. Pertinent information taken from these forms will be shared with all corridor states, WGA, and DOE.

Surveys will be used to help gauge the effectiveness of various aspects of the overall program and identify those factors that will have the greatest impact in generating public confidence in the program. Resources/attention can then be re–directed, if necessary, on those aspects of the program that have the strongest effect. This will be done as a joint effort among the lead states, WGA and DOE. Surveys will be conducted at least every three years.

On an annual basis, the lead states will evaluate the effectiveness of the Regional Communications Plan. This will be done by surveying the public information activities of each state, WGA and DOE. Significant deviations from the plan, identified problems, or major successes will be discussed at the next quarterly meeting of the Technical Advisory Group.

Table 11: Public Information and Participation

Lead States: Oregon, Nevada, New Mexico

Documents	Responsible for Updates	Status
Documents included in Guide		
Contacts for the Media and Public for Information on the WIPP Transportation Safety Program, Oregon and WGA, April 1995.	OR	Draft
Documents to be prepared		
Regional Communications Plan.	OR, NM, NV, & WGA	
Compilation of Information Resources.	OR, NM, NV, & WGA	
Regional Public Information Resources.	OR, NM, NV, & WGA	
Public Meeting Evaluation Form.	OR	
Survey of Public Information Activities.	OR, NM, NV, & WGA	
Reference material		
Carlsbad Area Office Stakeholder Outreach Strategic Plan, USDOE–CAO, March 1995.	CAO	Final

Section 12: Highway Routing of WIPP Shipments

Lead States: New Mexico, California, Colorado, Nevada

The Issue: There are various route options for moving transuranic waste from generator sites to the WIPP facility.

The Objective: Identify and select the safest routes for transporting transuranic waste to WIPP.

The Approach: DOT regulations for the routing of Highway Route Controlled Quantities (HRCQ) of radioactive materials require the use of Interstate System highways unless states have properly designated alternate preferred routes (49 CFR 397). Although not every WIPP shipment will be a HRCQ shipment, DOE has stated that, as a matter of policy, all WIPP shipments will be subject to this DOT routing requirement. DOE, with cooperation from the states, also identified specific Interstate System highway routes for WIPP shipments well before the actual shipments. This identification of specific routes limits the number of affected jurisdictions and allows states to focus preparation and training.

Preferred routes designated by the states may provide safer routes than the existing Interstate System. Routes for pickup at and delivery to facilities not on the Interstate System may also need to be analyzed to provide the best route. The identification, analysis, and selection of appropriate highway routes for the transportation of WIPP shipments can reduce the radiological and non–radiological risks associated with the WIPP shipping campaign.

The designation process entails the performance of a comparative route analysis following DOT's *Guidelines for Selecting Preferred Highway Routes for Highway Route Controlled Quantity Shipments of Radioactive* Materials (DOT/RSPA/HMS/92-02, August 1992) or an equivalent routing analysis which adequately considers overall risk to the public. In assessing the primary route comparison factors, basic data are compiled on accident rates, traffic counts, highway segment length, vehicle speeds, population distribution, land use and other relevant factors for each alternative route. Upon completion of the data compilation and verification process, the information is processed and used to compare alternative routes.

Upon completion of the preferred route designation process, states must file their routing designations with the DOT's Federal Highway Administration (FHWA). Coordination with local government authorities along prospective routes of travel and other adjacent state authorities is required to obtain relevant information and to ensure continuity of designated routes, should an alternative route be selected. Preferred routes become effective when a state receives formal acknowledgment from FHWA. To date, California, Colorado, and New Mexico have designated alternate preferred routes. Nevada is currently evaluating preferred routes.

Evaluation: Evaluation of routing issues will include an assessment of the benefit of DOE's preselection of routes, the safety of routes selected, environmental justice issues, and adherence to the selected routes.

Prior to the first shipment, lead states will prepare an evaluation of the benefit to the states of DOE's preselection of routes. By predesignating routes, states have been able to concentrate their activities along these routes instead of having to prepare for all possible routes. Items in this evaluation will include training and exercises, designated safe parking locations, medical preparedness and public information activities.

Every two years, lead states will conduct an evaluation of the safety of the routes. Items in this evaluation will include the number of incidents along the route involving radiological materials shipments, the number of incidents along the route involving other commercial trucks, locations with high accident rates or weather problems, and other trouble spots. This information will be used to consider use of other routes or to call attention to potential trouble spots.

Some states have already designated specific routes. Other states may also conduct route designation studies in the future. An evaluation of the route designation process by states that have designated routes could provide valuable information to states considering starting a route designation. The lead states will conduct an evaluation of the route designation process for those states that have already designated routes. This evaluation will include a description of the methodology used, information and data requirements, a description of the process followed, and lessons learned.

Executive Order 12898, signed by President Clinton on February 11, 1994, requires each federal agency to give priority to environmental justice. Its purpose is to emphasize compliance with provisions of existing environmental, health and civil rights laws and ensure a safe and healthful environment for all communities and persons. When conducting the evaluations described above, the lead states will also consider environmental justice issues.

States want to ensure that DOE and its transportation carrier follow preferred routes, as that term is defined in the applicable DOT regulations. The lead states, in consultation with other western corridor states, will review on an annual basis the designated WIPP routes in each state. Once this information is compiled and verified, it will be compared to the official listing of alternate preferred routes published annually by DOT for accuracy and consistency. The resulting compilation of preferred routes for WIPP shipments will then be reviewed with DOE and its carrier to ensure it corresponds directly with the information on WIPP preferred routes contained in the carrier's Management Plan.

Table 12: Highway Routing of WIPP Shipments

Lead States: New Mexico, California, Colorado, Nevada

Documents	Responsible for Updates	Status
Documents included in Guide		
Summary of WIPP Highway Routes through the Western States, New Mexico, April 1995.	NM	Draft
Reference material		
DOE/OCWRM Report on WIPP Route Designation Process.	OCWRM	Final
Preferred Routes Designated by States under 49 CFR 397, USDOT/FHWA, Washington, D.C.	DOT/FHWA	Final
Final Statement of Reasons: Designation of Routes for the Through Transportation of Highway Route Controlled Quantity Shipments of Radioactive Materials, HMS–94–1, CA Highway Patrol, Sacramento, California, August 1994, effective October 19, 1994.	CA	Final
Nuclear Materials Transportation Route Designation within the State of Colorado, Colorado Department of Public Safety, Division of State Patrol, Denver, Colorado; routing regulations codified in Nuclear Materials Routing Rules 1 through 4, Volume 8, Code of Colorado Regulations, Section 1507–6 (8 CCR 1507–6), effective March 10, 1989.	CO	Final
Report to the New Mexico Secretary of Highway and Transportation to the New Mexico State Highway Commission Recommending Action on Proposed State Highway and Transportation Department (SHTD) Rule 91–3 Designating Highway Routes for the Transport of Radioactive Materials, New Mexico State Highway and Transportation Department/Office of General Counsel, Santa Fe, New Mexico, May 1991.	NM	Final

Documents	Responsible for Updates	Status
Comparative Study of WIPP Transportation Alternatives, DOE/WIPP 93–058, USDOE/CAO, Carlsbad, New Mexico, February 1994.	CAO	Final

Section 13: Program Evaluation

Lead States: California, Oregon

The Issue: The WIPP Transportation Safety Program and its individual elements must be regularly and rigorously evaluated to determine their effectiveness.

The Objective: Measure the effectiveness of the WIPP Transportation Safety Program, identify areas needing improvement, and ensure issues are resolved.

The Approach: Western states have worked with DOE to develop a comprehensive transport safety program for WIPP shipments. This safety program is designed to reduce the risk of a WIPP transportation incident and to increase the public's confidence in these shipments and nuclear waste transportation in general. The program is also intended to serve as a model for use or adaptation for use on other radiological shipments.

The evaluation process has two elements: reviews of procedures and policies specific to each section, and evaluation of the WIPP Transportation Safety Program as a whole. Criteria for the evaluation for each section are developed by the lead states for each task. Criteria to evaluate the overall program are developed by all the states. Data collection and analysis should not be unnecessarily burdensome. Both quantitative and qualitative information will be used.

The evaluation of each section will include both the procedures and policy decisions specific to each section. For example, evaluation of safe parking could include looking at specific procedures such as whether directions to designated safe parking locations are easy to understand. It could also include a review of the policy issues such as whether the avoidance criteria agreed to by the states results in the selection of appropriate safe parking locations. This evaluation will be conducted by the lead states for each task.

The overall program evaluation includes looking at the interrelationship between various program elements and evaluating elements not contained in the individual sections. For example, the medical preparedness, training and equipment sections all have some elements that overlap. These interrelationships need to be evaluated to assure a consistency of effort and that tasks are not redundant. Program elements not evaluated as part of a particular section, such as coordination among the states and with Native American Nations, also need evaluation.

The overall program evaluation will occur annually and involve all the states. It will begin with a round table discussion at the last quarterly meeting of each year. The lead states for Program Evaluation will coordinate this activity and develop recommended suggestions for the program.

Since shipments to the WIPP site are not expected before 1998, there is a limit to the evaluation that can be done before shipments begin. Whenever possible, evaluation will be completed for other radioactive material shipments, in cooperation with DOE.

Table 13: Program Evaluation

Lead States: California, Oregon

Documents	Responsible for Updates	Status
Documents to be prepared		
Performance Criteria for Program Components.	CA, OR	
Draft Annual State Program Review.	CA, OR	
Draft Biennial Program Review.	CA, OR	

DCCA Augmentation Overview

Bob Bills

Office of Regulatory Compliance

July 13, 1995

Definition

- Information to supplement the Draft Compliance Certification Application delivered to the EPA on March 31, 1995

- Update the EPA on technical issues where additional information has become available since March 31

Contents

- Expanded Containment Requirements chapter 6
  - Includes disturbed performance calculations
  - Includes parameter ranges for many ? Performance Assessment parameters – why not all ?
- Revised Scenario Screening Appendix

2 pages of revisions for Chapter 8

Contents (con't)

- Performance Assessment Computer Code Appendices – Description, algorithms
  - BRAGFLO
  - NUTS – most stable
  - CUTTINGS
  - SECO2D

Only 4 out of 36+

Results

- Preliminary Performance Assessment indicates disturbed-case compliance with 40 CFR 191
  - Calculations based upon existing experimental data and expected outcomes from SPM activities

Plans

- Submit to the EPA on July 31, 1995
- Stakeholder copies available July 31, 1995
- No further formal updates to the DCCA until the Final CCA is submitted on 12/31/96

Status of PA Models and their QA

Robert A. Bills
Carlsbad Area Office
PA Manager

PA Schedule

- Final Models to PA [9/95 (**DDP**)]
- 25 PA codes to NQA 2.7 [9/95]
- All other codes to NQA 2.7 [3/96]
  - Graded Approach
- Final Data to PA [3/96(**DDP**)]
- FEP Calculations Complete [3/96]

PA Schedule Cont'd

- Parameter & Analysis QA Completed for CCA PA [3/96]
- CCA CCDF Completed [9/96(**DDP**)]
- Final PA input to CCA [10/96(**DDP**)]

PA Schedule Cont'd

(Screening means Sceened In or Screened Out)

- Phase I FEP Screening Complete [9/95]
  - FEPs That Must Be Understood and Screened Early, i.e., Could Have An Impact On PA
- Phase II FEP Screening Complete [3/96]
  - FEPS Believed To Not Have Impact On PA

Development of WIPP FEP List

Used 9 Lists Prepared for Several

Agencies/Countries to Make WIPP

List With About 900 unique FEPS

FEP Screening Process

- FEP Screening Based On:
  - Relevance to WIPP
  - Regulations
  - Probability
  - Consequence
- FEPs Screened In Will be Included in PA
- FEPs Screened Out Will be Documented and Maintained in Records Center

Screening Efforts - Progress

	May 11	July 10
• Gas Generation	13	9
• Disposal Room	17	13
• Rock Mechanics	2	0
• Salado Flow	15	12
• Seal Performance	10	10
• Non-Salado Flow	25	24
• Contaminant Transport	27	12
• Geologic Changes	3	0
• Regulatory Issues	13	4
TOTAL	125	85

NQA 2.7

- Requirements Documentation
- Design Documentation
- Users Documentation
- Independent V & V Verification & Validation
- Review
- Configuration Management
- Change Control

PA Codes to NQA 2.7 by 9/95

Scientific + Engineering Software

- SES Codes: BRAGFLO, NUTS, PANEL, CUTTINGS, SECOFL2D, SECOTP2D, GRASP-INV
- NON-SES Codes: CCDFCALC, LHS, GENMESH, GENNET, ICSET, BCSET, MATSET, PRE & POST BRAGFLO, PRE & POST SECOTP2D, PRE & POST SECOFL2D, PRE & POST LHS, PRE & POST NUTS, CCDFMC

NQA 2.7 Definition of Software V & V

- Verification
  - *The Process of determining whether or not the product of a given phase of software development cycle fulfills the requirements imposed by the previous phase*

- Validation
  - *The test and evaluation of the completed software to ensure compliance with software requirement*

EPA/EEG Training on Codes

- Phase I - Running the PA Codes
  - Operating System and Editor
  - Inputs Required/Outputs Produced
  - How Codes Work Together
- Phase II - Theory
  - Conceptual Model
  - Math Model
  - Approximations and Discretization
  - Source Code

PA Concerns

- Use Of NQA Is increased Work — Yankee Atomic
  - Brought In Outside Specialist To Assist
- QAing Many More Codes Than Originally Planned (Up to 180 Vice 50 as Briefed to EPA on June 17, 1994)
  - Using Increased Personnel
  - Using Graded Approach
  - Closer Cooperation Between PA and QA

Conclusions

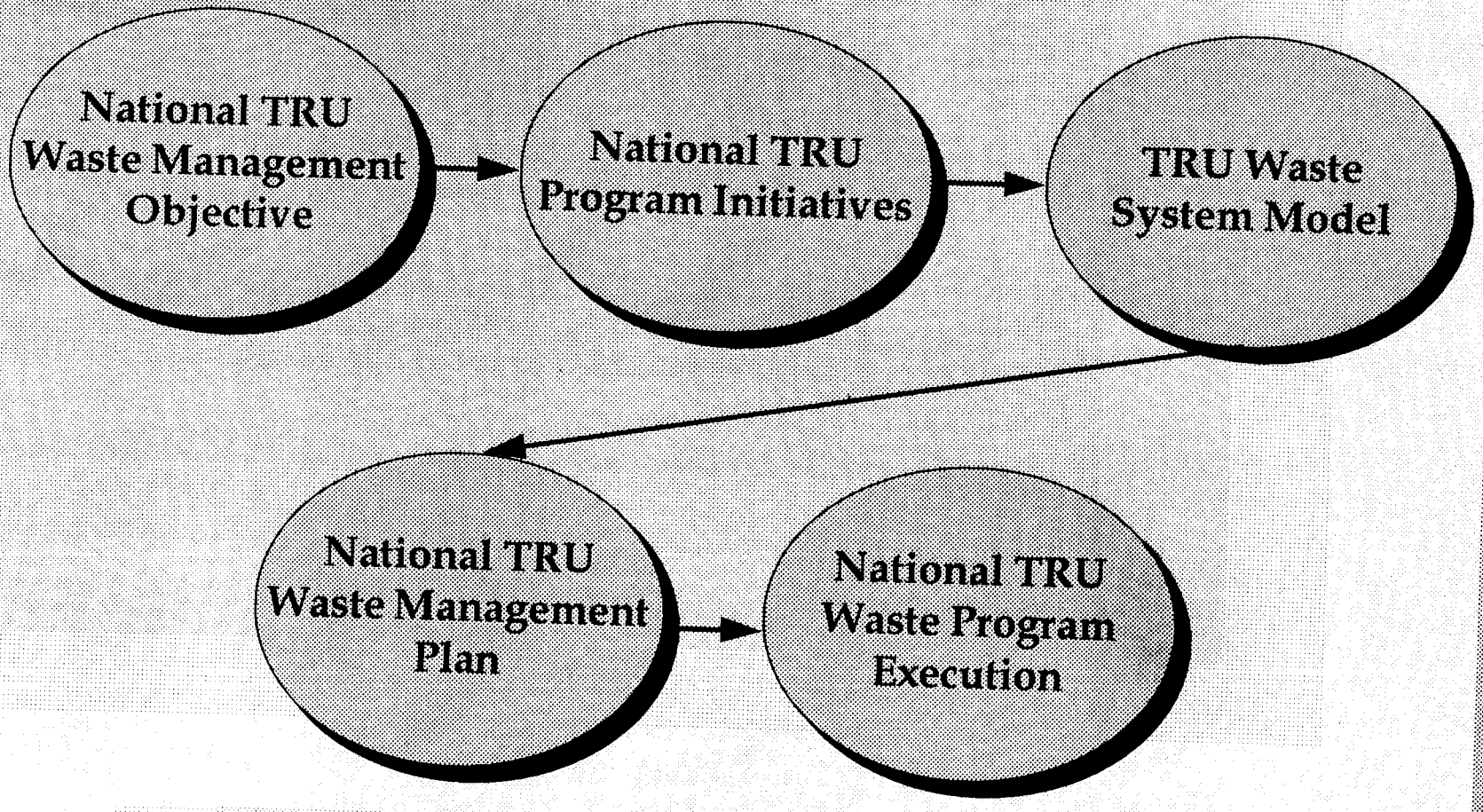
- Added Work Load Causes Problems But Manageable

- DDP <u>Still Aggressive</u> but <u>Still Achievable!!</u>

TRU Waste Management Plan and Program Guidance

Clifton R. Holman
National TRU Program
Carlsbad Area Office
July 13, 1995

National TRU Program System Process



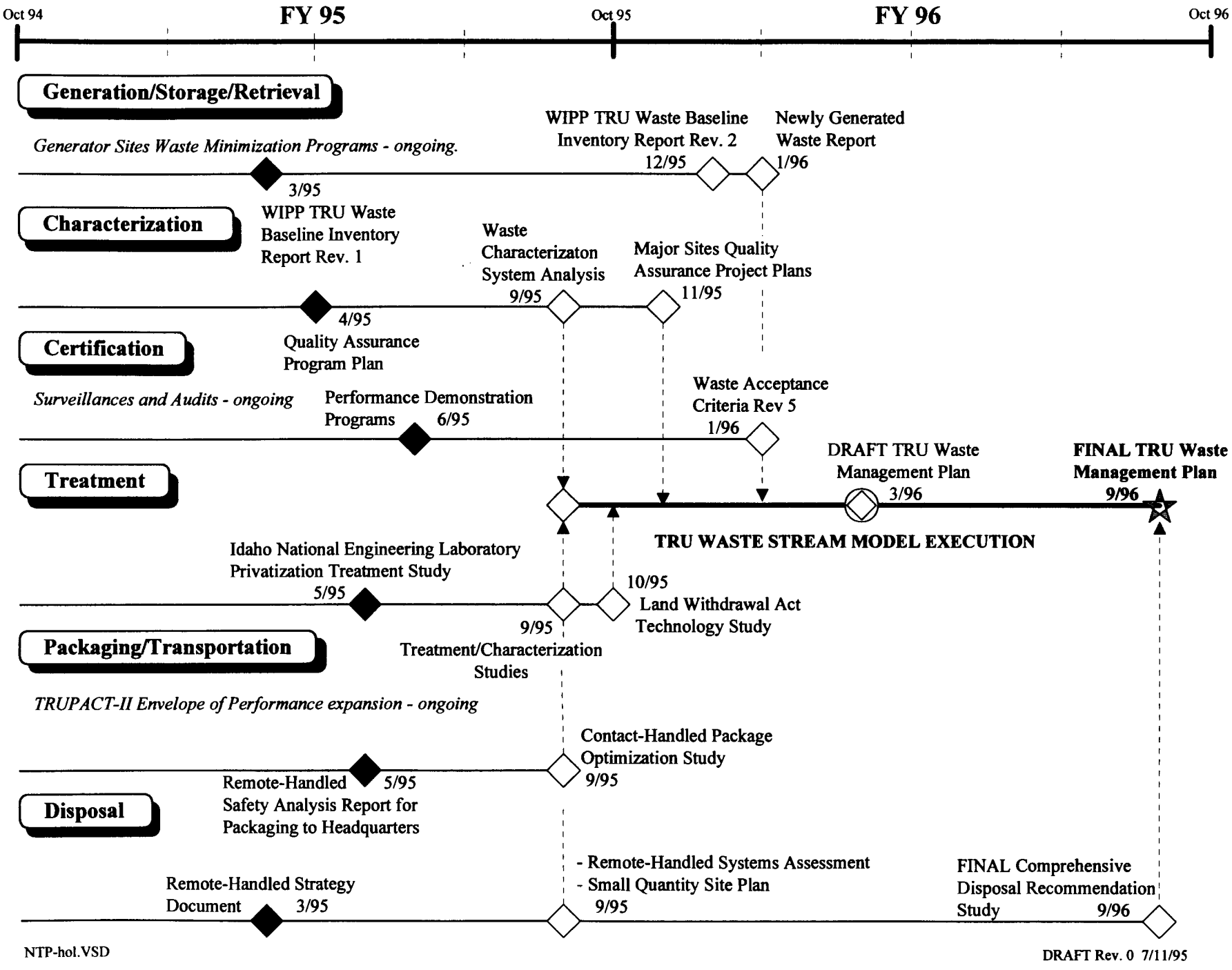
National TRU Waste Program Management Objective

In the interest of the health and safety of the public and protection of the environment, the National TRU Program will pursue the most efficient and effective means, in terms of schedule and budget, for the permanent disposal of all TRU waste.

