



## ENVIRONMENTAL EVALUATION GROUP

ENTERED

AN EQUAL OPPORTUNITY / AFFIRMATIVE ACTION EMPLOYER

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October 24, 2001

2001  
RECEIVED

Mr. Steve Zappe  
NMED Hazardous Waste Bureau  
2905 Rodeo Park Drive East  
Building 1  
Santa Fe, NM 87505-6303

Dear Steve:

Enclosed are copies of the handouts from the Quarterly Meeting held here in Albuquerque on October 23, 2001.

Sincerely,

*Matthew Silva*  
*js*

Matthew K. Silva  
Director

MKS:js

Enclosures

011018.5  


**76th WIPP Quarterly Review**  
**Hosted by**  
**Environmental Evaluation Group (EEG)**  
**Tuesday October 23, 2001**  
**7007 Wyoming, NE, Suite F-2**  
**Albuquerque, New Mexico 87109**  
**<http://www.eeg.org>**

**Agenda**

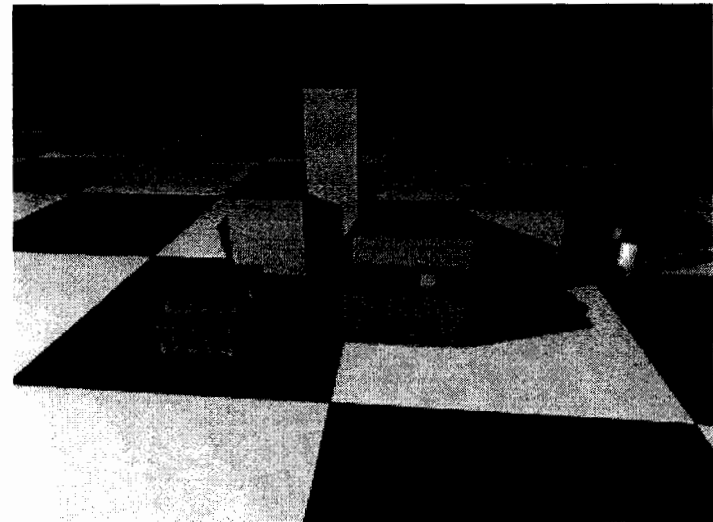
8:30 AM	Introductions, changes to agenda, Housekeeping Issues	(10 min.)	George Anastas
8:40	DOE update	(25 min.)	Inés Triay or Chuan Wu
9:05	EEG update (include Legislative Committee)	(25 min.)	Matthew Silva
9:30	NMED update (include reflections on Mod 3 comments)	(25 min.)	Steve Zappe
9:55	Break	(15 min.)	
10:10	Governor's Task Force update	(25 min.)	Anne Clark
10:35	Status of RH TRU program - addressing NAS and ASME/RSI reviews of the proposed RH TRU program and WIPP RH facility readiness	(25 min.)	Clayton Gist
11:00	TRU waste dosimetry  RH dosimetry at Battelle Columbus, LANL and ORNL  CH TRU dose rate and personnel exposure	(40 min.)	Chuan Wu and Casey Gadbury

**EEG QUARTERLY**  
**October 23, 2001**

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Lindsay Lovejoy	NM Atty. Gen. Office	505- 827-6695	<b>llovejoy@ago.state.nm.us</b>
Steve Zappe	NMED/ <i>by telephone from LANL</i>		

# **WIPP – What We Have Done & Where We Are Going?**

Chuan Wu  
Senior Technical Advisor /  
Senior Technical Safety Manager  
Carlsbad Field Office