TRU Waste System Elements

- Generation/Storage/Retrieval
- Characterization
- Certification
- Treatment
- Packaging/Transportation
- Disposal

TRANSURANIC WASTE MANAGEMENT SYSTEM PROCESS



TRU Waste System Model

- Integrate initiatives and evaluate multiple TRU system configuration
- Modeling results will assist in evaluating program priorities by providing quantitative criteria for decision making

National TRU Waste Program Management Plan

- National TRU Program Waste Management Plan
  - Focus activities for maximum use at WIPP disposal
  - Provide generator sites annual guidance for effective planning
  - Recommend programmatic prioritization

Process for Implementing the National TRU Waste Program Management Plan

- Identify TRU management programs
- Systematically prioritize enabling projects
- Ensure projects are integrated, coordinated, and prioritized

Implementation of the National TRU Waste Management Plan

- Generator Sites and DOE-Headquarters review and comment
- Approval of National TRU Waste Management Plan
- National TRU Waste Management Plan used as a guidepost for development of budget guidance, Activity Data Sheets, and budgets

Interim Near-term National TRU Waste Program Activities

- National TRU Program Near-Term Recommendations
  - Maximize waste availability prior to WIPP opening June 1998
  - High-level, qualitative recommendations for generator site activities
  - Apply preestablished criteria to program activities to promote consistent and objective review

Near-Term Program Criteria
Primary

- Ensure public health and safety and the environment are not jeopardized
- Support WIPP opening in 1998
- Maximize waste ready for transport to WIPP in 1998

Near-Term Program Criteria
Secondary

- Treat to meet WIPP Waste Acceptance Criteria only
- Focus on waste in drums and standard waste boxes, not oversized boxed waste
- Emphasize characterization and certification of waste
- Concentrate on ability to sustain near-term waste shipments

Summary

- Current initiatives are supporting near-term objectives as well as laying the foundation for the long-term direction of major TRU waste programs.
- Results of initiatives and information obtained from the TRU System Model will be used to develop the National TRU Waste Management Plan.
- National TRU Waste Management Plan is designed to provide the necessary guidance ensuring integrated, efficient, and effective TRU waste management consistent with the National TRU Waste Program Management Objective.

ENVIRONMENTAL EVALUATION GROUP

AN EQUAL OPPORTUNITY / AFFIRMATIVE ACTION EMPLOYER

7007 WYOMING BOULEVARD, N.E.
SUITE F-2
ALBUQUERQUE, NEW MEXICO 87109
(505) 828-1003
FAX (505) 828-1062

Radiological Survey of Surface Contamination at the Gnome Site

Jim Kenney

51st Quarterly Meeting
DOE/EEG/NMED/EMNRD
Santa Fe, NM

July 13, 1995

Providing an independent technical analysis of the Waste Isolation Pilot Plant (WIPP), a federal transuranic nuclear waste repository.

EEG'S ENVIRONMENTAL MONITORING PROGRAM

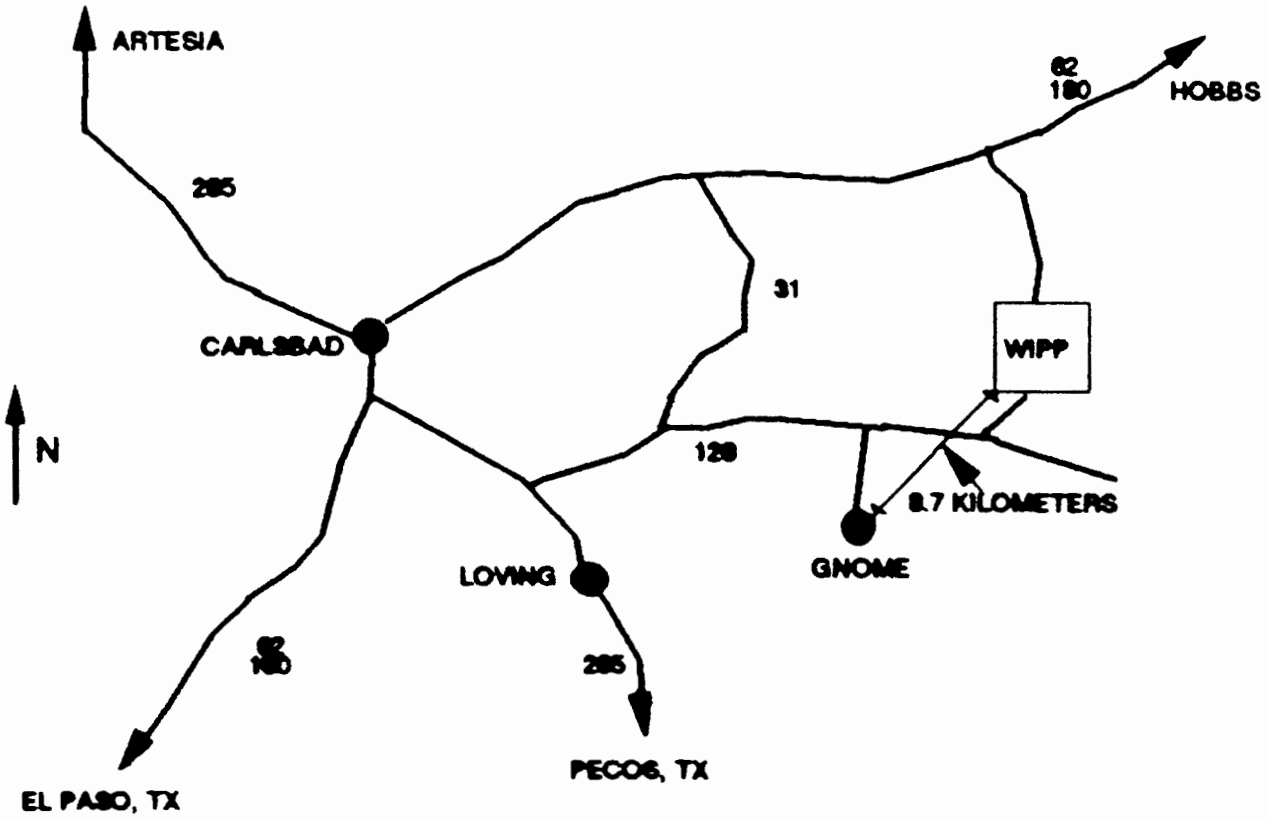
- DEVELOPED BY DR. SPIEGLER IN 1984 (EEG-26)

- SAMPLES COLLECTED IN THE WIPP ENVIRONMENT INCLUDE
  - AIR
  - SURFACE, GROUND AND EFFLUENT WATER
  - SOIL
  - BIOTA

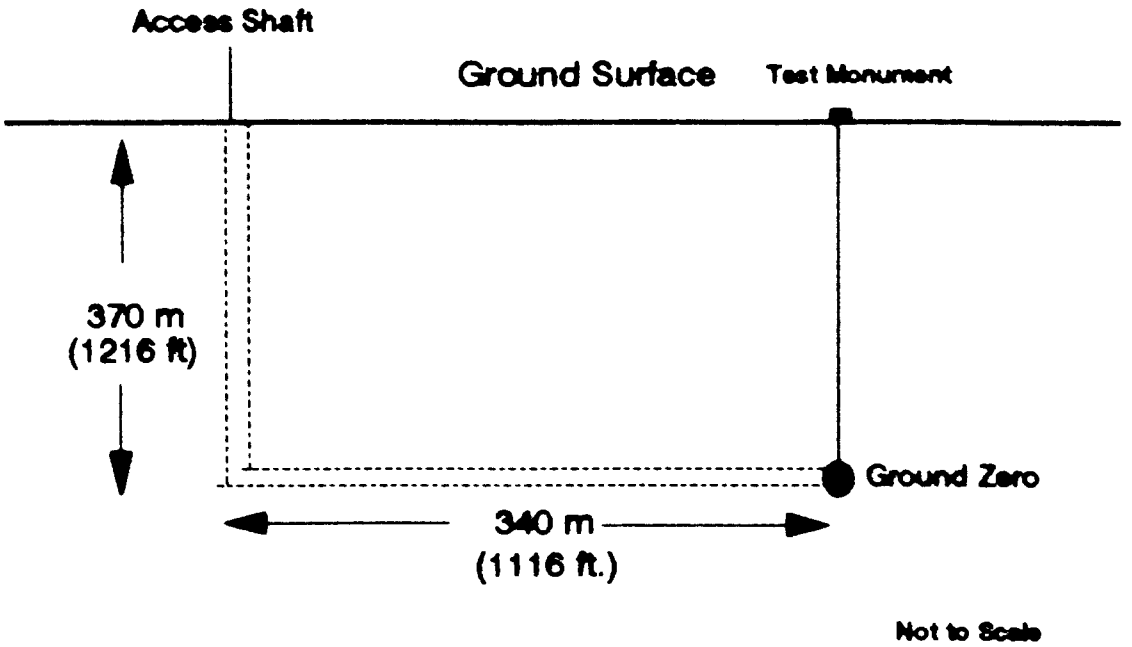
- GNOME SITE STUDIES EXTEND EXISTING EEG PROGRAM

GNOME PROJECT

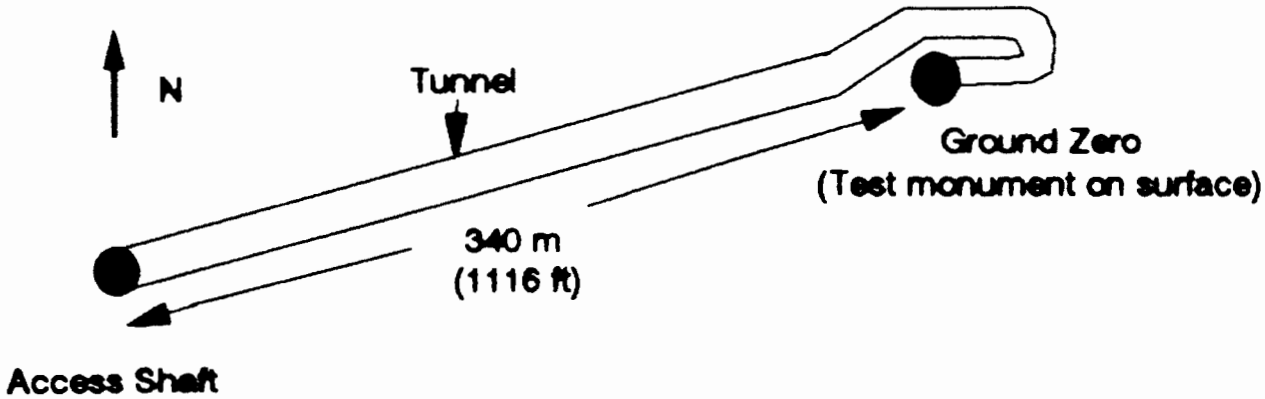
- AEC PLOWSHARE PROJECT
- UNDERGROUND NUCLEAR DETONATION ON DECEMBER 10, 1961 3.1 Kton
- VENTING OCCURRED FROM ACCESS SHAFT FOR 24+ HOURS
- SITE CLEANED 1968 AND 1977


ARTESIA
285
CARLSBAD
N
62
180
HOBBS
31
WIPP
128
8.7 KILOMETERS
GNOME
LOVING
62
180
285
EL PASO, TX
PECOS, TX

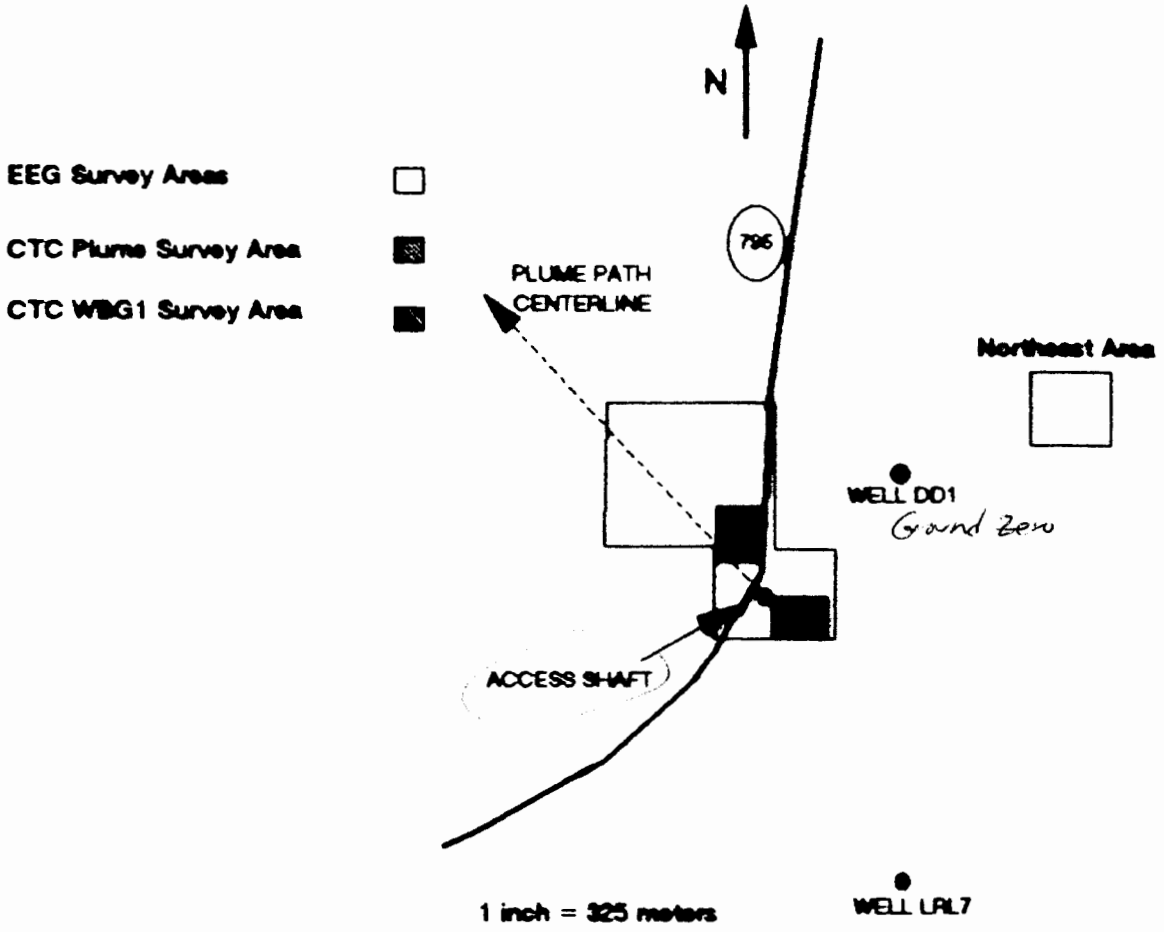
Gnome Site


Access Shaft
Ground Surface
Test Monument
370 m
(1216 ft)
Ground Zero
340 m
(1116 ft.)
Not to Scale

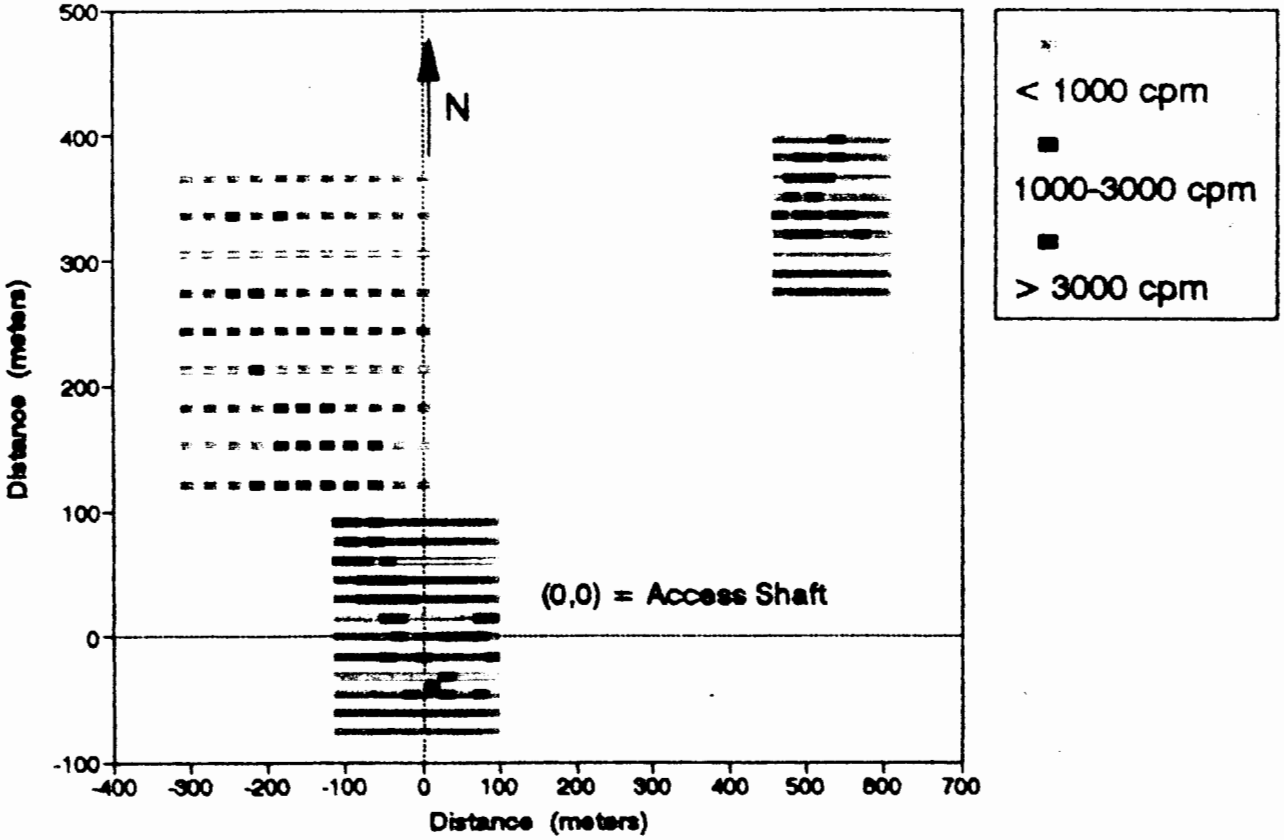
Gnome Site



Not to Scale


EEG Survey Areas
CTC Plume Survey Area
CTC WBG1 Survey Area
N
795
PLUME PATH
CENTERLINE
Northeast Area
WELL DD1
Ground Zero
ACCESS SHAFT
1 inch = 325 meters
WELL LRL7

Gamma Count Rate Measurements



Soil Sample Locations
at the Gnome Site

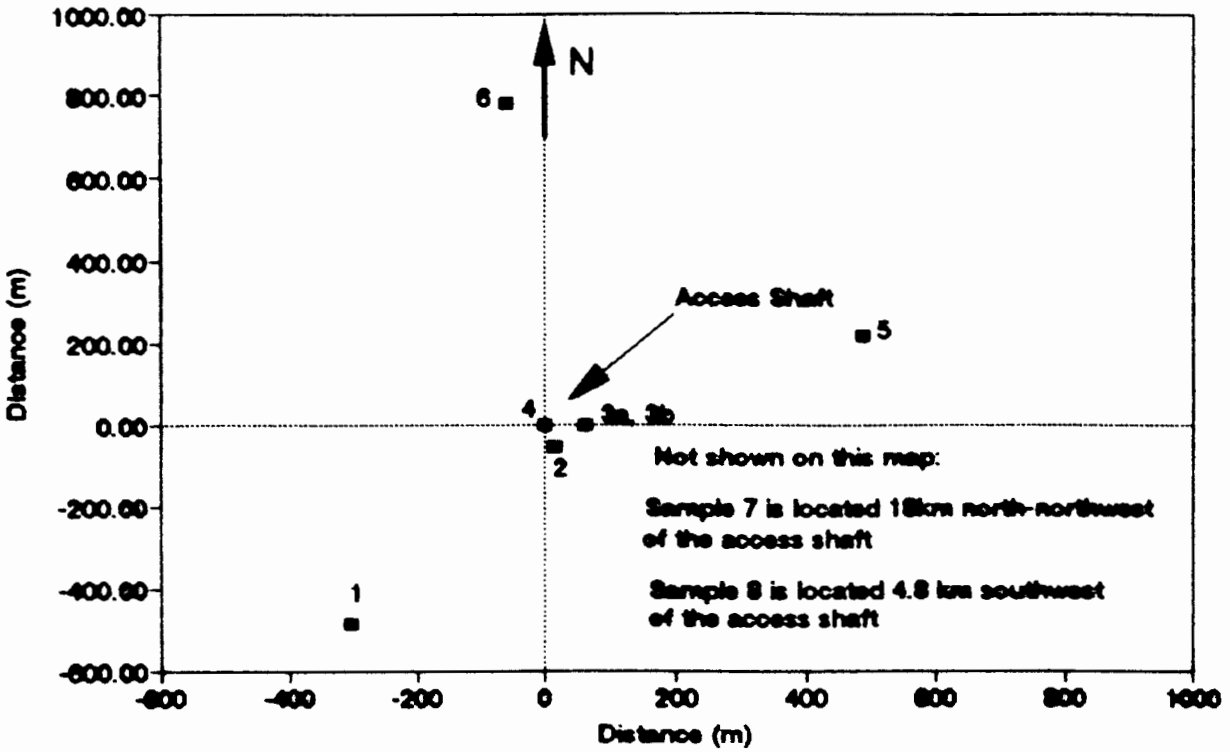


Table 2. Radiochemical Data

	$^{239+240}Pu$		^{238}Pu		^{241}Am	
Location	Bq/g	(pCi/g)	Bq/g	(pCi/g)	Bq/g	(pCi/g)
2	0.0044	(0.12)	0.00081	(0.022)	0.00059	(0.16)
3A	0.63	(17)	0.10	(2.7)	0.14	(3.9)
3A-1	0.48	(13)	0.067	(1.8)	0.085	(2.3)
3A-2	0.31	(8.5)	0.044	(1.2)	0.052	(1.4)
3A-3	48	(1290)	6.8	(184)	7.6	(205)
3A-4**	0.041	(1.1)	0.0067	(0.18)	0.0067	(0.18)
3A-5**	0.063	(1.7)	0.011	(0.31)	0.022	(0.60)
3A-6**	15	(410)	2.4	(66)	1.8	(48)
3A-7**	0.010	(2.7)	0.015	(0.40)	0.048	(1.3)
3B	0.059	(1.6)	0.0089	(0.24)	NA	NA
7	0.0008	(0.022)	0.0002	(0.005)	0.0004	(0.011)

Note: ** identifies analyses by a Commercial Laboratory
NA sample lost in processing

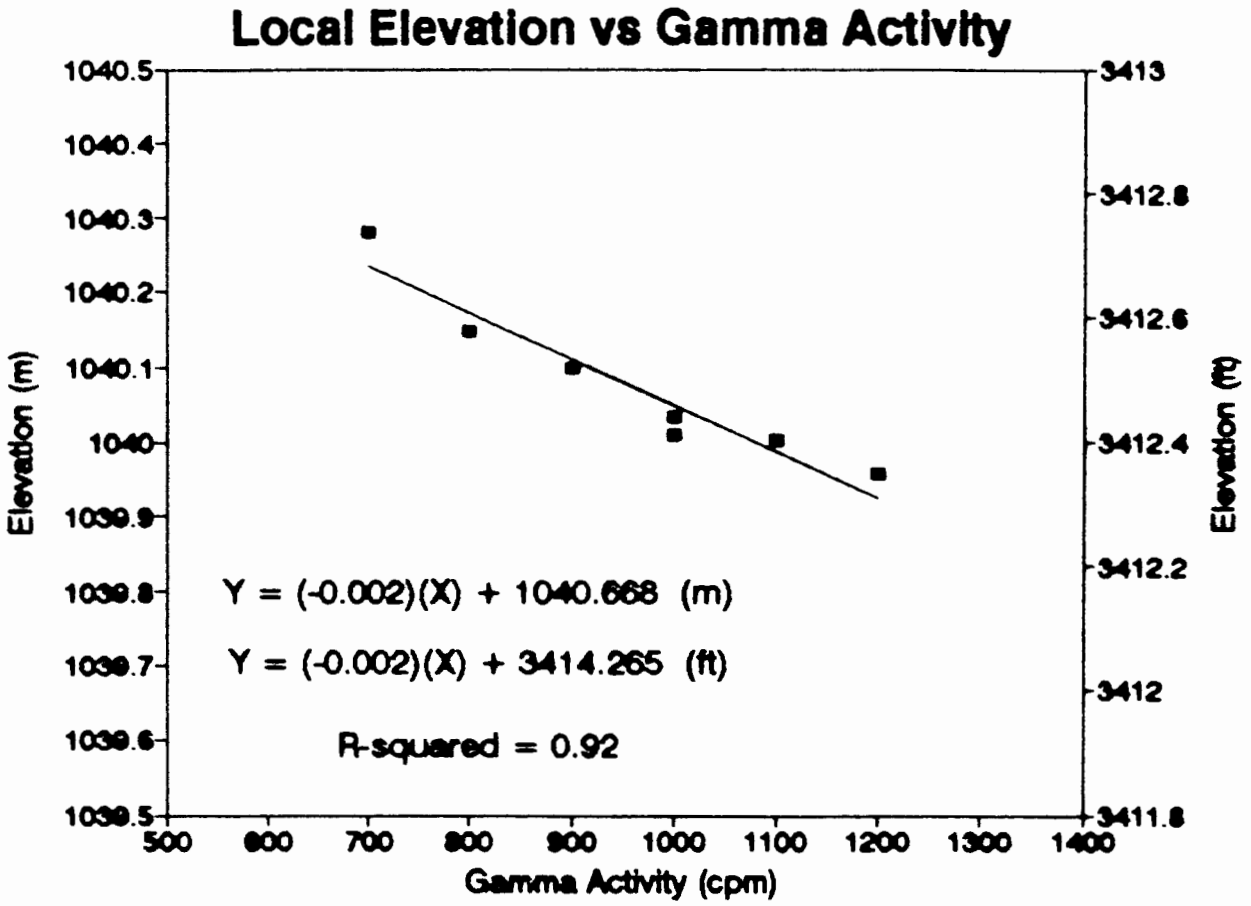

Local Elevation vs Gamma Activity
1040.5
1040.4
1040.3
1040.2
1040.1
1040
1039.9
1039.8
1039.7
1039.6
1039.5
Elevation (m)
3413
3412.8
3412.6
3412.4
3412.2
3412
3411.8
Elevation (ft)
500
600
700
800
900
1000
1100
1200
1300
1400
Gamma Activity (cpm)
Y = (-0.002)(X) + 1040.668 (m)
Y = (-0.002)(X) + 3414.265 (ft)
R-squared = 0.92

Table 1. ^{40}K and ^{137}Cs Soil Concentrations

Location	K-40		Cs-137		Ratio	Gross γ
	(Bq/g)	(pCi/g)	(Bq/g)	(pCi/g)	^{137}Cs:^{40}K	CPM
1	0.22	(6.00)	0.01	(0.20)	0.03	800
2	0.20	(5.37)	3.09	(83.40)	15.53	11000
3A	0.26	(7.07)	0.58	(15.60)	2.21	3800
3B	0.23	(6.08)	0.41	(11.20)	1.84	3800
4	0.17	(4.48)	0.07	(1.89)	0.42	NA
5	0.24	(6.44)	0.22	(5.92)	0.92	1400
6	0.24	(6.58)	0.10	(2.63)	0.40	1200
7	0.67	(18.00)	0.02	(0.64)	0.03	2500
8	0.23	(6.13)	0.003	(0.07)	0.01	800

CONCLUSIONS

- EEG MEASURED HETEROGENEOUSLY DISTRIBUTED RADIOLOGICAL CONTAMINATION IN SURFACE SOIL AT GNOME SITE

  - THE LEVELS FOUND DO NOT APPEAR TO PRESENT AN IMMEDIATE HEALTH AND SAFETY CONCERN

  - CURRENT EEG LABORATORY METHODOLOGY IS APPROPRIATE FOR IDENTIFICATION OF ^{238}PU, $^{239+240}$PU AND ^{241}AM IN ENVIRONMENTAL SAMPLES

- ADDITIONAL WORK NEEDED

  - SOIL PROFILES AND VEGETATION MEASUREMENTS OF RADIONUCLIDE CONCENTRATIONS (INCLUDING ^{90}SR)

  - ADDITIONAL DATA USEFUL TO DETERMINE IF A CERCLA REPORTABLE QUANTITY IS PRESENT AT GNOME

CONCLUSIONS CONTINUED

- GNOME SITE VALUABLE FOR RADIOLOGICAL MONITORING PROGRAMS

  - USE OF FIELD SURVEYS IN CONJUNCTION WITH LABORATORY MEASUREMENTS PROVED USEFUL

  - SUPERIORITY OF ULTRASONIC RANGING AND DATA SYSTEM (USRADS) OVER MANUAL SURVEY METHODOLOGY

  - POTENTIAL METHODOLOGIES FOR WIPP MONITORING OR ACCIDENT EVALUATION

EEG-58

COPY

RADIONUCLIDE BASELINE IN SOIL NEAR PROJECT GNOME AND THE WASTE ISOLATION PILOT PLANT

Jim W. Kenney
Paula S. Downes
Donald H. Gray
Sally C. Ballard

Environmental Evaluation Group
New Mexico

July 1995

EEG-58
DOE/AL/58309-58

RADIONUCLIDE BASELINE IN SOIL NEAR PROJECT GNOME AND THE WASTE ISOLATION PILOT PLANT

Jim W. Kenney
Paula S. Downes
Donald H. Gray
Sally C. Ballard

Environmental Evaluation Group
P. O. Box 3149, 505 N. Main Street
Carlsbad, NM 88221-3149

and

7007 Wyoming Blvd., NE, Suite F-2
Albuquerque, NM 87109

July 1995

FOREWORD

The purpose of the New Mexico Environmental Evaluation Group (EEG) is to conduct an independent technical evaluation of the Waste Isolation Pilot Plant (WIPP) Project to ensure the protection of the public health and safety and the environment. The WIPP Project, located in southeastern New Mexico, is being constructed as a repository for the disposal of transuranic (TRU) radioactive wastes generated by the national defense programs. The EEG was established in 1978 with funds provided by the U. S. Department of Energy (DOE) to the State of New Mexico. Public Law 100-456, the National Defense Authorization Act, Fiscal Year 1989, Section 1433, assigned EEG to the New Mexico Institute of Mining and Technology and continued the original contract DE-AC04-79AL10752 through DOE contract DE-ACO4-89AL58309. The National Defense Authorization Act for Fiscal Year 1994, Public Law 103-160, continues the authorization.

EEG performs independent technical analyses of the suitability of the proposed site; the design of the repository, its planned operation, and its long-term integrity; suitability and safety of the transportation systems; suitability of the Waste Acceptance Criteria and the generator sites' compliance with them; and related subjects. These analyses include assessments of reports issued by the DOE and its contractors, other federal agencies and organizations, as they relate to the potential health, safety and environmental impacts from WIPP. Another important function of EEG is the independent environmental monitoring of background radioactivity in air, water, and soil, both on-site and off-site.

Robert H. Neill
Director

EEG STAFF

Sally C. Ballard, B.S., Laboratory Scientist

William T. Bartlett, Ph.D., Health Physicist

Radene Bradley, Secretary III

Lokesh Chaturvedi, Ph.D., Deputy Director & Engineering Geologist

Paula Sue Downes, B.S., Environmental Engineer

Patricia D. Fairchild, Secretary III

Donald H. Gray, M.A., Environmental Specialist

Jim W. Kenney, M.S., Environmental Scientist/Supervisor

Lanny King, Assistant Environmental Technician

Betsy J. Kraus, M.S., Technical Editor/Librarian

William W.-L. Lee, Sc.D., P.E., D.E.E., Senior Scientist

Robert H. Neill, M.S., Director

Jill Shortencarier, Administrative Secretary

Matthew K. Silva, Ph.D., Chemical Engineer

Susan Stokum, Administrative Secretary

Ben A. Walker, B.A., Environmental Technician

Brenda J. West, B.A., Administrative Officer

ACKNOWLEDGEMENTS

The authors wish to thank Dr. William Bartlett for his technical review of this report, Ms. Betsy Kraus for assistance in obtaining cited literature, Mrs. Susan Stokum for final report preparation, and Mr. Ben Walker for his review. The report is a result their kind assistance.

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ACRONYMS

AEC . . . . Atomic Energy Commission

CERCLA . Comprehensive Environmental Response, Compensation, and Liability Act

CTC . . . . Chemrad Tennessee Corporation

DAC . . . . Derived Air Concentration

DOE . . . . Department of Energy

EEG . . . . Environmental Evaluation Group

GM . . . . . Geiger-Müller

NaI(Tl) . . . Sodium Iodide Detector

NIST . . . . National Institute of Standards and Technology

NTS . . . . Nevada Test Site

REEco . . . Reynolds Electrical & Engineering Co., Inc.

TLD . . . . Thermoluminescent Dosimeters

TRU . . . . Transuranic

USRADS . Ultrasonic Ranging and Data System

WID . . . . Waste Isolation Division

WIPP . . . Waste Isolation Pilot Plant

EXECUTIVE SUMMARY

The Gnome site is the location of a 1961 underground nuclear detonation in the Atomic Energy Commission (AEC) Plowshare program that vented radioactive contamination to the atmosphere. The resulting ground contamination was cleaned up in 1968-1969 and again in 1977 as weathering affected some shallow burial. Subsequent environmental surveys revealed slightly elevated ^{137}Cs levels, but no transuranic contamination.

The Waste Isolation Pilot Plant (WIPP) is approximately 8.8 km (5.5 mi) northeast of the Gnome site, and the Gnome site is within the preoperational radiological surveillance area for the WIPP. The Environmental Evaluation Group (EEG) conducts a WIPP preoperational radiological surveillance program, and the EEG initiated field surveys at Gnome in 1994.

The EEG used a combination of traditional and state-of-the-art radiological survey techniques. In addition, soil samples were collected for analysis in the newly established EEG radiochemistry laboratory, and the EEG results were compared to commercial laboratory analyses. New methods for contamination surveys, sample screening and telemetry were evaluated and found to be more sensitive and efficient than historical methods.

Localized surface contamination was identified, and soil samples were taken from selected areas and control locations outside the Gnome site. Radiochemical analyses by EEG and a commercial laboratory indicated elevated levels of ^{238}Pu, $^{239+240}Pu$, and ^{241}Am at Gnome. The radioactivity was heterogeneously distributed within the samples which is consistent with contamination from atmospheric nuclear weapons testing. Samples outside the Gnome area did not indicate transuranic contamination.

The EEG radiochemical analyses, limited to surface soil samples, show the presence of transuranic contamination at the Gnome site. Although there is measurable transuranic

contamination at Gnome, the levels do not appear to present any immediate health and safety concerns. Additional work is needed to determine if contamination is at greater soil depths, and if further remedial action is needed.

CONCLUSIONS

The Gnome site is a unique study area that can provide valuable information about the long term trend in radionuclide transport in the environment surrounding the WIPP. The current study shows that field surveys are useful in determining the areas of radionuclide accumulation. The USRADS technology provides the most detailed information and should be considered by organizations involved in preoperational and operational environmental monitoring. Additional γ survey information is needed in the vicinity of Gnome, the WIPP facility, surrounding communities and along WIPP transportation routes to complete the baseline. This information would provide data that would allow for an analysis of long and short term changes that may occur as a result of WIPP activities or changes in world-wide fallout. Field survey methodology would also be useful in post-accident evaluation and response.

Gamma spectroscopy can be used to identify the individual radionuclides responsible for elevated field γ measurements. Timely identification of individual radionuclides will be necessary in the event of a release of radioactivity related to WIPP activities. Preoperational knowledge of the distribution of various radionuclides at the WIPP and surrounding areas is required to evaluate the impact of WIPP on the environment.

Radiochemical analysis can be used to quantify radionuclide concentrations in soil with much lower detection limits. The EEG radiochemical laboratory located in Carlsbad, NM is an integral part of the EEG environmental monitoring program which enables good control of quality assurance activities, rapid analysis and ongoing participation in the EPA Performance Evaluation Studies Program.