***76<sup>th</sup> Quarterly Meeting***

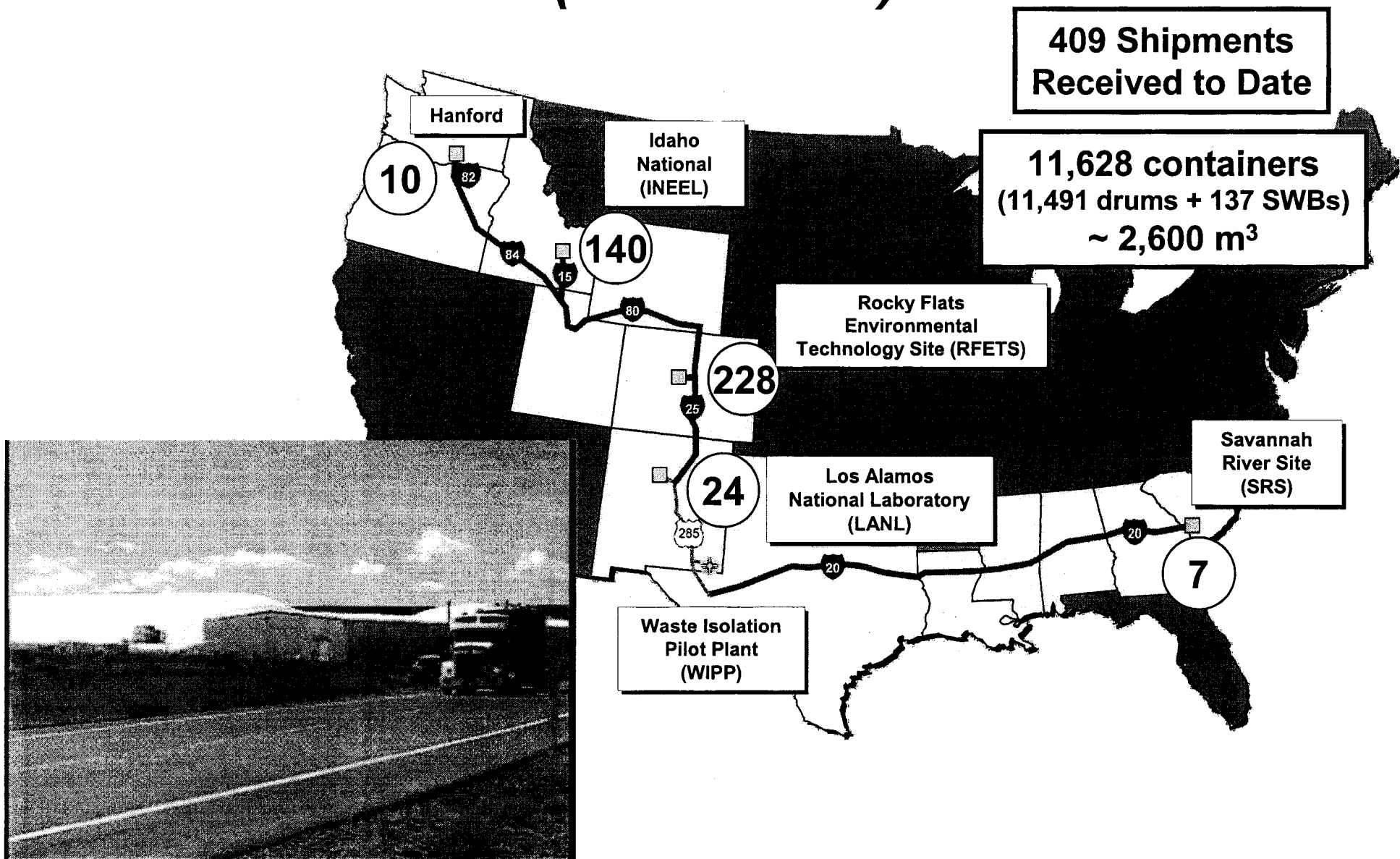
***October 23, 2001***

***Albuquerque, NM***



# CH TRU Waste Disposal Status

(10/23/2001)



# **WIPP Operational Activities**

- **First disposal room (Room 7, Panel 1) filled to capacity (2,000 m<sup>3</sup>) and sealed from repository air flow – 8/24/01**
- **TRU shipment suspensions due to security reasons**
  - 9/11 (~2 weeks)
  - 10/7 (~1 week)
- **Near-term TRU shipment schedule**
  - Resumed 10/15/01
  - Weekly approval from DOE/HQ
  - Week of 10/15/01: 5 shipments (RFETS)
  - Week of 10/22/01: 12 shipments (7 from RFETS, 4 from INEEL, 1 from SRS) planned
- **36 TRUPACT-IIs available, increasing by 2 per month**

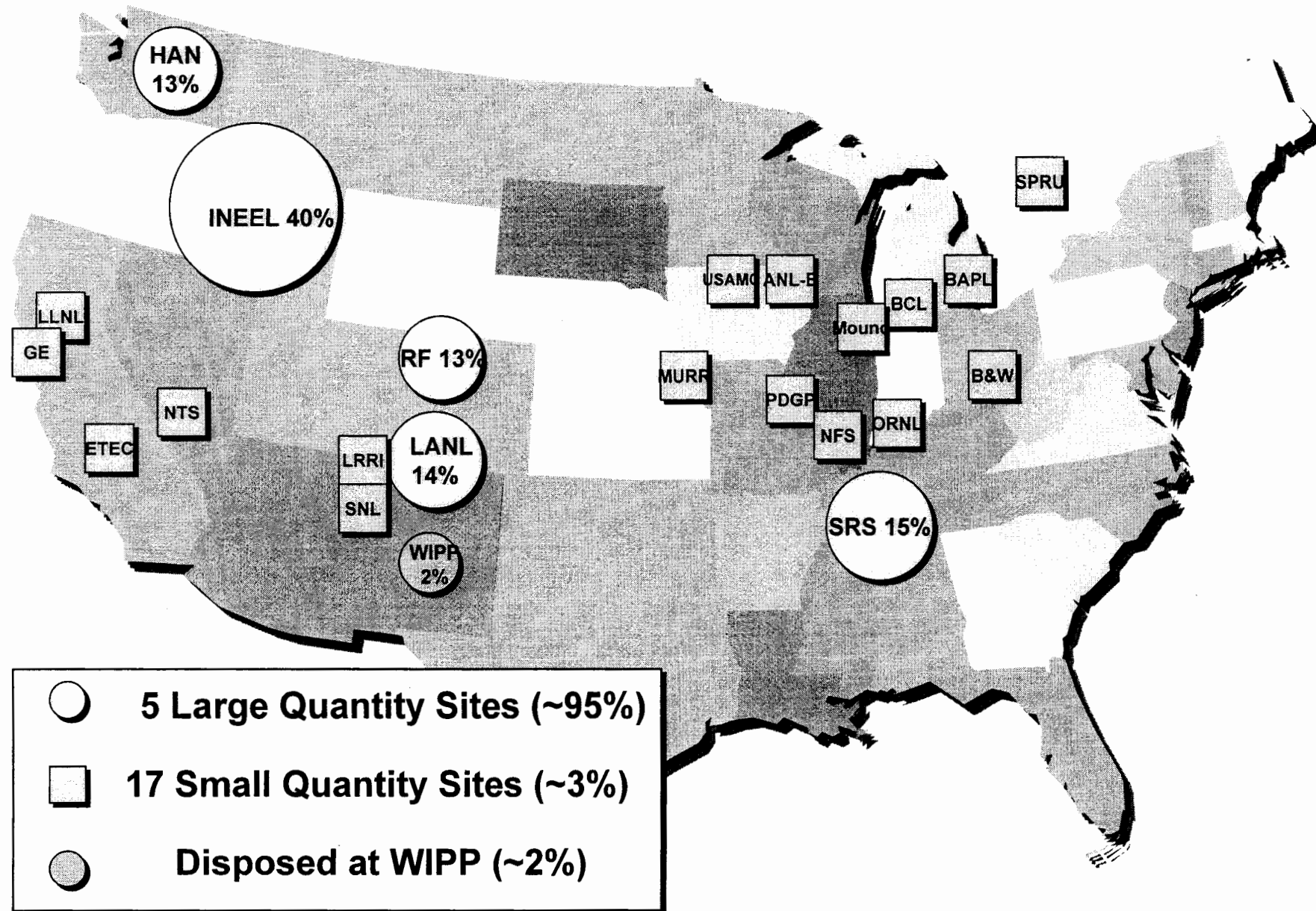
# **Safety Excellence of WIPP Operations**

- **Negligible radiation dose to workers**
  - **Radiation worker annual dose limit: 5 rem/y**
  - **Maximum dose to WIPP worker since 1999: 0.039 rem/y**  
**(Note: average dose from natural background radiation: 0.300 rem/y)**
- **Safety achievements**
  - **Initial implementation of Integrated Safety Management System (ISMS) completed in July 2000; annual verification completed in September 2001**
  - **Over 2 million worker-hours without lost workday accidents**
  - **2001 SUPERIOR STAR Award from the Volunteer Protection Program (VPP) Participants Association:**
    - **VPP STAR Status**
    - **Facility Recordable Injury Rate < 50% industry average**
  - **2001 New Mexico Mine Operator Award**