The following specific conclusions relate to the Gnome study:

1. The EEG measured heterogeneously distributed transuranic contamination (^{238}Pu, $^{239+240}Pu$, and ^{241}Am) on the surface of the Gnome site. This result was independently confirmed by commercial laboratory analyses. Although the contamination was measurable, the levels do not appear to present any immediate health and safety concerns.

2. Only limited surface measurements were made. Additional work is needed to determine if contamination exists at greater soil depths or outside the identified survey areas. The DOE is considering the need for additional Gnome site remedial action (USDOE 1995). It is also possible that Gnome may require action in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

3. Previous survey methods used at Gnome were not adequate nor appropriate for locating and quantifying low-level transuranic contamination. The following comments relate to EEG radiological methods:

   a. The traditional grid plat of potentially contaminated areas and subsequent γ survey is a minimum pre-requisite for identifying possible contamination and soil sampling locations.

   b. The Ultrasonic Ranging and Data System (USRADS), employed by CTC, was a significant advance in identifying surface γ and beta contamination. This method has the advantages of detecting contamination trends and hot spots that might otherwise be undetected. In addition, thousands of measurements are made and documented in a substantially reduced survey time.

   c. Gamma spectroscopic screening of potentially contaminated environmental samples is a necessary prerequisite to radiochemical analysis. It was found

that heterogeneously distributed radioactivity in Gnome samples may cause high measurement variability.

d. The current EEG radiochemical methodology is appropriate for identification of ^{238}Pu, $^{239+240}Pu$, and ^{241}Am in environmental samples.

INTRODUCTION

The Environmental Evaluation Group (EEG) conducts an on-site and off-site radiological environmental monitoring program at the Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico (NM&USDOE 1984; NDAA 1993). Since WIPP is a planned repository for the permanent disposal of nuclear transuranic wastes from the nations defense programs it is important to quantify ^{238}Pu, $^{239+240}$Pu, ^{241}Am and other radionuclides that already exist in the WIPP environment. As part of this program, the EEG obtained and analyzed environmental samples from the Gnome site, a Plowshare test site located 8.8 km (5.5 mi) southwest of the WIPP facility boundary. This report contains the results of the EEG's Gnome survey.

The EEG began collecting environmental samples at the WIPP site and in surrounding communities in 1985, and since then has systematically improved both the field and laboratory measurement capabilities. In 1989, the EEG added radiological survey equipment capable of detecting ^{238}Pu, $^{239+240}$Pu and ^{241}Am radionuclide contamination. In 1994, the EEG began developing radiochemical methods for measuring transuranic radionuclides in environmental samples.

This report includes Gnome historical information, a general description of EEG's radiological measurement methods, an evaluation of the Ultrasonic Ranging and Data System (USRADS) survey methods available from Chemrad Tennessee Corporation (CTC), and the overall results of the EEG's Gnome study.

In 1961, the surface area of the Gnome site was contaminated with fission radionuclides when an underground nuclear explosion vented to the surface (USDOC 1962). The site was decontaminated in 1968-1969 and again in 1978 (Berry 1981). The second 1978 cleanup used more conservative measurement criteria than the 1968-1969 cleanup. However the survey techniques were not designed to find ^{238}Pu, $^{239+240}$Pu and ^{241}Am radionuclides. A

follow-up decontamination and decommissioning project in 1979 indicated negligible plutonium contamination (Berry 1981).

BACKGROUND INFORMATION

The following sections briefly describe and provide references to the WIPP project, Project Gnome, and the WIPP project's preoperational environmental monitoring programs.

The WIPP Project

The WIPP is a Department of Energy (DOE) facility whose mission is to dispose of 176,000 m^3 (6,200,000 cubic feet) of transuranic (TRU) waste (WIPP 1992). The TRU wastes result from defense activities of the United States and primarily contain the radionuclides ^{241}Am, ^{137}Cs, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{241}Pu, ^{90}Sr, and ^{90}Y (USDOE 1990b). After approval of the DOE certification application by the Environmental Protection Agency (EPA) that disposal meets the EPA standards (40 CFR 191) for safe disposal of TRU wastes (USEPA 1994a), wastes are to be disposed of in this deep geologic repository at a depth of 655 m (2,150 ft) below land surface in a bedded salt formation.

The WIPP is located approximately 42 km (26 mi) east-southeast of Carlsbad, New Mexico, in the Los Medanos area that consists of sand dunes covered with a variety of desert vegetation and wildlife.

The Gnome Site

The Gnome site is approximately 8.8 km (5.5 mi) southwest of the WIPP facility boundary (Figure 1), in the same Los Medanos tract as the WIPP. The region supports flora and fauna common to both the northern Chihuahuan desert and southern Great Plains. The characteristic vegetation and topography are evident in Figure 2. The site is unrestricted, with cattle grazing and hunting as typical land uses.

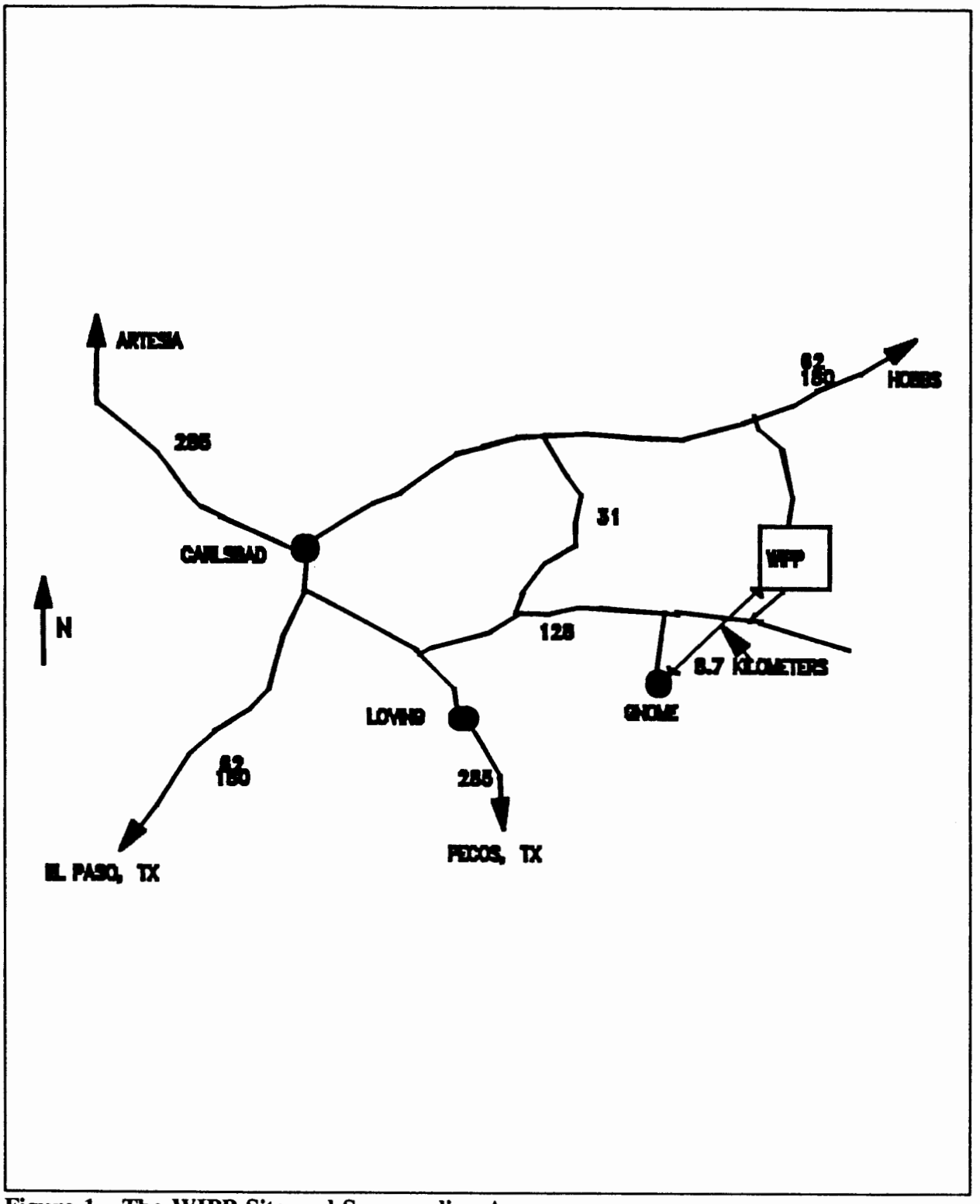

Figure 1. The WIPP Site and Surrounding Areas

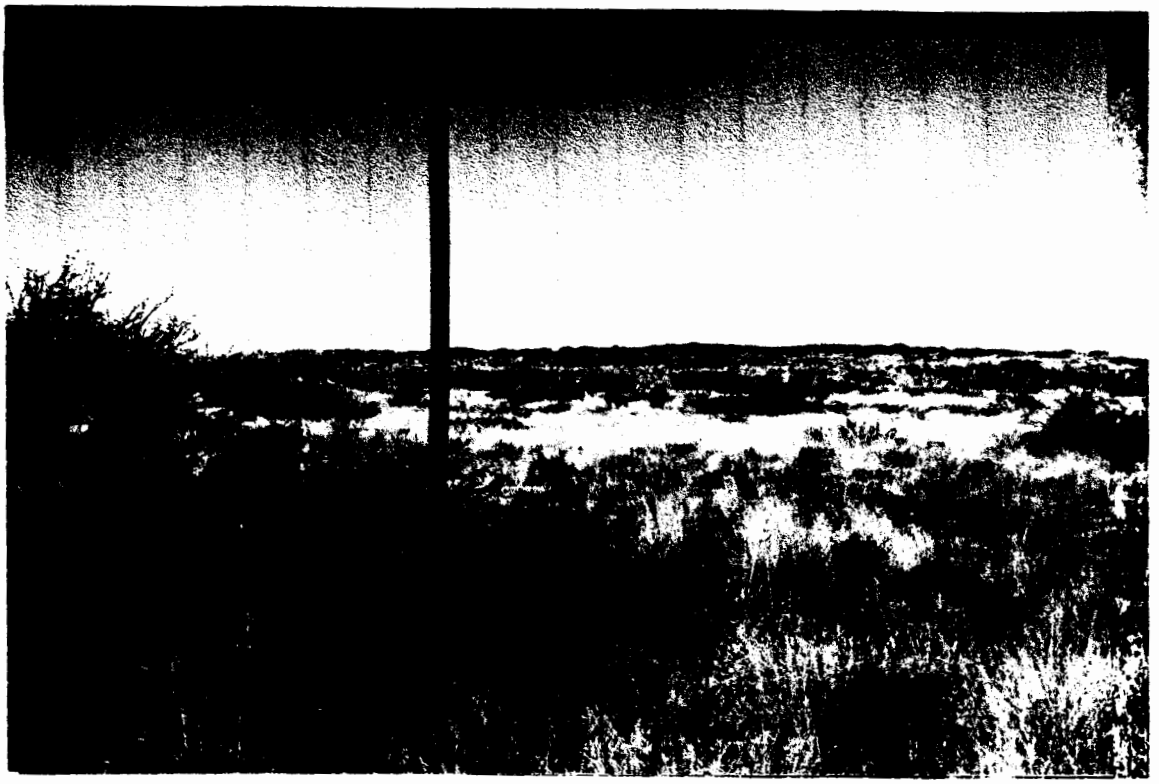

Figure 2. Typical Gnome Vegetation

Project Gnome was part of the Atomic Energy Commission's (AEC) Plowshare program for the peaceful uses of nuclear explosives. The overall objectives were to use "nuclear explosives in civil engineering projects, development of natural resources, production of isotopes and power, and scientific studies" (USAEC 1961).

To accomplish the stated objectives the AEC detonated a 3-kiloton ^{239}Pu device 370 m (1,216 ft.) below the land surface in the Salado formation on December 10, 1961 (UNS 1988). Figures 3a and 3b represent the surface and subsurface configurations of the Gnome site. Plans were to contain all radioactivity underground; however, venting from the access shaft occurred for more than 24 hours following detonation (USDOC 1962). During the venting process fission products were released, contaminating the surrounding environment (Rawson et al. 1961).

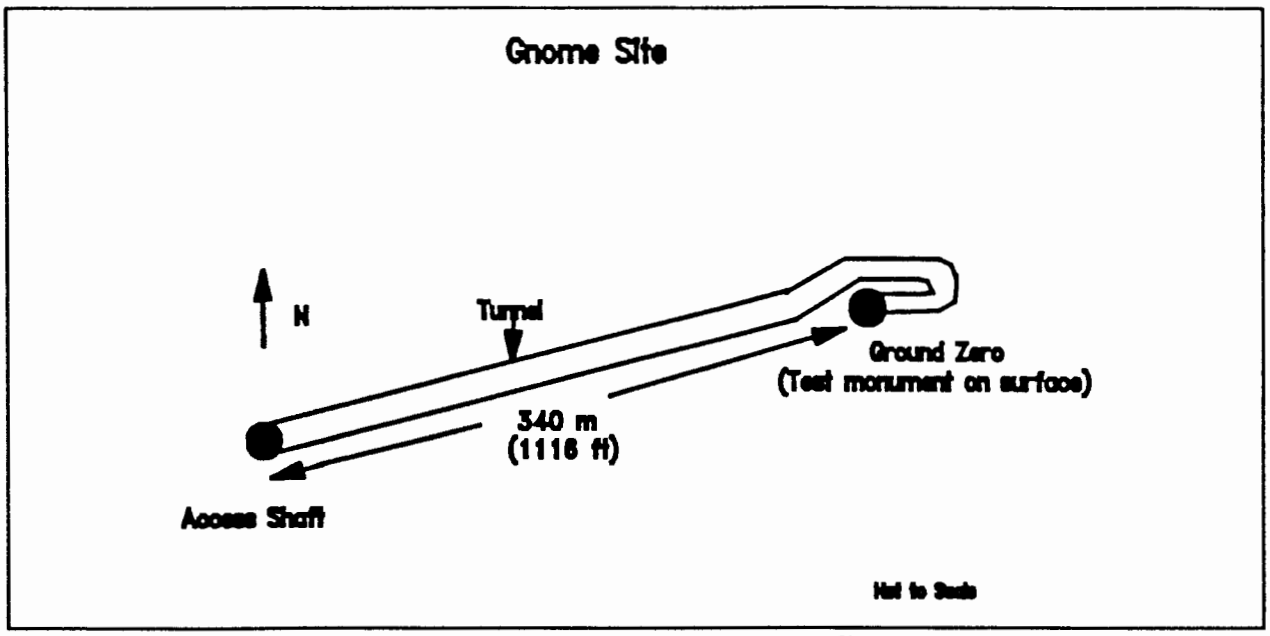

Figure 3a. Diagram of the Gnome Site Underground Configuration

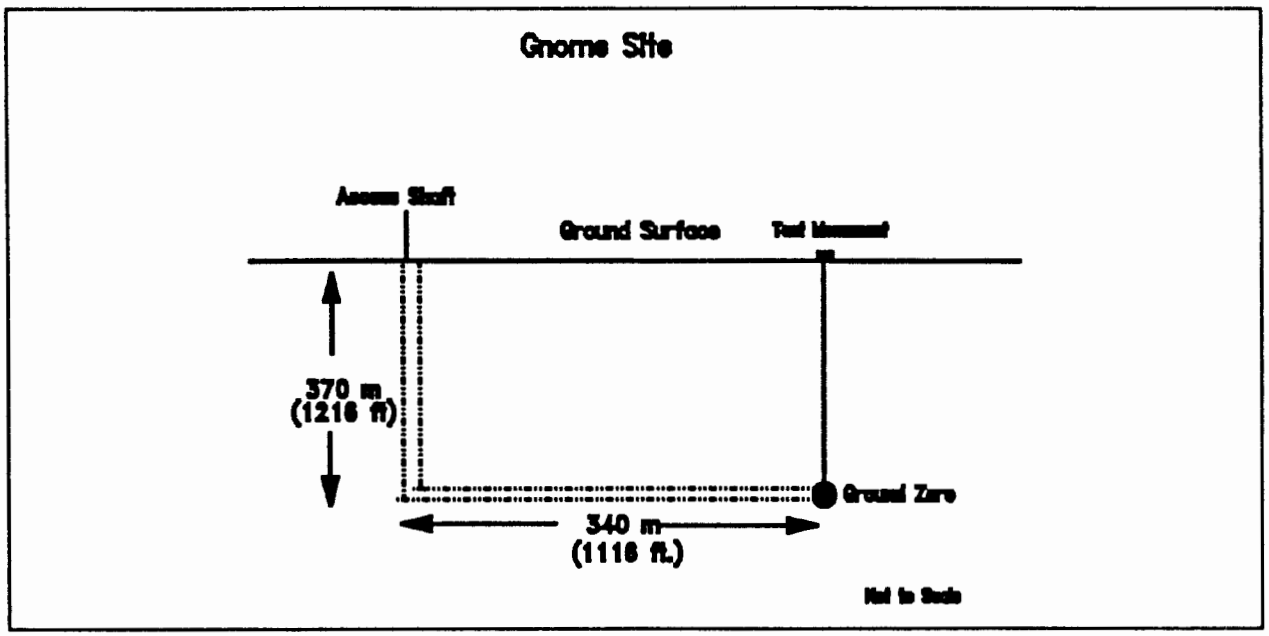

Figure 3b. Lateral Diagram of the Gnome Site Underground Configuration

In 1968 the AEC began the initial cleanup of the Gnome site. Dose-rate guidelines for cleanup of the site specified the removal of material above 0.1 mR/h (β plus γ)[1] as measured by Geiger-Müller (GM) portable survey instrument with a 30 mg/cm^2 window (Tappan and Lorenz 1969). All surface facilities were removed and all drill holes were plugged with the exception of wells LRL7 and DD1 (Figure 4) which were left for use as monitoring wells. Contaminated material was removed from the surface and placed into the Gnome cavity or transported to off-site disposal facilities (Berry 1981).

A 1972 inspection revealed that contaminated material buried northeast of the access shaft was becoming exposed to the environment (Berry 1981). From 1972 to 1977, the DOE continued to monitor the site, but remedial action was not taken. In 1977 the DOE contracted with Reynolds Electrical & Engineering Co., Inc. (REEco) and Fenix & Scisson, Inc. to decontaminate the site. After the 1968 cleanup, the guidelines for remediation changed. The new guidelines (Berry 1981) required soil decontamination to levels below 20 pCi/g (β plus γ)[1], averaged over 0.25 hectares, and 30,000 pCi/ml of tritium in soil moisture. Berry (1981) described the decontamination tasks as follows. The first task completed by REEco was an aerial gamma survey that identified ^{137}Cs as the primary gamma emitter in the vicinity of the Gnome site. All subsequent cleanup activities were based solely upon ^{137}Cs and ^{3}H contamination. As soil was removed, the newly exposed soil was surveyed with a Ludlum micro-R-meter (Model 19). Excavation stopped when the survey revealed exposure rates below 25 μR/hr, and random soil samples were collected and analyzed for comparison to the decontamination criteria. Contaminated crushed soil was mixed with water, and the resulting slurry was pumped into the Gnome cavity. Material not placed in the cavity was packaged and transported to the Nevada Test Site low-level waste facility for disposal.