# **Optimizing TRU Waste Management**

***Safety, Efficiency and  
Cost-effectiveness***

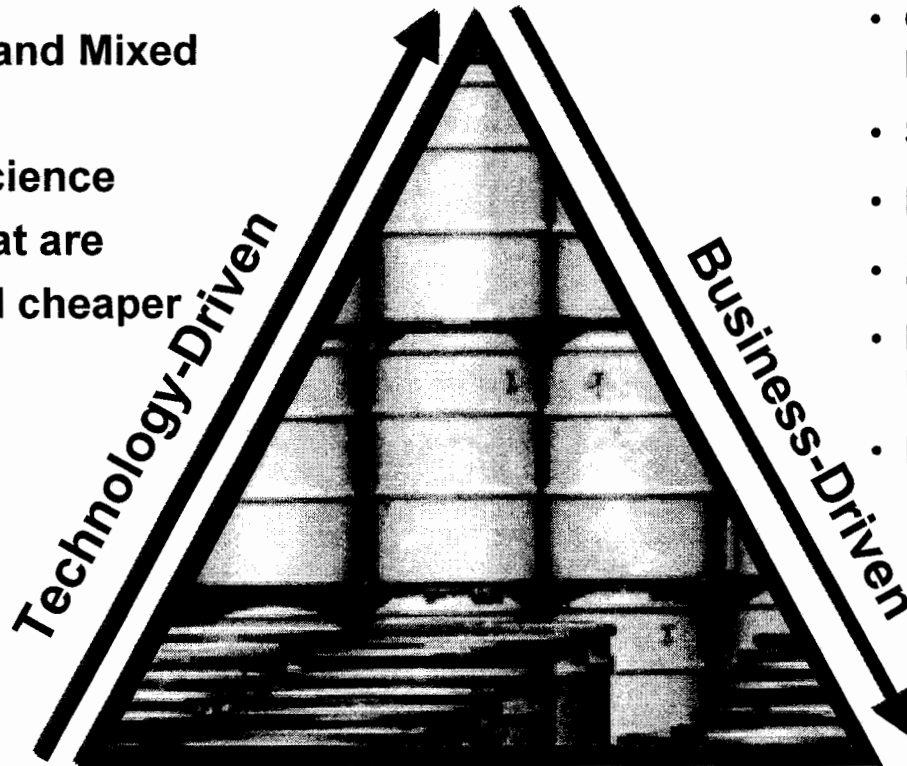
# TRU Waste Locations and Quantities



*Total TRU waste volume authorized for disposal at WIPP: 175,000 m<sup>3</sup>*

### Technology-Driven

- Co-Managed TRU and Mixed Waste Focus Area
  - Best available science
  - Technologies that are better, faster and cheaper



### Best Business Practices

- Corporate Board – Partnership with TRU Sites
- Standardization
- Economy of Scale
- Mobile/Modular Systems
- National Authorization Basis
- Data Automation

### Regulatory Compliance

- Safety and legal-based requirements

**Applying best business practices, new technology, and a performance driven regulatory approach . . .**

## Cycle time--from start of generator site characterization to shipment to WIPP



Now: could be as long as 212 days for debris  
(on average 90 days)



Optimized: < 20 days  
(potentially as short as 5 days)



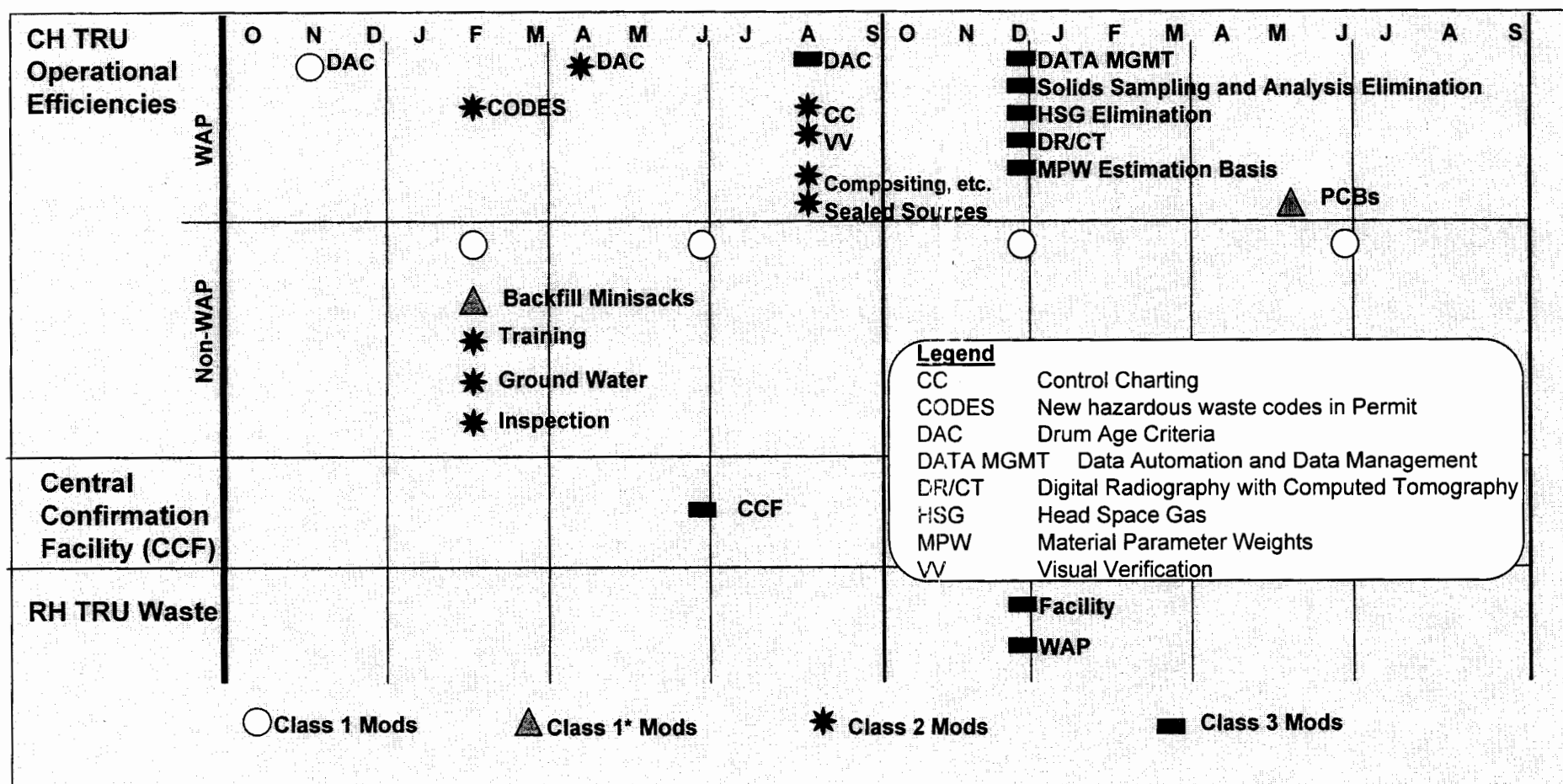
Optimizing  
Waste  
Characterization



# RCRA Permit Modification Roadline

FY 2001

FY 2002







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# LXXVI Quarterly Meeting

**U.S. Department of Energy**  
**N.M. Energy, Minerals, and Natural Resources**  
**N.M. Environment Department**  
**N.M. Attorney General**

**Environmental Evaluation Group**

**October 23, 2001**  
**Albuquerque**

## **TECHNICAL COMMUNICATIONS**

- Aug. 1      Presented to ASME/RSI Panel on  
RH-TRU**
- Sept. 24    Presented Radiological Laboratory  
and Environmental Monitoring  
Capabilities at workshop**
- Sept. 27    70 page submittal of Class 3 Mod for  
Central Waste Characterization  
Facility**
- Oct. 4      Presented and participated in NAS  
WIPP Committee on RH-TRU waste  
characterization**
- Oct. 5      Requested DOE Analyses of Increased  
Separation of Rock Adjacent to Waste  
Handling Shaft**

# **EEG Review of the Class 3 Permit Modification Proposal for the Central Confirmation Facility**

## **PRIMARY CONCERNS**

- 1. Changing WAP to conform to modification rather than the reverse**
- 2. Re-definition of the terms “characterization” and “confirmation”**
- 3. Proposed characterization process does not ensure that shipping requirements are met**
- 4. Keep central confirmation facility requirements separate so that there will be no changes to the current waste characterization process at the sites**

## **ADDITIONAL CONCERNS:**

- 1. Modification applies only to debris waste?**
- 2. No procedures to ensure fully characterized waste not comingled with waste to be confirmed at WIPP**

# **MODIFICATIONS TO PANEL CLOSURE**

## **EEG Accepts Five:**

- 1. Replacement of Salado Mass Concrete with a generic salt-based concrete;**
- 2. Replacement of the explosion wall with a construction wall;**
- 3. Replacement of freshwater grouting with salt-based grouting;**
- 4. Option to allow surface or underground mixing; and**
- 5. Option to allow up to one-year for completion of closure.**

- 6. EEG conditionally accepts carbonate aggregate pending further testing**
- 7. EEG rejects contractor discretion to remove steel forms**
  - concerns about flow pathways**

## **Audits**

- |                 |  |
|-----------------|--|
| <b>8/20-21</b>  | <b>CBFO audit of EPD facilities<br/>Carlsbad, NM</b>                       |
| <b>10/15-19</b> | <b>Observation of Program Evaluation<br/>of CCP-SRS<br/>Savannah River</b> |
| <b>10/22-25</b> | <b>LANL Recertification<br/>Underway at this time</b>                      |