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[1]The 1968 cleanup guidelines were based on dose rate measurements; the 1977 guidelines were based on soil concentration limits. These two measurements are not comparable.

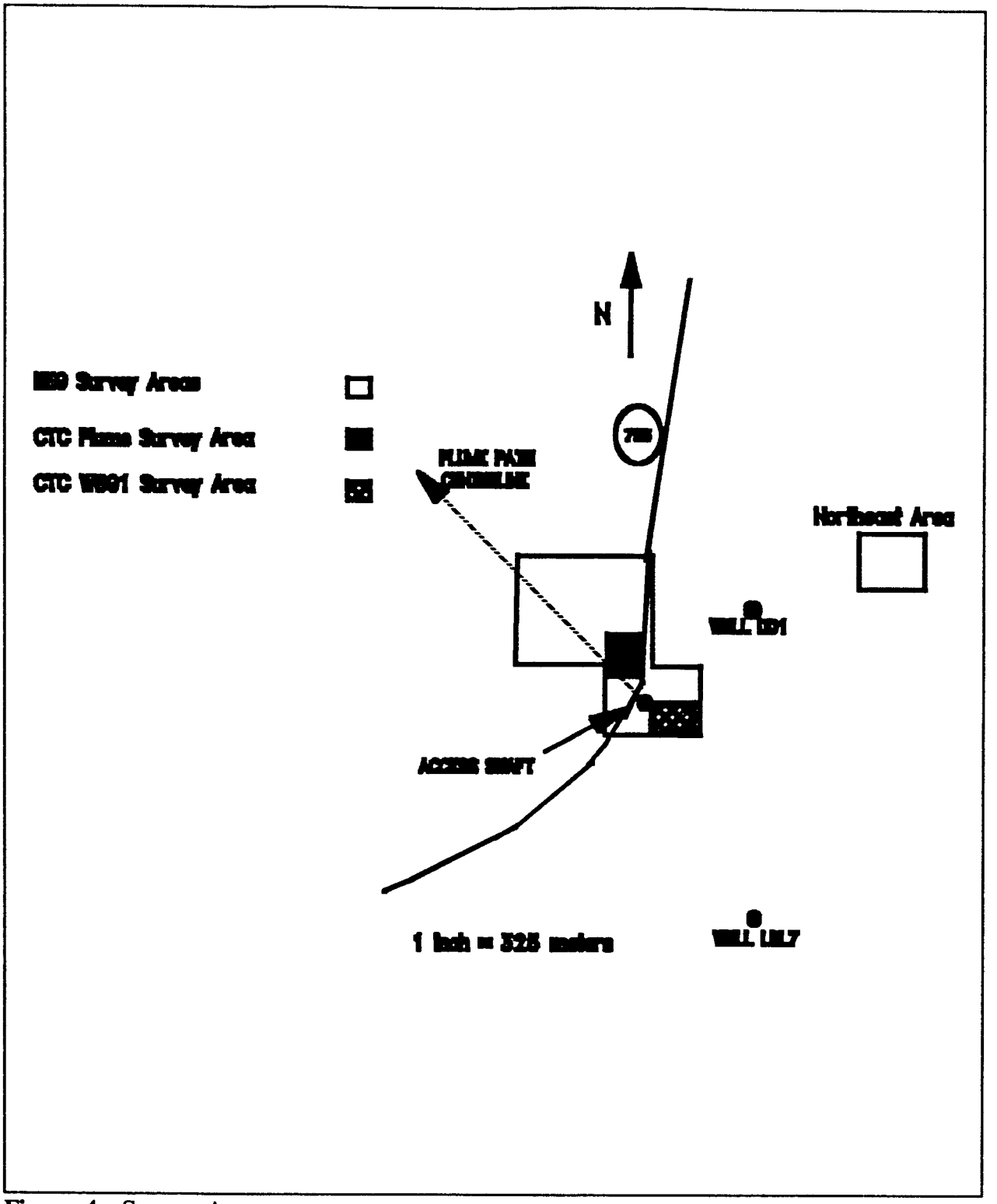

Figure 4. Survey Areas

WIPP Preoperational Monitoring Programs

The goal of the EEG's environmental monitoring program is to establish independent baseline measurements of radionuclide concentrations in the environment and communities surrounding the WIPP facility. In 1984 EEG developed an environmental surveillance network radionuclide measurements as described in Environmental measurements began in 1985 as described in EEG report #26, "Proposed Pre-operational Environmental Monitoring Program for the WIPP" (Spiegler 1984). The EEG has published five environmental data reports that contain pre-operational baseline concentrations of selected radionuclides (Kenney et al. 1990; Kenney and Ballard 1990; Kenney 1991; Kenney 1992; and Kenney 1994).

The EEG environmental monitoring program is similar to the program conducted by the Waste Isolation Division (WID) of Westinghouse Electric Corporation, the prime contractor for the WIPP. WID environmental monitoring data are documented in eight environmental reports (Reith et al. 1986; Banz et al. 1987; USDOE 1988; USDOE 1989; USDOE 1990a; USDOE 1991; USDOE 1992; and USDOE 1993). None of these EEG or WID environmental reports contain radionuclide data specific to Gnome area soil.

The DOE conducted a pre-operational aerial gamma survey of the WIPP area that included the Gnome site in 1988 (Berry 1989). The aerial survey distinguished between ^{137}Cs and naturally occurring ^{40}K. The survey identified man-made ^{137}Cs activity at the Gnome site and the presence of naturally occurring ^{40}K in other areas.

In 1991, the EPA conducted spot measurements of the Gnome site using a pressurized ionization chamber, and high-purity germanium detector (HpGe) for in-situ measurements at 22 locations (USEPA 1994). Limited radiochemical analyses of soil samples were performed, but the results were reported only as ^{90}Sr to ^{137}Cs ratios. The EPA identified ^{137}Cs contamination as high as 11.49 kBq/m^2 (3.1×10^5 pCi/m^2) based upon gamma spectrometry.

MATERIALS AND METHODS

The EEG conducted field gamma surveys, collected soil samples, developed soil screening protocols and performed radiochemical analyses of selected soil samples. The literature indicates the relative locations of the predominate plume release pathway, burial sites for contaminated materials, and structures associated with the project (USDOC 1962; USAEC 1969; Berry 1989; US EPA 1994). The EEG selected gamma survey locations according to information in these Gnome reports. Soil samples were collected from "hot spots" identified in the field gamma surveys, rainwater catchment basins and control points outside of the Gnome study area. The EEG also contracted with the Chemrad Tennessee Corporation (CTC) to performed detailed β, γ and dose rate surveys.

The EEG radiological surveys were conducted over a seven-month period between September 1994 and March 1995. The survey locations are identified in Figure 4. The EEG typically worked at the site for short periods of time (1-3 hours) on 22 separate days. On December 12 -13, 1994, the CTC conducted comprehensive surveys at predesignated locations within the EEG survey areas.

The access shaft was used as the survey reference point because it was the origin of the plume release and it was an easily identified landmark. Distance from the access shaft was determined with the rangefinder function of a DataScope™ (digital compass/rangefinder). The Gnome access shaft was designated as (0,0) on a Cartesian coordinate system with the X-axis representing the east/west distance and the Y-axis representing the north/south distance for all survey locations in this report. Magnetic north was determine with a DataScope™ , and each grid point was referenced in meters east/west and north/south of the access shaft (0,0).

EEG Field Survey Equipment

Initial γ surveys were performed with a 2.54 cm by 2.54 cm (1 in. by 1 in.) sodium iodide detector (NaI(Tl)) coupled to a Bicron (Analyst Model) portable ratemeter. Initial calibration and daily performance checks were made with a nominal activity 1 μCi ^{137}Cs button source (Eberline, Model CS-7B). The ^{137}Cs source produced 3,200 cpm/μCi in the reference position. The detector manufacturer suggests a low energy cut off point of approximately 60 keV. A nominal activity 3 μCi ^{241}Am (59 keV) source was placed at the reference position, with no measurable instrument response. Field measurements were made with the detector approximately 10 cm (4 in.) above the ground.

A standard Geiger-Müller pancake probe, Ludlum Model 44-9, with a thin detector window (1.7 mg/cm^2), was used for personnel and equipment contamination surveys. The GM probe has a nominal sensitivity to alpha, but typical background counts cause this instrument to be more appropriate for beta than for alpha contamination surveys. Swipe surveys of clothing and equipment were performed with filter papers which were subsequently counted on a Protean Instrument Corporation, Model MPC 9310, gas-flow proportional counter.

Elevation within a topographic depression was determined by using a surveyor's transit and steel tape. The NaI(Tl) detector was positioned 10 cm (4 in.) above the surface, as in other field measurements, and the measurement and elevation recorded.

Chemrad Tennessee Corporation

The EEG contracted with CTC to perform more detailed ground surveys in selected areas at Gnome. The CTC team used USRADS™ technology that combines radio-frequency communications, ultrasonics, and microcomputers. The surveyor carried a pack containing the radiation detection instrumentation, the electronic data gathering and positioning equipment while walking the survey area. The operator managed the microcomputer and the master receiver. As the surveyor walked, signals were sent at one second intervals to the

master receiver that recorded β, γ, and dose rate measurements. The measurements were instantaneously correlated with the location of the surveyor. The location and corresponding data values were continuously plotted by the computer. The β, γ, and dose rate surveys were conducted simultaneously in a single walkover of each survey grid.

During the CTC survey the following Quality Control measures were taken to assure data quality objectives were met:

1. daily source checks of instrumentation using sources dimensionally traceable to the National Institute of Standards and Technology (NIST) to verify accuracy of radiological data;

2. continuous monitoring of the survey position and the individual data channels, by the computer operator, to quickly note any discrepancies in the data;

3. cross checks of stationary receiver locations to confirm accuracy of survey coordinates;

4. redundancy measurements on each grid surveyed to insure the ability to reproduce data;

5. review and analysis of the data by CTC's data processing staff; and

6. review and analysis of the final data by CTC management.

Sample Collection Method

Soil samples were collected as follows. A square aluminum form 20 cm (7.9 in) by 2.5 cm (1 in) deep was pressed into the sampling area and soil was removed from within the form.

Each soil sample was placed into a 1ℓ Marinelli beaker to achieve a counting geometry consistent with a multi-γ soil calibration source dimensionally traceable to the NIST.

Gamma Spectroscopic Analyses

Gamma spectroscopic analyses were conducted using a liquid-nitrogen-cooled Canberra high-purity germanium detector, Model GR-3021 is housed in a Nuclear Data shield, Model 1260-FO. A mixed-gamma soil standard, (Analytics Inc. Model 37654-249 in a Marinelli geometry) was used to calibrate the gamma spectroscopy system. Gnome soil samples were placed in the shield in the same geometry as the mixed-gamma soil standard and counted for 3600 seconds. Spectra were analyzed using Quantum Technology software GDR version 6.1.

Radiochemistry Methods

Radiochemical analyses were performed on four of the eight soil samples collected. Representative aliquots of the four samples were dissolved using acid leaching, addition of hydrofluoric acid, and carbonate fusion. Separation and purification of transuranics was achieved using extraction chromatography methodology (Horwitz et al. 1993). Preparation for alpha spectroscopy measurements included electrodeposition of the purified fraction based on published methods (Talvitie 1972; Mitchell 1960). A Tennelec 4-detector alpha-spectrometer was used in conjunction with DMR-II software for spectral analyses.

Radiological Protection

The primary health physics concerns at the Gnome site were the potential for personnel radiological contamination, internal uptake of radioactive material and exposure from γ emitting radionuclides. The health physics surveys and protective measures are described below. The health physics surveys also serve as indicators of the mobility of Gnome contamination.

To prevent possible personnel contamination, the staff routinely wore protective clothing and shoe covers while in suspect areas. Protective clothing was removed after exiting survey areas. In addition, α and β contamination surveys of personnel and equipment were performed in the field prior to entering the Carlsbad facility. The entrance to the radiochemistry laboratory is controlled and adhesive pads are used on floors at laboratory entrances to ensure radiation protection control. Contamination was not detected by the surveys or on the adhesive pads.

The preliminary EEG surveys indicated that γ exposure rates were extremely low. The EEG staff wore Eberline thermoluminescent dosimeters (TLDs) while in the Gnome area. As expected, the TLDs received no measurable doses although two staff members were in the area approximately 48 hours.

If residual Gnome soil contamination was resuspended in the air by wind or mechanical means, then personnel could potentially inhale the radioactive material. An air sampler was positioned at worst-case locations for particle resuspension and used to sample ambient air during some field operations. The air filters showed no measurable activity when analyzed using α and β pancake probe survey instruments and no detectable activity by laboratory γ spectroscopic analysis. The lower limit of detectable activity for ^{241}Am by γ spectroscopic analysis is 13 pCi. The total air volume sample collected was 110 m^3 resulting in a minimum detectable concentration of 10^{-13} μCi/ml. The radiation worker derived air concentration (DAC) for controlling radiation dose by inhalation of ^{241}Am is 2 X 10^{-12} μCi/ml (USDOE 1994). The dose rate limit for radiation workers is 5000 mrem/yr, based on a 2040 hour work year. Considering the limited time spent at Gnome (48 hrs) and the minimum detectable concentration (1.13 X $10^{-13}$$\mu$Ci/ml) , the maximum potential dose to EEG workers from ^{241}Am inhalation is approximately 7 mrem which is well below the 5000 mrem limit.

The National Council on Radiation Protection and Measurements (NCRP) states that many parameters are involved with the resuspension of surface contamination, such as the age and chemical properties of the contamination, the magnitude and duration of wind, rain and other

physical activities (NCRPM 1985). The NCRP also suggests that the resuspension factor is the most appropriate method for characterizing air concentration at sites contaminated after nuclear bomb testing in the southwestern United States and is defined as follows:

$$K(t) = \frac{Xr(t)}{S}$$

where:

K(t)	=	Resuspension Factor (m^{-1})
Xr(t)	=	Air concentration of resuspended activity at time t after the deposition has been completed (pC/m^3), and
S	=	Surface deposition per unit area (pC/m^2).

For material deposited greater than 25 years, the suggested NCRP resuspension factor is K(t) = 10^{-9} (m^{-1}) and is consistent with historical values (Bennett 1974).

RESULTS

Both the EEG and CTC area surveys indicate elevated environmental γ measurements in the probable Gnome plume release pathway. In addition, EEG measurements in an area identified as a contaminated waste burial site (Berry 1981) also indicate elevated environmental γ measurements. Laboratory γ spectroscopic analysis of soil samples indicated that ^{137}Cs was the principle radionuclide associated with the Gnome site γ measurements. Radiochemical analysis of the same soil samples revealed elevated levels of $^{239+240}Pu$, ^{238}Pu, and ^{241}Am radionuclide contamination.

EEG Surveys

In Figure 4, EEG survey locations are shown relative to the road leading to Gnome, sampling wells and the access shaft. The EEG environmental γ measurements using the NaI(Tl) survey instrument are graphically displayed in Figure 5. All measurements are gross counts, that is, background is not subtracted. The yellow areas indicate γ count rates less than 1000 cpm, blue indicates count rates between 1000 and 3000 cpm, and red indicates count rates greater than 3000 cpm. The data are in Appendix A.

Elevated γ count rate measurements were found around the access shaft and leading to the northwest. The northwest trend appears to correspond with the predominate Gnome plume release pathway. The area southeast of the access shaft has isolated areas of elevated count rates including the two highest count rates found (see red marks on Figure 5). A γ count rate approximately 20 times the background count rate was measured at the southern most red mark in Figure 5 which corresponds to soil sample location 2 as shown in Figure 6.

Because of the high γ measurements, soil samples were collected for additional analyses from the two red locations, and these results are discussed in the section below on Radiochemical Analyses of Soil Samples.

The EEG surveyed an area northeast of the access shaft and again found a pattern of elevated γ measurements (Figure 5). This area corresponds to the contaminated waste burial area described by Berry (1981).

In an undisturbed area approximately 750 m north of the access shaft (sample location 6, Figure 6), γ measurements as high two times background were identified. It was suspected that these elevated measurements were related to the water catch basin topography. As described previously, the elevation within the water catch basin was recorded with each γ survey measurement. The results are shown in Figure 7, and there appears to be strong correlation (R-squared = 0.92) between γ count rate and elevation.