# **ENVIRONMENTAL MONITORING**

## **2000 Data on EEG WEB Page**

**[www.eeg.org](http://www.eeg.org)**

**Data are not significantly different from preoperational baseline data**

**EEG expanding laboratory space by 30%**

**New instrumentation has been purchased to allow analysis of  $^{241}\text{Pu}$**



## WIPP Quarterly Review October ~~24~~<sup>23</sup>, 2001

### Activities Update for NMED's RCRA Permits Program

#### 1. Ongoing Permitting Process

- Class 1 Completeness Determination
  - NMED issued determination on August 31, 2001
  - Covered all Class 1 modifications from March 29, 2000 through March 6, 2001, except for July 21, 2000 Data Management and Reporting
  - Identified those modifications that were withdrawn, rejected, or accepted with changes
  - Expressed concern over adequacy of Class 1 notifications to public
  - NMED also issued a revised version of the WIPP Permit on August 31, 2001
- NMED received no Class 1 permit modification notifications from DOE/MTS in the past three months
- Drum Age Criteria (DAC)/ Ten Drum Overpack (TDOP) Storage Volume Class 2 modification request
  - NMED issued final determination for these Class 2 modifications on August 30, 2001
  - NMED denied the TDOP mod after first rejecting the underlying modification originally submitted and implemented as a Class 1 modification
  - NMED reclassified the DAC mod as a Class 3 and intends to issue draft permit for public comment (target was within 30 to 60 days, will now be longer)
- Centralized Waste Confirmation Facility Class 3 modification request
  - Public comment period was extended until September 27, 2001
  - Received approximately 550 pages of comments
  - Reflects input from 477 commentators, including several "form" responses
  - NMED is evaluating the comments, developing a path forward (multiple of 1000 comments)
- "Three Item" Class 2 modification request
  - Submitted by Permittees on August 29, 2001
  - Elected to follow Class 2 process for five previously submitted Class 1 modifications (headspace gas compositing, VE safety conditions, sampling through filter vent holes)
  - Permittees also requested Temporary Authorization (TA) for these activities
  - On September 24, 2001, NMED issued a letter that:
    - rejected the underlying Class 1 modifications and established a "Schedule for Completion" to bring Permittees back into compliance

- denied the TA request, required submittal of revised modification request overview, and required re-notice of modification explicitly as a Class 2
    - provided technical comments on headspace gas compositing modification
  - Permittees responded on September 28, 2001 with revised modification request provided as comment for the record
  - Public meetings held in Carlsbad (October 9) and Santa Fe (October 11)
  - Public comment period ends November 2, 2001
  - WIPP Facility Work Plan, RCRA Facility Work Plan/Sampling and Analysis Plan
    - NMED received DOE request to approve approval for proposed investigation of SWMUs August 10, 2001 (*Solid Waste Management Units*)
    - NMED provided conditional approval on August 17, 2001
    - NMED staff observed field sampling activities August 20 - 22, 2001 *and collected split samples*
  - Groundwater Detection Monitoring Program
    - NMED received response to comments on groundwater monitoring report for June through December 2000 from the Permittees on August 31, 2001. *NMED req comments on DOE responses of 8/31/01*
2. RCRA-related Audits
- RFETS Recertification and Homogeneous Followup, January 29 - February 1, 2001
    - Received final audit report September 10, 2001
    - Rejected by NMED October 11, 2001 for noncompliance with WAP (composite sampling and sampling through filter vent holes)
  - LANL Packaging, May 14 - 18, 2001
    - Awaiting final audit report
  - Hanford Recertification, June 11 - 15, 2001
    - Received final audit report July 16, 2001
    - Rejected by NMED October 11, 2001 for noncompliance with WAP (sampling through filter vent holes)
  - INEEL Recertification, July 30 - August 3, 2001
    - Awaiting final audit report
  - Central Characterization Project (CCP) Audit at SRS, October 15 - 19, 2001
    - Observed entire CCP operation at the SRS facility, rather than in two different locations as occurred during the surveillance
    - NMED expressed concerns over the interaction between CCP and the approved SRS characterization program, especially if both are characterizing the same waste stream
    - Also expressed concern about availability for SC regulators of CCP characterization records held in Carlsbad

- LANL Recertification, October 22 - 26, 2001
  - Happening right now
- Other tentatively scheduled audits
  - RFETS New Equipment and Processes, November 26 - 30, 2001
  - SRS Recertification, December 10 - 14, 2001
  - CCP @ ANL-E, TRD (January 2002?)
  - RFETS Recertification, February 4 - 8 2002

### 3. Compliance issues

- Inspection of Container Storage Units
  - Conducted by NMED staff on August 8, 2001
  - Evaluated potential for exceeding current storage limitations during the suspension of emplacement activities associated with EPA's evaluation of WAGS radioassay equipment
  - No violations noted, but final letter of compliance from our Compliance and Technical Assistance program not yet issued pending Permittees' response to their October 3, 2001 letter
- Overpack Container in WWIS
  - NMED notified Permittees on September 18, 2001 of concerns surrounding WWIS records of 85-gallon overpack emplaced at WIPP
  - NMED requested original container number, source, associated waste stream profile form, disposal location, explanation for lack of info in WWIS
  - NMED received Permittees' response on September 21, 2001, stating container had not met WIPP acceptance criteria for containers
  - Response also identified corrective action taken to resolve flaw in WWIS logic
- Notice of Violation, September 24, 2001
  - Cited Permittees for submitting and putting into effect permit modifications that failed to meet the requirements for Class 1 modifications, and for failing to manage, store and dispose of waste as required under the Permit
  - Required the Permittees to comply with the "Schedule for Completion" in NMED's other letter of September 24, 2001

### 4. Other activities

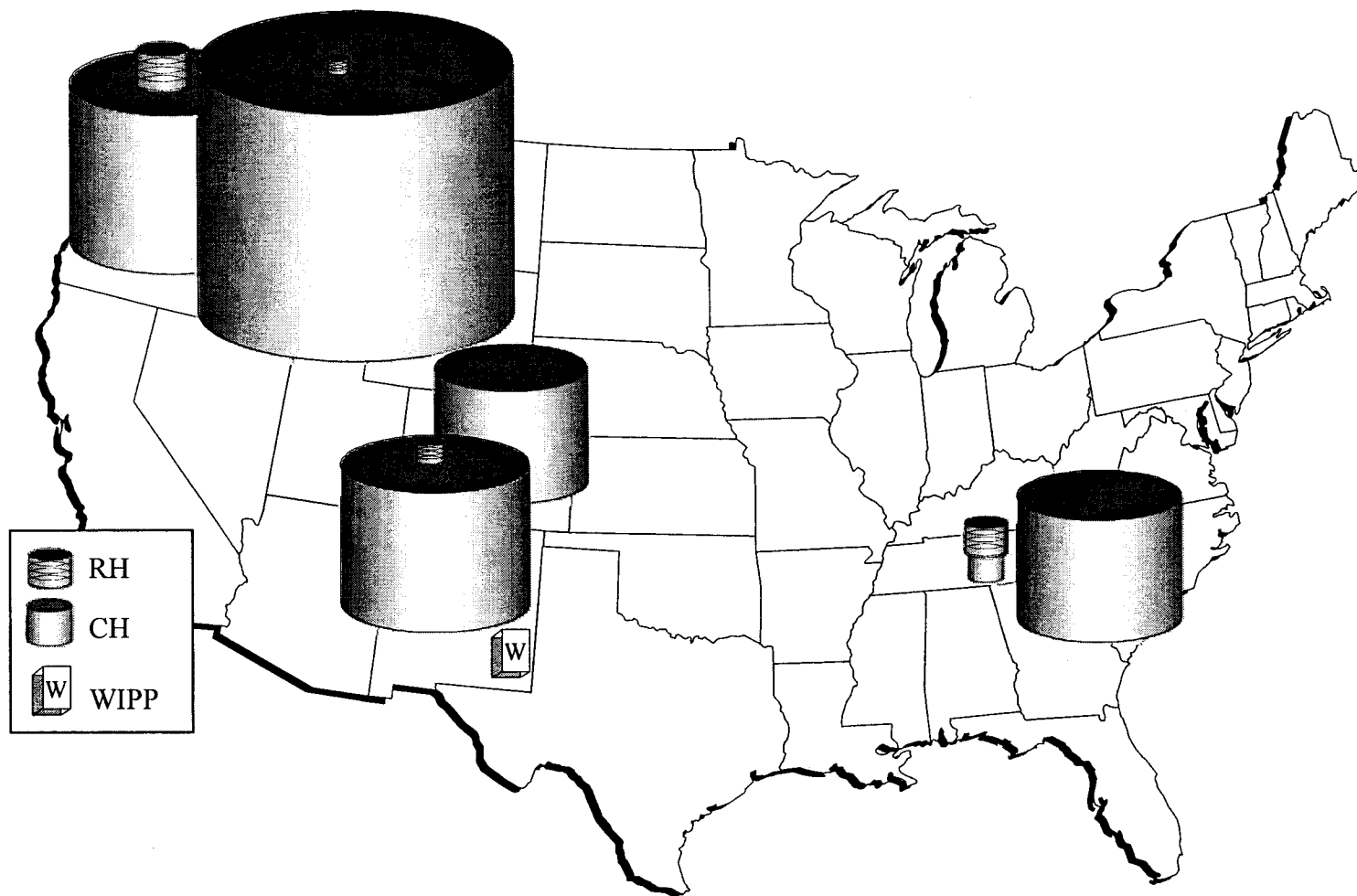
- New NMED WIPP employee - Phillis Stevens started September 15, 2001
- Engaging in ongoing pre-submittal discussions with Permittees regarding a proposed "operational efficiencies" permit modification
- Steve Zappe presented NMED's position on RH waste prohibition in the permit to the NAS Committee on Characterization of RH TRU Waste in Albuquerque October 4, 2001