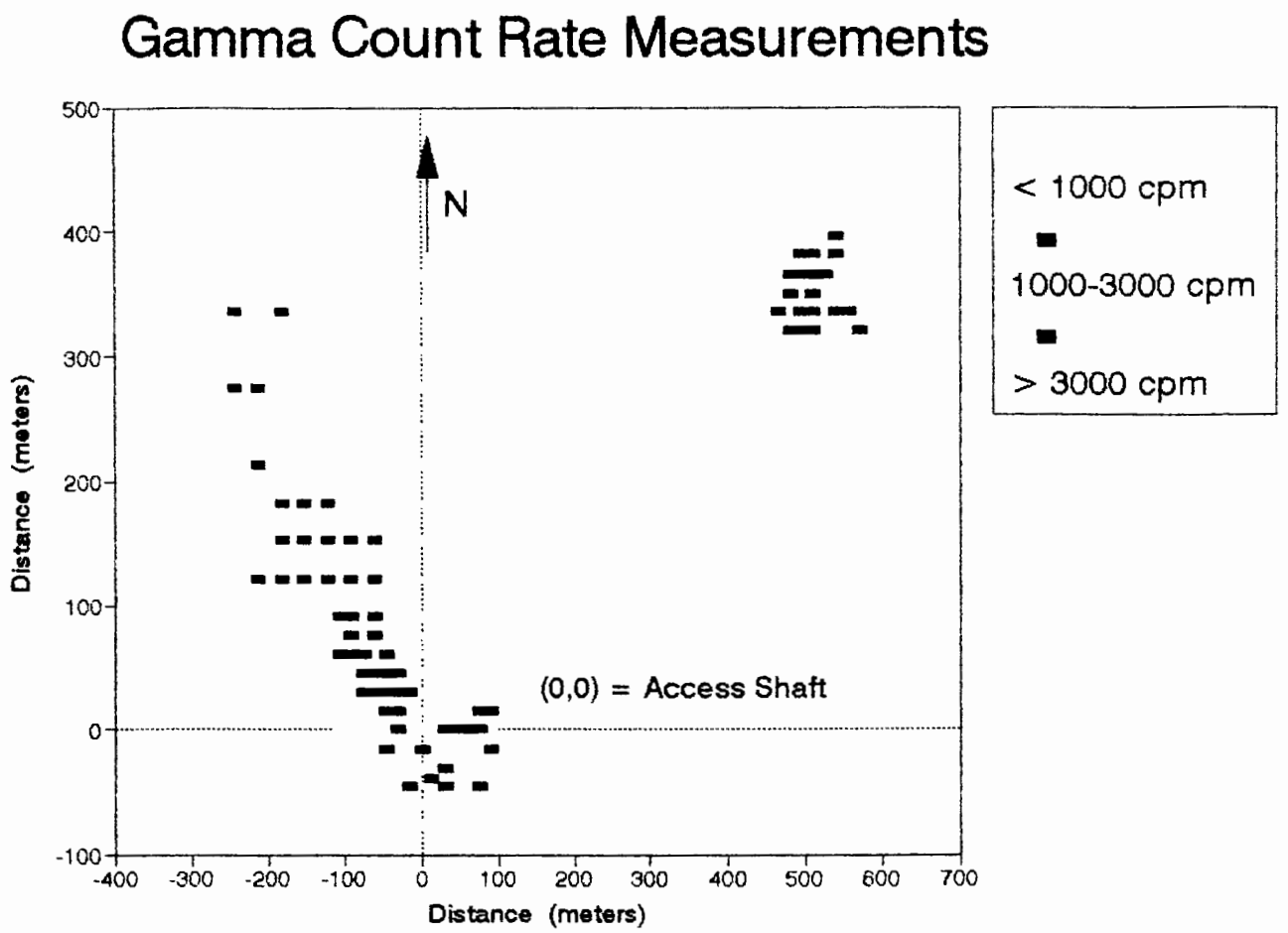

Figure 5. Gamma Count Rates at the Gnome Site

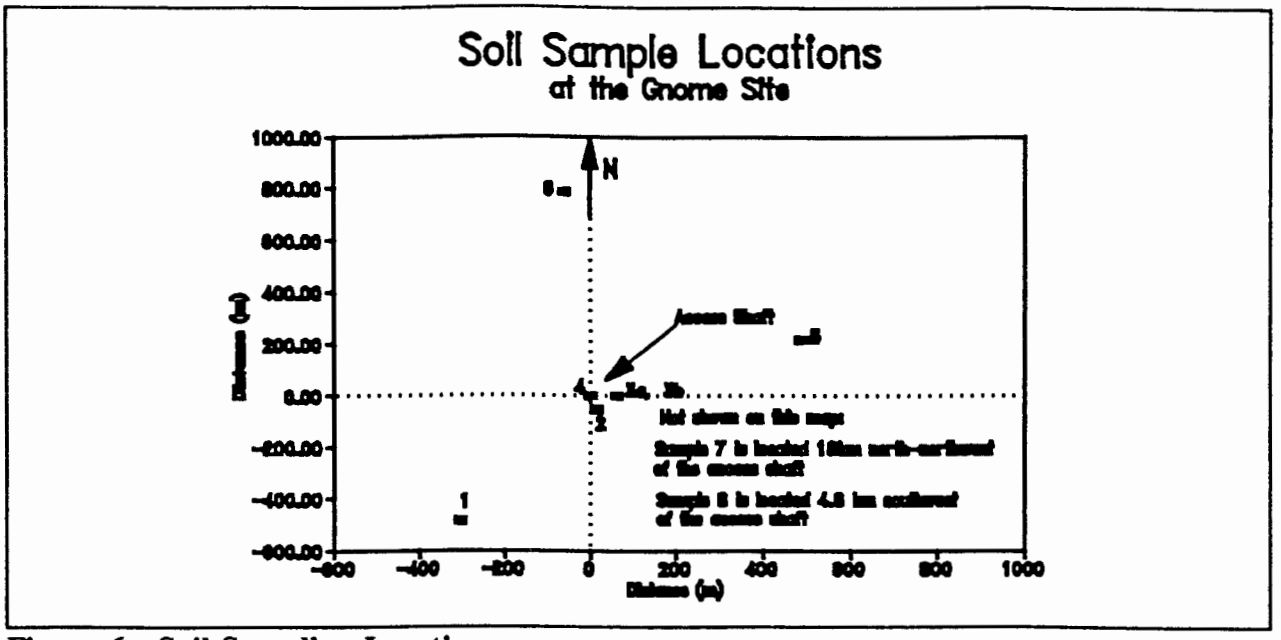

Figure 6. Soil Sampling Locations

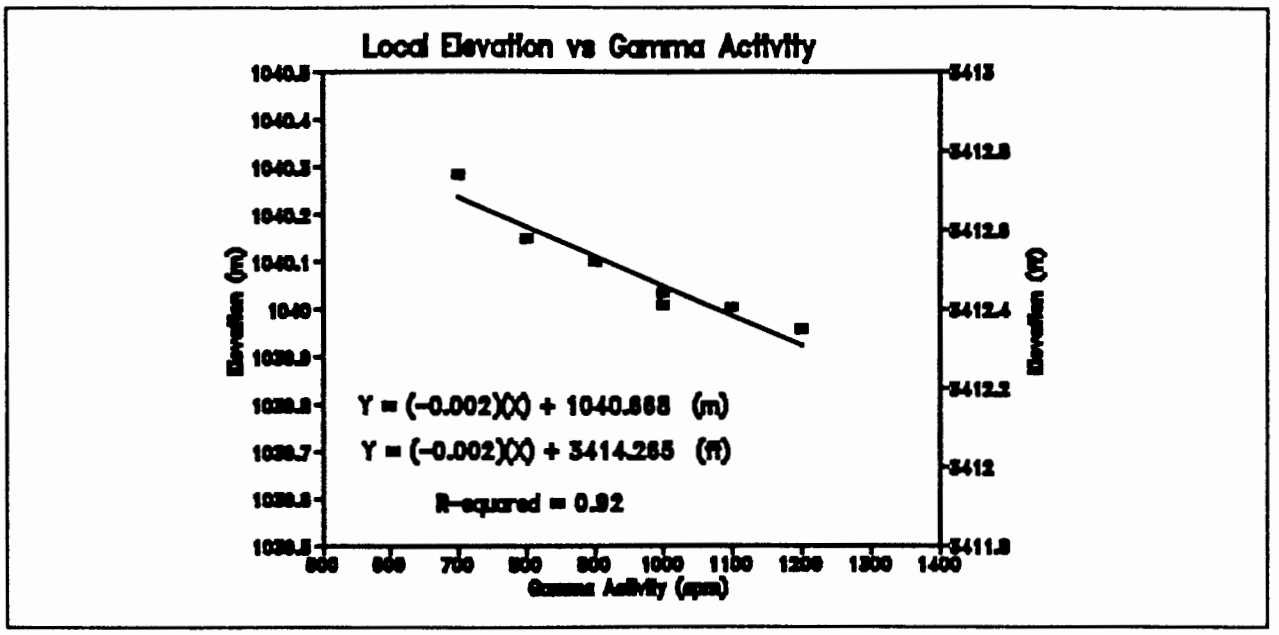

Figure 7. Relative Elevation and Gamma Count Rate

Chemrad Tennessee Corporation (CTC) Surveys

The CTC radiological surveys were performed on December 12 - 13, 1994, in the two locations shown in Figure 4 and identified as the CTC plume and CTC WBG1 surveys. The CTC plume survey data are in Appendix B, Figure B1 and identified as USRADS v1.10d Track Map, Plume C. The NaI(Tl) γ measurements in Figure B1 indicate a pattern of elevated count rate along a northwest path from the access shaft release point. This pattern appears to correspond to the main Gnome release pathway and to the apparent plume trend shown in the EEG survey (Figure 5). The elevated CTC measurements were generally three to four times the background count rate with one isolated measurement at about seven times background.

The CTC WBG1 survey data are in Appendix B, Figure B2 and identified as WBG1(A), Track Map. The CTC WBG1 data indicated several areas with count rates of two to three times background and two points as high as six to seven times background. The two highest count rates are shown in red in Figure 5 and are map coordinates x = 12.25 m, y = -43.13 m and x = 45.1 m, y = -41.3 m. At the first location, the EEG NaI(Tl) measurement was 11,000 cpm, and the CTC NaI(Tl) measurement was about 12,000 cpm. At the second location, EEG measured 3800 cpm and CTC 5660 cpm.

The CTC reported a mean of 5.47 +/- 1.83 μrem h^{-1} in the plume area and 3.95 +/- 3.42 μrem h^{-1} in the burial area. The measurements were made with a Bicron MicroRem Model Tissue Equivalent Survey Meter carried in the same geometry as the CTC NaI(Tl) survey meter.

Soil Sample Gamma Spectroscopic Screening

A total of nine soil samples were collected for γ spectroscopic analysis with relative locations shown in Figure 6. Samples 1 and 6 were outside the EEG survey area, but on the Gnome site. Samples 2 and 3 were at the red markers shown in Figure 5, and two samples were

collected at location 3. Sample 4 was near the access shaft, and sample 5 was in the suspected burial area. Samples 7 and 8 were collected outside the Gnome area.

Table 1 contains the results of the γ spectroscopic analyses. The R-squared value for the correlation between γ count rate and ^{137}Cs is 0.95. The ^{40}K concentrations are relatively constant for all samples. The ratio of ^{40}K to ^{137}Cs is highly variable due to great variation in the ^{137}Cs concentrations.

Table 1. ^{40}K and ^{137}Cs Soil Concentrations

Location	K-40		Cs-137		Ratio	Gross γ
	(Bq/g)	(pCi/g)	(Bq/g)	(pCi/g)	^{137}Cs:^{40}K	CPM
1	**0.22**	(6.00)	**0.01**	(0.20)	0.03	800
2	**0.20**	(5.37)	**3.09**	(83.40)	15.53	11000
3A	**0.26**	(7.07)	**0.58**	(15.60)	2.21	3800
3B	**0.23**	(6.08)	**0.41**	(11.20)	1.84	3800
4	**0.17**	(4.48)	**0.07**	(1.89)	0.42	NA
5	**0.24**	(6.44)	**0.22**	(5.92)	0.92	1400
6	**0.24**	(6.58)	**0.10**	(2.63)	0.40	1200
7	**0.67**	(18.00)	**0.02**	(0.64)	0.03	2500
8	**0.23**	(6.13)	**0.003**	(0.07)	0.01	800

Radiochemical Analyses of Soil Samples

Table 2 shows the activity concentrations of transuranic radionuclides as determined by radiochemistry. Four aliquots from sample 3A were sent to a commercial laboratory for independent analyses. The commercial samples are samples 3A-4 through 3A-7. The highest concentration of transuranic contamination was found in the soil sample from location 3A, near some exposed metallic debris located approximately 76 m (250 ft) east-southeast of the access shaft (Figure 8).

Table 2. Radiochemical Data

	$^{239+240}Pu$		^{238}Pu		^{241}Am	
Location	Bq/g	(pCi/g)	Bq/g	(pCi/g)	Bq/g	(pCi/g)
2	**0.0044**	(0.12)	**0.00081**	(0.022)	**0.00059**	(0.16)
3A	**0.63**	(17)	**0.10**	(2.7)	**0.14**	(3.9)
3A-1	**0.48**	(13)	**0.067**	(1.8)	**0.085**	(2.3)
3A-2	**0.31**	(8.5)	**0.044**	(1.2)	**0.052**	(1.4)
3A-3	**48**	(1290)	**6.8**	(184)	**7.6**	(205)
3A-4*	**0.041**	(1.1)	**0.0067**	(0.18)	**0.0067**	(0.18)
3A-5*	**0.063**	(1.7)	**0.011**	(0.31)	**0.022**	(0.60)
3A-6*	**15**	(410)	**2.4**	(66)	**1.8**	(48)
3A-7*	**0.010**	(2.7)	**0.015**	(0.40)	**0.048**	(1.3)
3B	**0.059**	(1.6)	**0.0089**	(0.24)	**NA**	NA
7	**0.0008**	(0.022)	**0.0002**	(0.005)	**0.0004**	(0.011)

Note: * identifies analyses by a Commercial Laboratory
NA sample lost in processing

Figure 8. Exposed Debris Southeast of the Access Shaft

DISCUSSION

The EEG study was more detailed than previous studies conducted near the Gnome site. The increased detail and use of new methodologies identified radionuclides not previously found at the Gnome site. Most likely this is because the EEG data were not averaged over large areas as in previous remedial surveys. The EEG study identified isolated areas of contamination and soil samples were then collected from these locations for radiochemical analysis. Therefore, the probability of the EEG finding transuranic contaminants was greatly increased. EEG radiochemistry methodology involved complete dissolution of the sample which enabled analyses of all radioactive constituents regardless of solubility.

Field Gamma Surveys

The field γ surveys performed by the EEG identified the probable plume path and located the contaminated waste burial areas. Field γ surveys proved to be useful in identifying local areas of elevated γ count rates. Ritchie and McHenry (1990) reported numerous findings of ^{137}Cs accumulation in water catchment basins which is consistent with the limited EEG data set. Table 1 shows positive correlation between γ count rate and ^{137}Cs concentrations (R-squared = 0.95) while Figure 7 shows a strong relationship between γ count rate and local elevation, (R-squared = 0.92). Another major γ contributor, ^{40}K, was found to be relatively constant in all soil samples. Future work should include additional measurements of γ count rates and radionuclide concentrations in water catchment basins and elevated locations near WIPP and along the waste transportation routes. Such information could be helpful in predicting where radionuclides will accumulate in the environment.

The CTC survey identified areas with elevated γ count rates that the EEG survey did not identify due to greater detail provided by the USRADS system used by CTC. Variations in the EEG and CTC measurements conducted at the same locations can be attributed to differences in calibration methods, and variations in field geometry (detector-to-ground

distance). The CTC instrument response was approximately 50% greater than the EEG instrument response in the same geometry.

In addition to the γ count rate surveys, CTC also provided a detailed track map of dose rates which indicated no significantly elevated measurements. The average dose rates reported by CTC were 5.47 μR/h for the plume survey and 3.95 μR/h for the WBG1 survey. The detailed contour maps of dose rates are not included in this report.

The β measurements taken by CTC were near background and inconclusive, however, ^{90}Sr is expected to have dispersed with ^{137}Cs at the time of the Gnome detonation. The CTC β measurements are not included in this report. Gilbert (Gilbert et al 1988) reported that ^{90}Sr bioaccumulates in the roots of vegetation and is transferred to the leaves. The EEG is in the process of developing radiochemical methodology to measure β emitters such as ^{90}Sr. Additional γ, β, and dose surveys in the vicinity of Gnome and the WIPP site may be useful as WIPP preoperational and operational studies continue.

Gamma Spectroscopy

Field γ surveys were useful in identifying areas of elevated γ activity but did not distinguish individual radionuclides (natural and man-made) that contributed to the gross γ activity. Gamma spectroscopy was used to quantify ^{137}Cs and ^{40}K concentrations in soil samples using a Marinelli beaker configuration. Berry (1989) identified elevated levels of ^{40}K associated with potash tailing deposits. The influence of these large deposits of ^{40}K must be evaluated in various topographies near the WIPP site and along WIPP transportation routes as an additional part of the environmental baseline studies.

Gamma spectroscopy was also used to screen soil samples for ^{241}Am activity, however, the sensitivity can be reduced because of self-attenuation. High variability in measurements could be caused by non-uniform distribution of radioactive particles within a sample (Doctor et al. 1980).

Radiochemistry

Gamma spectroscopy was not capable of quantifying ^{238}Pu and $^{239+240}Pu$ at the concentrations present in Gnome site soil. Therefore, radiochemical analysis was used to determine concentrations of ^{238}Pu and $^{239+240}Pu$ in selected soil samples. The first radiochemical data from soil samples was collected in 1989 as a part of the EEG preoperational monitoring program for the WIPP. Previous soil radiochemical data obtain from a commercial laboratory is included in appendix C along with data obtained from the Gnome baseline study. The ^{228}Th, ^{230}Th, ^{232}Th, $^{233+234}U$, ^{235}U, and ^{238}U radionuclide concentrations found at the WIPP and the Gnome site are similar. As expected the concentrations of ^{238}Pu and $^{239+240}Pu$ are significantly greater in the Gnome samples.

Watters et al. (1980) found wind erosion to be the primary transport mechanism for deposited radioactive isotopes of plutonium in arid regions. Lee and Tamura (1981) determined that ^{241}Am is not uniformly distributed within the first 5 cm of soil depth. Radiochemical analysis of soil from the Gnome area will provide data that could be used to predict where these radionuclides accumulate. Previous WIPP baseline studies have not included this type of isotopic soil profile.

REFERENCES

Banz, I., P. Bradshaw, J. S. Cockman, N. T. Fischer, J. K. Prince, A. L. Rodriguez, D. Uhland, 1987. Annual site environmental monitoring report for the Waste Isolation Pilot Plant calendar year 1986. DOE/WIPP-87-002, U.S. Department of Energy.

Bennett, Burton G., 1974. Plutonium and other transuranium elements: sources, environmental distribution and biomedical effects. In environmental pathways of transuranic elements. WASH-1359, U.S. Atomic Energy Commission, Health and Safety Laboratory.

Berry, H. A., 1981. Gnome Site decontamination and decommissioning project: radiation contamination and clearance report, March 28, 1979 - September 23, 1979. DOE/NV/00410-59, Reynolds Electrical & Engineering Co., Inc.

Berry, H. A., 1989. An aerial radiological survey of the Waste Isolation Pilot Plant and surrounding area, Carlsbad, New Mexico. AMO-8809, EG&G Energy Measurements.

Doctor, P. G., R. O. Gilbert, and J. E. Pinder III, 1980. Appropriate use of ratios in environmental transuranic element studies. In Transuranics in the Environment, ed. Wayne C. Hanson, Pacific Northwest Laboratory, 187-208.

Gilbert, R.O., J. H. Shin, E. H. Essington, T. Tamura, E. M. Romney, K .S. Moor, and T. P. O'Farrell, 1988. Radionuclide transport from soil to air, native vegetation, kangaroo rats and grazing cattle on the Nevada Test Site. Health Physics, 55(6): 869-887.

Horwitz, E.P., Chiarizia, R., Dietz, M.L., Diamond, H., and Nelson, D., 1993. Separation and preconcentration of actinides from acidic media by extraction chromatography, Analytica Chimica Acta, 281: 361-372.

Kenney, Jim W., 1991. Preoperational radiation surveillance of the WIPP project by EEG during 1990. EEG-49, Environmental Evaluation Group.

Kenney, Jim W., 1992. Preoperational radiation surveillance of the WIPP project by EEG during 1991. EEG-51, Environmental Evaluation Group.

Kenney, Jim W., 1994. Preoperational radiation surveillance of the WIPP project by EEG during 1992. EEG-51, Environmental Evaluation Group.

Kenney, Jim W., and Sally C. Ballard, 1990. Preoperational radiation surveillance of the WIPP project by EEG during 1989. EEG-47, Environmental Evaluation Group.

Kenney, Jim, John Rodgers, Jenny Chapman, Kevin Shenk, 1990. Preoperational radiation surveillance of the WIPP project by EEG, 1985-1988. EEG-43, Environmental Evaluation Group.

Lee, S. Y. and T. Tamura, 1981. Distribution and characterization of radionuclides in soils and from the Nevada Test Site. Journal of Environ. Quality, 10(2): 234-239.

Mitchell, R. F., 1960. Electrodeposition of actinide elements at tracer concentrations. Analytical Chemistry, 32: 326-328.

National Council on Radiation Protection and Measurements, 1985. Radiological assessment: predicting the transport, bioaccumulation, and uptake by man of radionuclides released to the environment. NCRP Report No. 76.

National Defense Authorization Act for fiscal year 1994, 1993. Statutes at Large. Vol. 107, 1547-1966.

New Mexico State of, and U. S. Department of Energy, 1984. First modification to the July 1, 1981 "Agreement for consultation and cooperation" on WIPP by the State of New Mexico and U. S. Department of Energy.

Rawson, D., C. Boardman, and N. Jaffe-Chazan, 1961. The environment created by a nuclear explosion in salt. PNE-107F, Lawrence Radiation Laboratory.

Reith, C., K. Prince, T. Fischer, A. Rodriguez, D. Uhland, D. Winstanley, 1986. Annual site environmental monitoring report for the Waste Isolation Pilot Plant calendar year 1985. DOE-WIPP-86-002, U.S. Department of Energy.

Ritchie, Jerry C. and J. Roger McHenry, 1990. Application of radioactive cesium-137 for measuring soil erosion and sediment accumulation rates and patterns: a review. Journal Environmental Quality, 19:215-233.

Spiegler, P., 1984. Proposed preoperational environmental monitoring program for WIPP. EEG-26, Environmental Evaluation Group.

Talvitie, N.A., 1972. Electrodeposition of actinides for alpha spectrometric determination. Analytical Chemistry, 44(2): 280-283.

Tappan, John T. and Jerry J. Lorenz, 1969. Carlsbad site roll-up program on-site radiological safety report. EVO-410-2, Reynolds Electrical & Engineering Co., Inc.

University of Nevada System, Desert Research Institute, Water Resources Center, 1988. CERCLA preliminary assessment of DOE's Nevada operations office nuclear weapons testing areas.

U. S. Atomic Energy Commission, Project Gnome Organization, 1961. Project Gnome. AL Pamphlet 3100-1.

U. S. Atomic Energy Commission, Nevada Operations Office, 1969. Site disposal report Carlsbad (Gnome/Coach) nuclear test site. NVO-41.

U. S. Department of Commerce, 1962. Final report of weather and surface radiation prediction for project Gnome. PNE-126F, Weather Bureau Research Station, Las Vegas, NV.

U. S. Department of Energy, 1988. Annual site environmental monitoring report for the Waste Isolation Pilot Plant calendar year 1987. DOE/WIPP-88-009, USDOE, Waste Isolation Pilot Plant.

U. S. Department of Energy, 1989. Annual site environmental monitoring report for the Waste Isolation Pilot Plant calendar year 1988. DOE/WIPP-89-005, USDOE, Waste Isolation Pilot Plant.

U. S. Department of Energy, 1990a. Annual site environmental monitoring report for the Waste Isolation Pilot Plant calendar year 1989. DOE/WIPP-90-003, USDOE, Waste Isolation Pilot Plant.

U. S. Department of Energy, 1990b. Final supplement environmental impact statement. DOE/EIS-0026-FS, Volume 2, USDOE, Office of Environmental Restoration and Waste Management.

U. S. Department of Energy, 1991. Annual site environmental monitoring report for the Waste Isolation Pilot Plant calendar year 1990. DOE/WIPP-91-008, USDOE, Waste Isolation Pilot Plant.

U. S. Department of Energy, 1992. Annual site environmental monitoring report for the Waste Isolation Pilot Plant calendar year 1991. DOE/WIPP-92-007, USDOE, Waste Isolation Pilot Plant.

U. S. Department of Energy, 1993. Annual site environmental monitoring report for the Waste Isolation Pilot Plant calendar year 1992. DOE/WIPP-93-017, USDOE, Waste Isolation Pilot Plant.

U. S. Department of Energy, 1994. 10 Code of federal regulations part 835, appendix A: derived air concentrations (DAC) for controlling radiation exposure to workers at DOE facilities. Washington DC: Office of Federal Register, National Archive and Records Administration.

U. S. Department of Energy, 1995. Estimating the cold war mortgage: the 1995 baseline environmental management report, Volume II: site summaries March 1995. USDOE, Office of Environmental Management.

U. S. Environmental Protection Agency, 1994a. Environmental radiation protection standards for the management and disposal of spent nuclear fuel, high-level and transuranic radioactive wastes. 40 CFR Part 191, U. S. Code of Federal Regulations.

U. S. Environmental Protection Agency, 1994b. Residual soil radioactivity at the Gnome site in Eddy County, New Mexico. EPA 600/R-94/117.

Waste Isolation Pilot Plant Land Withdrawal Act, 1992. Statutes at Large. Vol. 106, 4777-4796.

Watters, R. L., D. N. Edgington, T. E. Hakonson, W. C. Hanson, M. H. Smith, F. W. Whicker, and R. E. Wildung, 1980. Synthesis of the research literature. In Transuranics in the Environment, ed. Wayne C. Hanson, Pacific Northwest Laboratory, 1-44.

APPENDIX A:

Gamma Count Rate Data

GAMMA COUNT RATE DATA

X (m)	Y (m)	Gross Gamma Counts
-304.8	121.92	700
-304.8	152.4	700
-304.8	182.88	700
-304.8	213.36	900
-304.8	243.84	700
-304.8	274.32	800
-304.8	304.8	900
-304.8	335.28	900
-304.8	365.76	900
-304.8	365.76	900
-277.3	304.8	900
-274.3	121.92	1000
-274.3	152.4	900
-274.3	182.88	900
-274.3	213.36	800
-274.3	243.84	800
-274.3	274.32	1000
-274.3	335.28	800
-274.3	365.76	900
-243.8	121.92	900
-243.8	152.4	1000
-243.8	182.88	1000
-243.8	213.36	900
-243.8	243.84	1000
-243.8	274.32	1100
-243.8	304.8	700
-243.84	335.28	1100
-243.84	365.76	900
-213.36	121.92	1200
-213.36	152.4	900
-213.36	182.88	1000
-213.36	213.36	1100
-213.36	243.84	1000
-213.36	274.32	1100
-213.36	304.8	900
-213.36	335.28	950
-213.36	365.76	900
-182.88	121.92	1200
-182.88	152.4	1100
-182.88	182.88	1100
-182.88	213.36	900
-182.88	243.84	800
-182.88	274.32	900
-182.88	304.8	900
-182.88	335.28	1100
-182.88	365.76	900
-152.4	121.92	1200
-152.4	152.4	1500
-152.4	182.88	1250
-152.4	213.36	1000
-152.4	243.84	1000
-152.4	274.32	900

GAMMA COUNT RATE DATA

X (m)	Y (m)	Gross Gamma Counts
-152.4	304.8	800
-152.4	335.28	1000
-152.4	365.76	900
-121.92	121.92	1600
-121.92	152.4	1600
-121.92	182.88	1100
-121.92	213.36	950
-121.92	243.84	1000
-121.92	274.32	900
-121.92	304.8	900
-121.92	335.28	1000
-121.92	365.76	900
-106.68	-76.2	700
-106.68	-60.96	750
-106.68	-45.72	800
-106.68	-30.48	900
-106.68	-15.24	900
-106.68	0	700
-106.68	15.24	800
-106.68	30.48	900
-106.68	45.72	700
-106.68	60.96	1200
-106.68	76.2	1000
-106.68	91.44	1500
-91.44	-76.2	800
-91.44	-60.96	800
-91.44	-45.72	700
-91.44	-30.48	900
-91.44	-15.24	600
-91.44	0	750
-91.44	15.24	850
-91.44	30.48	900
-91.44	45.72	850
-91.44	60.96	1250
-91.44	76.2	1100
-91.44	91.44	1300
-91.44	121.92	1400
-91.44	152.4	1300
-91.44	182.88	1000
-91.44	213.36	800
-91.44	243.84	850
-91.44	274.32	1000
-91.44	304.8	1000
-91.44	335.28	900
-91.44	365.76	900
-76.2	-76.2	800
-76.2	-60.96	400
-76.2	-45.72	1000
-76.2	-30.48	700
-76.2	-15.24	800
-76.2	0	700
-76.2	15.24	1000

GAMMA COUNT RATE DATA

X (m)	Y (m)	Gross Gamma Counts	X (m)	Y (m)	Gross Gamma Counts
-76.2	30.48	1150	-45.72	-76.2	400
-76.2	45.72	1400	-45.72	-60.96	600
-76.2	60.96	1400	-45.72	-45.72	500
-76.2	76.2	1000	-45.72	-30.48	500
-76.2	91.44	1000	-45.72	-15.24	1400
-60.96	-76.2	350	-45.72	0	900
-60.96	-60.96	500	-45.72	15.24	1100
-60.96	-45.72	500	-45.72	30.48	1100
-60.96	-30.48	500	-45.72	45.72	1400
-60.96	-15.24	650	-45.72	60.96	1050
-60.96	0	900	-45.72	76.2	850
-60.96	15.24	850	-45.72	91.44	950
-60.96	30.48	1050	-30.48	-76.2	400
-60.96	45.72	1100	-30.48	-60.96	450
-60.96	60.96	1000	-30.48	-45.72	500
-60.96	76.2	1350	-30.48	-30.48	900
-60.96	91.44	2000	-30.48	-15.24	800
-60.96	121.92	1400	-30.48	0	1300
-60.96	152.4	1800	-30.48	15.24	1100
-60.96	182.88	900	-30.48	30.48	1250
-60.96	213.36	900	-30.48	45.72	1200
-60.96	243.84	1000	-30.48	60.96	900
-60.96	274.32	800	-30.48	76.2	850
-60.96	304.8	1000	-30.48	91.44	750
-60.96	335.28	800	-30.48	121.92	1000
-60.96	365.76	700	-30.48	152.4	900

GAMMA COUNT RATE DATA

X (m)	Y (m)	Gross Gamma Counts	X (m)	Y (m)	Gross Gamma Counts
-30.48	182.88	900	0	30.48	900
-30.48	213.36	1000	0	45.72	600
-30.48	243.84	800	0	60.96	600
-30.48	274.32	900	0	76.2	600
-30.48	304.8	800	0	91.44	700
-30.48	335.28	1000	0	121.92	800
-30.48	365.76	700	0	152.4	750
-15.24	-76.2	300	0	182.88	900
-15.24	-60.96	400	0	213.36	1000
-15.24	-45.72	2900	0	243.84	900
-15.24	-30.48	900	0	274.32	700
-15.24	-15.24	850	0	304.8	700
-15.24	0	500	0	335.28	700
-15.24	15.24	1000	0	365.76	700
-15.24	30.48	1100	12.192	-39.624	11000
-15.24	45.72	1000	15.24	-76.2	250
-15.24	60.96	900	15.24	-60.96	300
-15.24	76.2	800	15.24	-45.72	1000
-15.24	91.44	800	15.24	-30.48	600
0	-76.2	300	15.24	-15.24	850
0	-60.96	400	15.24	0	800
0	-45.72	900	15.24	15.24	700
0	-30.48	800	15.24	30.48	850
0	-15.24	1500	15.24	45.72	1000
0	0	500	15.24	60.96	800
0	15.24	550	15.24	76.2	800

GAMMA COUNT RATE DATA

X (m)	Y (m)	Gross Gamma Counts	X (m)	Y (m)	Gross Gamma Counts
15.24	91.44	650	60.96	-60.96	300
30.48	-76.2	250	60.96	-45.72	850
30.48	-60.96	200	60.96	-30.48	1000
30.48	-45.72	1100	60.96	-15.24	600
30.48	-30.48	1200	60.96	0	2800
30.48	-15.24	700	60.96	15.24	900
30.48	0	1200	60.96	30.48	800
30.48	15.24	700	60.96	45.72	700
30.48	30.48	950	60.96	60.96	750
30.48	45.72	850	60.96	76.2	750
30.48	60.96	850	60.96	91.44	700
30.48	76.2	750	76.2	-76.2	200
30.48	91.44	700	76.2	-60.96	300
45.72	-76.2	350	76.2	-45.72	1100
45.72	-60.96	300	76.2	-30.48	800
45.72	-45.72	1000	76.2	-15.24	600
45.72	-30.48	900	76.2	0	2200
45.72	-15.24	600	76.2	0	3800
45.72	0	1500	76.2	15.24	1100
45.72	15.24	800	76.2	30.48	950
45.72	30.48	700	76.2	45.72	600
45.72	45.72	750	76.2	60.96	700
45.72	60.96	800	76.2	76.2	600
45.72	76.2	900	76.2	91.44	700
45.72	91.44	800	91.44	-76.2	750
60.96	-76.2	250	91.44	-60.96	800

GAMMA COUNT RATE DATA

X (m)	Y (m)	Gross Gamma Counts	X (m)	Y (m)	Gross Gamma Counts
91.44	-45.72	800	464.82	381	800
91.44	-30.48	750	464.82	396.24	700
91.44	-15.24	2200	480.06	274.32	900
91.44	0	1000	480.06	289.56	800
91.44	15.24	1200	480.06	304.8	1000
91.44	30.48	900	480.06	320.04	1500
91.44	45.72	800	480.06	335.28	900
91.44	60.96	750	480.06	350.52	1300
91.44	76.2	600	480.06	365.76	1100
91.44	91.44	600	480.06	381	800
464.82	274.32	700	480.06	396.24	800
464.82	289.56	700	495.3	274.32	900
464.82	304.8	700	495.3	289.56	950
464.82	320.04	1000	495.3	304.8	950
464.82	335.28	1500	495.3	320.04	1100
464.82	350.52	900	495.3	335.28	2000
464.82	365.76	1000	495.3	350.52	900
464.82	381	800	495.3	365.76	1500
464.82	396.24	700	495.3	381	1200
480.06	274.32	900	495.3	396.24	900
480.06	289.56	800	510.54	274.32	800
480.06	304.8	1000	510.54	289.56	900
480.06	320.04	1500	510.54	304.8	900
480.06	335.28	900	510.54	320.04	3000
480.06	350.52	1300	510.54	335.28	1400
480.06	365.76	1100	510.54	350.52	1400

GAMMA COUNT RATE DATA

X (m)	Y (m)	Gross Gamma Counts
525.78	365.76	1200
525.78	381	750
525.78	396.24	800
541.02	274.32	700
541.02	289.56	700
541.02	304.8	700
541.02	320.04	800
541.02	335.28	1900
541.02	350.52	700
541.02	365.76	750
541.02	381	1100
541.02	396.24	1200
556.26	274.32	700
556.26	289.56	700
556.26	304.8	700
556.26	320.04	600
556.26	335.28	1200
556.26	350.52	900
556.26	365.76	800
556.26	381	700
556.26	396.24	700
571.5	274.32	700
571.5	289.56	700
571.5	304.8	1000
571.5	320.04	1200
571.5	335.28	900
571.5	350.52	900
571.5	365.76	700
571.5	381	700
571.5	396.24	700
586.74	274.32	700
586.74	289.56	1000
586.74	304.8	900
586.74	320.04	700
586.74	335.28	700
586.74	350.52	700
586.74	365.76	700
586.74	381	700
586.74	396.24	700
601.98	274.32	700
601.98	289.56	700
601.98	304.8	700
601.98	320.04	700
601.98	335.28	700
601.98	350.52	700
601.98	365.76	700
601.98	381	700
601.98	396.24	700

APPENDIX B:

Chemrad Tennessee Corporation Report

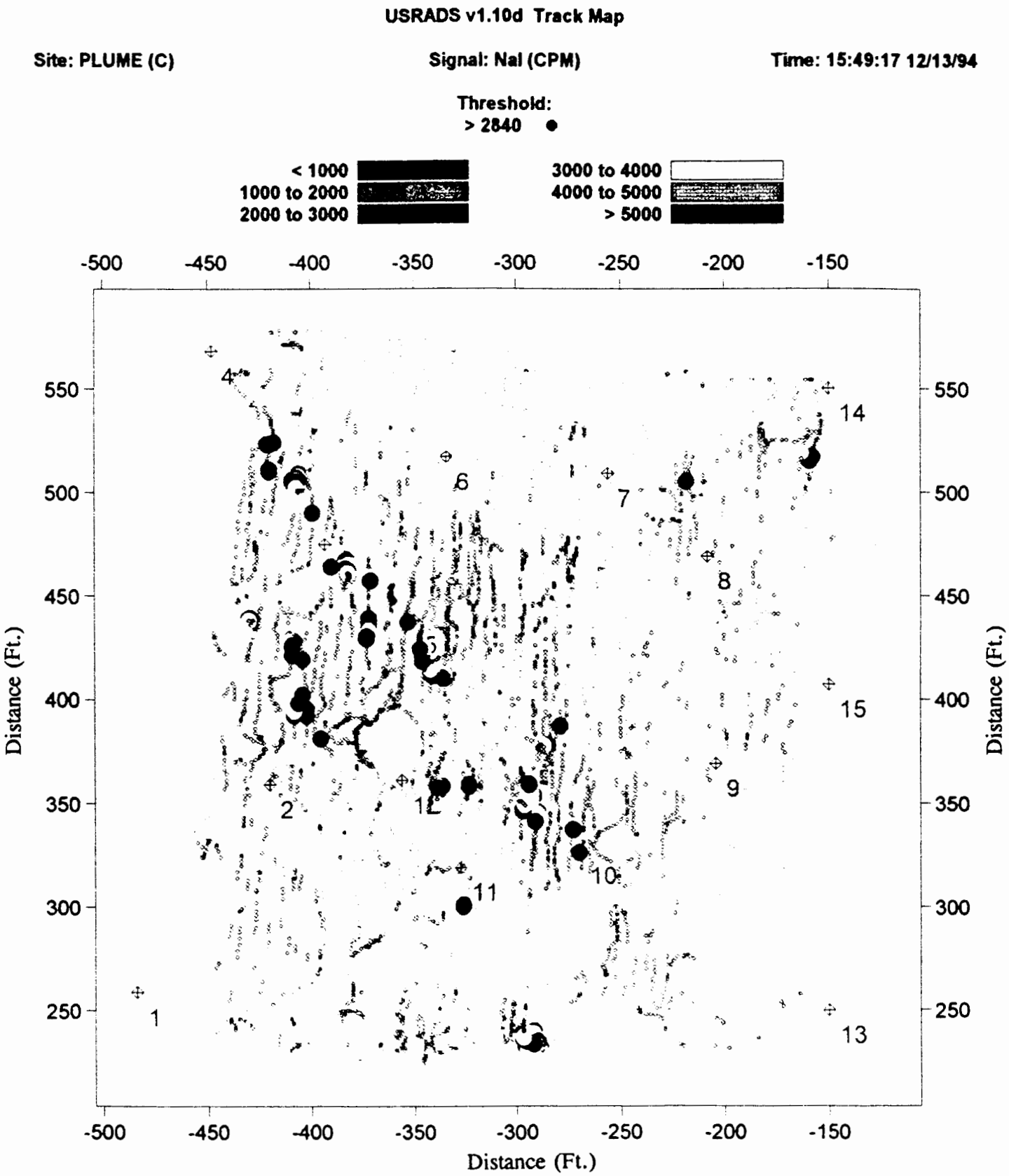

Figure B1. CTC Gamma Survey of the Plume

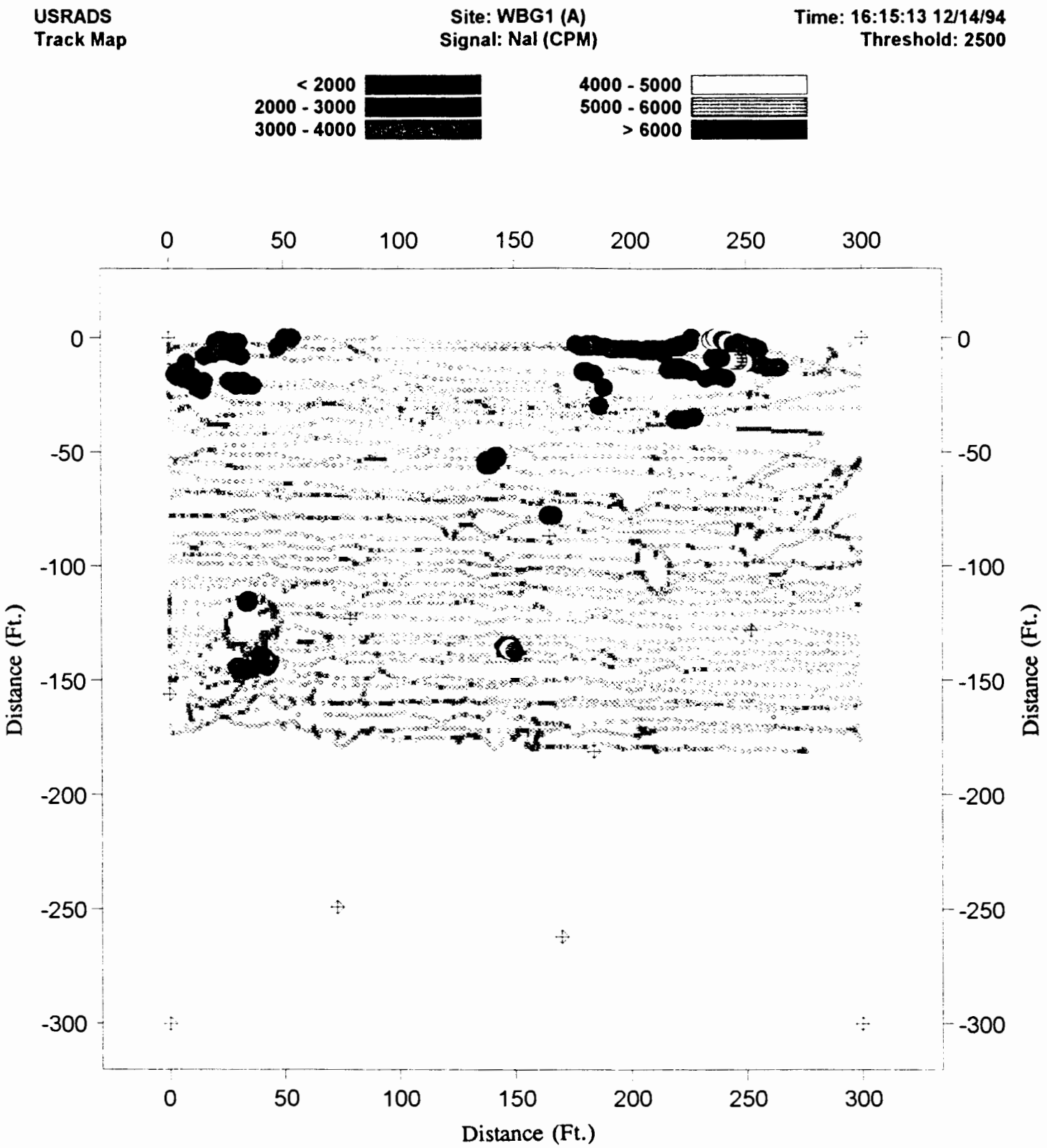

Figure B2. CTC Gamma Survey of WB61

APPENDIX C:

Radiochemical Soil Data

**** Indicates Commercial Laboratory Results**

WIPP SOIL SAMPLE RESULTS

1000 M NW WIPP EXHAUST **

8/7/89

NUCLIDE	Bq/g	(pCi/g)
PU238	**0.00037**	(0.01)
PU239+240	**0**	(0.00)
SR90	**0.015**	(0.41)
TH228	**N/A**	(N/A)
TH230	**N/A**	(N/A)
TH232	**N/A**	(N/A)
U233+234	**N/A**	(N/A)
U235	**N/A**	(N/A)
U238	**N/A**	(N/A)
CS137	**0.0074**	(0.20)

390 M EAST OF WIPP EXHAUST **

08/01/90

NUCLIDE	Bq/g	(pCi/g)
PU238	**-0.00037**	(-0.010)
PU239+240	**0.00037**	(0.010)
SR90	**-0.0074**	(-0.20)
TH228	**0.00**	(0.00)
TH230	**0.0074**	(0.20)
TH232	**0.0074**	(0.20)
U233+234	**0.0074**	(0.20)
U235	**0.00**	(0.00)
U238	**0.0074**	(0.20)
CS137	**0.0074**	(0.20)

575 M NORTH WIPP EXHAUST **

08/01/90

NUCLIDE	Bq/g	pCi/g
PU238	**-0.00037**	(-0.010)
PU239+240	**0**	(0.010)
SR90	**-0.011**	(-0.30)
TH228	**0**	(0.00)
TH230	**0.0074**	(0.20)
TH232	**0.0074**	(0.20)
U233+234	**0.0037**	(0.10)
U235	**0**	(0.00)
U238	**0.0037**	(0.10)
CS137	**0.0037**	(0.10)

530 M SOUTH WIPP EXHAUST **

08/01/90

NUCLIDE	Bq/g	(pCi/g)
PU238	**0.00**	(0.00)
PU239+240	**0.00074**	(0.20)
SR90	**0.0074**	(0.20)
TH228	**0.0074**	(0.20)
TH230	**0.0074**	(0.20)
TH232	**0.0074**	(0.20)
U233+234	**0.0074**	(0.20)
U235	**0.00**	(0.00)
U238	**0.0074**	(0.20)
CS137	**0.00**	(0.00)

WIPP SOIL SAMPLE RESULTS

775 M WEST OF WIPP EXHAUST **

08/01/90

NUCLIDE	Bq/g	(pCi/g)
PU238	**-0.00037**	(-0.01)
PU239+240	**0.00037**	(0.01)
SR90	**-0.0074**	(-0.20)
TH228	**0.011**	(0.30)
TH230	**0.0074**	(0.20)
TH232	**0.011**	(0.30)
U233+234	**0.0074**	(0.20)
U235	**0**	(0.00)
U238	**0.0074**	(0.20)
CS137	**0.0037**	(0.10)

100 M NW WIPP MET TOWER **

04/18/91

NULCIDE	Bq/g	(pCi/g)
PU238	**0.00**	(0.00)
PU239+240	**0.00**	(0.00)
SR90	**0.052**	(1.40)
TH228	**0.015**	(0.40)
TH230	**0.011**	(0.30)
TH232	**0.015**	(0.40)
U233+234	**0.0074**	(0.20)
U235	**0.00**	(0.00)
U238	**0.0074**	(0.20)
CS137	**0.00**	(0.00)

100 M NE OF WELL H2C **

4/18/91

NUCLIDE	Bq/g	(pCi/g)
PU238	**0.00**	(0.00)
PU239+240	**0.00**	(0.00)
SR90	**0.0074**	(0.20)
TH228	**0.015**	(0.40)
TH230	**0.022**	(0.60)
TH232	**0.015**	(0.40)
U233+234	**0.011**	(0.30)
U235	**0.00**	(0.00)
U238	**0.011**	(0.30)
CS137	**0.00**	(0.00)

390 M EAST OF WIPP EXHAUST **

12/01/92

NUCLIDE	Bq/g	(pCi/g)
PU238	**0.00**	(0.00)
PU239+240	**0.00**	(0.00)
SR90	**0.0037**	(0.10)
TH228	**0.0074**	(0.20)
TH230	**0.0074**	(0.20)
TH232	**0.011**	(0.30)
U233+234	**0.0074**	(0.20)
U235	**0.0000**	(0.00)
U238	**0.0074**	(0.20)
CS137	**0.0026**	(0.070)

WIPP SOIL SAMPLE RESULTS

512 M NE WIPP EXHAUST **

12/1/92

NUCLIDE	Bq/g	(pCi/g)
PU238	**0.00**	(0.00)
PU239+240	**0.00**	(0.00)
SR90	**-0.0074**	(-2.0)
TH228	**0.011**	(0.30)
TH230	**0.0037**	(0.10)
TH232	**0.0074**	(0.20)
U233+234	**0.0074**	(0.20)
U235	**0.00**	(0.00)
U238	**0.033**	(0.90)
CS137	**0.0052**	(0.14)

GNOME STUDY - SOIL SAMPLE RESULTS

SOIL SAMPLE 2

NUCLIDE	Bq/g	(pCi/g)
AM-241	**0.000407**	(0.110)
PU-238	**0.000787**	(0.0212)
PU-239	**0.00418**	(0.113)
TH-228	**0.0101**	(0.273)
TH-230	**0.0175**	(0.473)
TH-232	**0.00964**	(0.260)
U-234	**0.0174**	(0.470)
U-235	**0.000738**	(0.0199)
U-238	**0.0155**	(0.419)

SOIL SAMPLE 3A

NUCLIDE	Bq/g	(pCi/g)
AM-241	**0.133**	(3.59)
PU-238	**0.0978**	(2.64)
PU-239	**0.629**	(17.0)
TH-228	**0.0105**	(0.284)
TH-230	**0.0143**	(0.386)
TH-232	**0.00987**	(0.267)
U-234	**0.0149**	(0.402)
U-235	**0.000605**	(0.0163)
U-238	**0.0131**	(0.354)

SOIL SAMPLE 3B

NUCLIDE	Bq/g	(pCi/g)
AM-241	**0.00***	(0.00)*
PU-238	**0.00885**	(0.239)
PU-239	**0.0561**	(1.51)
TH-228	**0.0131**	(0.354)
TH-230	**0.0132**	(0.356)
TH-232	**0.00795**	(0.215)
U-234	**0.0112**	(0.302)
U-235	**0.000454**	(0.0123)
U-238	**0.0117**	(0.316)

SOIL SAMPLE 7

NUCLIDE	Bq/g	(pCi/g)
AM-241	**0.000202**	(0.00545)
PU-238	**0.000259**	(0.00699)
PU-239	**0.000621**	(0.0168)
TH-228	**0.0377**	(1.02)
TH-230	**0.0462**	(1.25)
TH-232	**0.0354**	(0.956)
U-234	**0.0257**	(0.694)
U-235	**0.00123**	(0.0332)
U-238	**0.0269**	(0.726)

APPENDIX D:

List of EEG Reports

LIST OF EEG REPORTS

EEG-1 Goad, Donna, A Compilation of Site Selection Criteria Considerations and Concerns Appearing in the Literature on the Deep Disposal of Radioactive Wastes, June 1979.

EEG-2 Review Comments on Geological Characterization Report, Waste Isolation Pilot Plant (WIPP) Site, Southeastern New Mexico SAND 78-1596, Volume I and II, December 1978.

EEG-3 Neill, Robert H., et al., (eds.) Radiological Health Review of the Draft Environmental Impact Statement (DOE/EIS-0026-D) Waste Isolation Pilot Plant, U.S. Department of Energy, August 1979.

EEG-4 Little, Marshall S., Review Comments on the Report of the Steering Committee on Waste Acceptance Criteria for the Waste Isolation Pilot Plant, February 1980.

EEG-5 Channell, James K., Calculated Radiation Doses From Deposition of Material Released in Hypothetical Transportation Accidents Involving WIPP-Related Radioactive Wastes, October 1980.

EEG-6 Geotechnical Considerations for Radiological Hazard Assessment of WIPP. A Report of a Meeting Held on January 17-18, 1980, April 1980.

EEG-7 Chaturvedi, Lokesh, WIPP Site and Vicinity Geological Field Trip. A Report of a Field Trip to the Proposed Waste Isolation Pilot Plant Project in Southeastern New Mexico, June 16 to 18, 1980, October 1980.

EEG-8 Wofsy, Carla, The Significance of Certain Rustler Aquifer Parameters for Predicting Long-Term Radiation Doses from WIPP, September 1980.

EEG-9 Spiegler, Peter, An Approach to Calculating Upper Bounds on Maximum Individual Doses From the Use of Contaminated Well Water Following a WIPP Repository Breach, September 1981.

EEG-10 Radiological Health Review of the Final Environmental Impact Statement (DOE/EIS-0026) Waste Isolation Pilot Plant, U. S. Department of Energy, January 1981.

EEG-11 Channell, James K., Calculated Radiation Doses From Radionuclides Brought to the Surface if Future Drilling Intercepts the WIPP Repository and Pressurized Brine, January 1982.

LIST OF EEG REPORTS (CONTINUED)

EEG-12 Little, Marshall S., Potential Release Scenario and Radiological Consequence Evaluation of Mineral Resources at WIPP, May 1982.

EEG-13 Spiegler, Peter, Analysis of the Potential Formation of a Breccia Chimney Beneath the WIPP Repository, May, 1982.

EEG-14 Not published.

EEG-15 Bard, Stephen T., Estimated Radiation Doses Resulting if an Exploratory Borehole Penetrates a Pressurized Brine Reservoir Assumed to Exist Below the WIPP Repository Horizon - A Single Hole Scenario, March 1982.

EEG-16 Radionuclide Release, Transport and Consequence Modeling for WIPP. A Report of a Workshop Held on September 16-17, 1981, February 1982.

EEG-17 Spiegler, Peter, Hydrologic Analyses of Two Brine Encounters in the Vicinity of the Waste Isolation Pilot Plant (WIPP) Site, December 1982.

EEG-18 Spiegler, Peter and Dave Updegraff, Origin of the Brines Near WIPP from the Drill Holes ERDA-6 and WIPP-12 Based on Stable Isotope Concentration of Hydrogen and Oxygen, March 1983.

EEG-19 Channell, James K., Review Comments on Environmental Analysis Cost Reduction Proposals (WIPP/DOE-136) July 1982, November 1982.

EEG-20 Baca, Thomas E., An Evaluation of the Non-Radiological Environmental Problems Relating to the WIPP, February 1983.

EEG-21 Faith, Stuart, et al., The Geochemistry of Two Pressurized Brines From the Castile Formation in the Vicinity of the Waste Isolation Pilot Plant (WIPP) Site, April 1983.

EEG-22 EEG Review Comments on the Geotechnical Reports Provided by DOE to EEG Under the Stipulated Agreement Through March 1, 1983, April 1983.

EEG-23 Neill, Robert H., et al., Evaluation of the Suitability of the WIPP Site, May 1983.

EEG-24 Neill, Robert H. and James K. Channell, Potential Problems From Shipment of High-Curie Content Contact-Handled Transuranic (CH-TRU) Waste to WIPP, August 1983.

LIST OF EEG REPORTS (CONTINUED)

EEG-25 Chaturvedi, Lokesh, Occurrence of Gases in the Salado Formation, March 1984.

EEG-26 Spiegler, Peter, Proposed Preoperational Environmental Monitoring Program for WIPP, November 1984.

EEG-27 Rehfeldt, Kenneth, Sensitivity Analysis of Solute Transport in Fractures and Determination of Anisotropy Within the Culebra Dolomite, September 1984.

EEG-28 Knowles, H. B., Radiation Shielding in the Hot Cell Facility at the Waste Isolation Pilot Plant: A Review, November 1984.

EEG-29 Little, Marshall S., Evaluation of the Safety Analysis Report for the Waste Isolation Pilot Plant Project, May 1985.

EEG-30 Dougherty, Frank, Tenera Corporation, Evaluation of the Waste Isolation Pilot Plant Classification of Systems, Structures and Components, July 1985.

EEG-31 Ramey, Dan, Chemistry of the Rustler Fluids, July 1985.

EEG-32 Chaturvedi, Lokesh and James K. Channell, The Rustler Formation as a Transport Medium for Contaminated Groundwater, December 1985.

EEG-33 Channell, James K., et al., Adequacy of TRUPACT-I Design for Transporting Contact-Handled Transuranic Wastes to WIPP, June 1986.

EEG-34 Chaturvedi, Lokesh, (ed.), The Rustler Formation at the WIPP Site, February 1987.

EEG-35 Chapman, Jenny B., Stable Isotopes in Southeastern New Mexico Groundwater: Implications for Dating Recharge in the WIPP Area, October 1986.

EEG-36 Lowenstein, Tim K., Post Burial Alteration of the Permian Rustler Formation Evaporites, WIPP Site, New Mexico, April 1987.

EEG-37 Rodgers, John C., Exhaust Stack Monitoring Issues at the Waste Isolation Pilot Plant, November 1987.

EEG-38 Rodgers, John C. and Jim W. Kenney, A Critical Assessment of Continuous Air Monitoring Systems at the Waste Isolation Pilot Plant, March 1988.

LIST OF EEG REPORTS (CONTINUED)

EEG-39 Chapman, Jenny B., Chemical and Radiochemical Characteristics of Groundwater in the Culebra Dolomite, Southeastern New Mexico, March 1988.

EEG-40 Review of the Final Safety Analyses Report (Draft), DOE Waste Isolation Pilot Plant, December 1988, May 1989.

EEG-41 Review of the Draft Supplement Environmental Impact Statement, DOE Waste Isolation Pilot Plant, July 1989.

EEG-42 Chaturvedi, Lokesh, Evaluation of the DOE Plans for Radioactive Experiments and Operational Demonstration at WIPP, September 1989.

EEG-43 Kenney, Jim W., et al., Preoperational Radiation Surveillance of the WIPP Project by EEG 1985-1988, January 1990.

EEG-44 Greenfield, Moses A., Probabilities of a Catastrophic Waste Hoist Accident at the Waste Isolation Pilot Plant, January 1990.

EEG-45 Silva, Matthew K., Preliminary Investigation into the Explosion Potential of Volatile Organic Compounds in WIPP CH-TRU Waste, June 1990.

EEG-46 Gallegos, Anthony F. and James K. Channell, Risk Analysis of the Transport of Contact Handled Transuranic (CH-TRU) Wastes to WIPP Along Selected Highway Routes in New Mexico Using RADTRAN IV, August 1990.

EEG-47 Kenney, Jim W. and Sally C. Ballard, Preoperational Radiation Surveillance of the WIPP Project by EEG During 1989, December 1990.

EEG-48 Silva, Matthew, An Assessment of the Flammability and Explosion Potential of Transuranic Waste, June 1991.

EEG-49 Kenney, Jim, Preoperational Radiation Surveillance of the WIPP Project by EEG During 1990, November 1991.

EEG-50 Silva, Matthew K. and James K. Channell, Implications of Oil and Gas Leases at the WIPP on Compliance with EPA TRU Waste Disposal Standards, June 1992.

EEG-51 Kenney, Jim W., Preoperational Radiation Surveillance of the WIPP Project by EEG During 1991, October 1992.

LIST OF EEG REPORTS (CONTINUED)

EEG-52 Bartlett, William T., An Evaluation of Air Effluent and Workplace Radioactivity Monitoring at the Waste Isolation Pilot Plant, February 1993.

EEG-53 Greenfield, Moses A. and Thomas J. Sargent, A Probabilistic Analysis of a Catastrophic Transuranic Waste Hoist Accident at the WIPP, June 1993.

EEG-54 Kenney, Jim W., Preoperational Radiation Surveillance of the WIPP Project by EEG During 1992, February 1994.

EEG-55 Silva, Matthew K., Implications of the Presence of Petroleum Resources on the Integrity of the WIPP, June 1994.

EEG-56 Silva, Matthew K. and Robert H. Neill, Unresolved Issues for the Disposal of Remote-Handled Transuranic Waste in the Waste isolation Pilot Plant, September 1994.

EEG-57 Lee, William W.-L, Lokesh Chaturvedi, Matthew K. Silva, Ruth Weiner, and Robert H. Neill, An Appraisal of the 1992 Preliminary Performance Assessment for the Waste Isolation Pilot Plant, September 1994.

EEG-58 Kenney, Jim W., Paula S. Downes, Donald H. Gray, Sally C. Ballard, Radionuclide Baseline in Soil Near Project Gnome and the Waste Isolation Pilot Plant, June 1995.