# **The WIPP Remote Handled Transuranic Waste Program**

## **Where We Are and Where We Are Going**

**Dr. Clayton Gist, Manager  
RH-TRU Waste Program  
Carlsbad Field Office**

# RH-TRU Inventory *(cont.)*



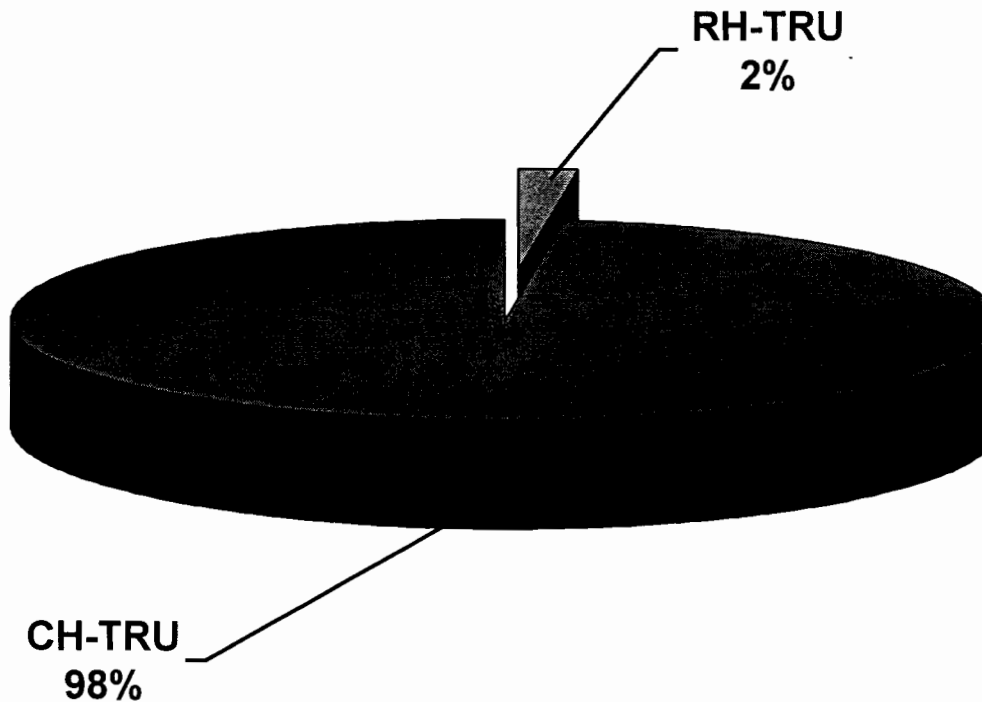
# RH-TRU Inventory (cont.)

## Updated RH-TRU Inventory Summary Stored, Projected, and Anticipated Disposal Volumes 10/12/01

SITE NAME	RH-TRU Waste Volume (m <sup>3</sup> )			
	Stored	Projected	Total	Planned Disposal
Hanford Reservation	207.0	938.0	1,145.0	1,048.0
Idaho National Engineering and Environmental Laboratory	84.0	101.3	185.3	275.2
Los Alamos National Laboratory	99.5	24.0	123.5	120.0
Oak Ridge National Laboratory	1,306.0	288.6	1,594.6	453.4
<b>Total</b>	<b>1,696.5</b>	<b>1,351.9</b>	<b>3,048.4</b>	<b>1,896.6</b>
<b>Small-Quantity Sites</b>				
Argonne National Laboratory - East	2.0	8.0	10.0	10.0
Argonne National Laboratory - West	1.1	5.0	6.1	6.1
Battelle Columbus Laboratories	0.0	20.8	20.8	20.8
Bettis Atomic Power Laboratory	3.0	0.0	3.0	3.0
Energy Technology Engineering Center	8.7	0.0	8.7	5.5
General Electric-Vallecitos Nuclear Center	11.8	0.0	11.8	11.8
Knolls Atomic Power Laboratory	3.7	6.8	10.5	10.5
Sandia National Laboratories	1.5	24.0	25.5	
West Valley Demonstration Project	470.5	8.4	478.9	
<b>Total Waste Volumes</b>	<b>2,197.3</b>	<b>1,400.9</b>	<b>3,598.2</b>	<b>1,964.3</b>

# RH-TRU Inventory *(cont.)*

Comparison of Revised RH-TRU Volume Estimates  
(10/12/01)



# RH-TRU Inventory (cont.)

**Updated RH-TRU Inventory Summary Activity Estimates**  
**Most of the RH Activity is in Oak Ridge**  
**10/12/01**

Site Name	Estimated Stored Activity (Ci)
Hanford Reservation	36,000
Idaho National Engineering and Environmental Laboratory	6,360
Los Alamos National Laboratory	10,700
Oak Ridge National Laboratory	587,000
Total	
Small-Quantity Sites	
Argonne National Laboratory - East	NR
Argonne National Laboratory - West	NR
Battelle Columbus Laboratories	5,800
Bettis Atomic Power Laboratory	16,300
Energy Technology Engineering Center	8
General Electric-Vallecitos Nuclear Center	NR
Knolls Atomic Power Laboratory	118
Sandia National Laboratories	
West Valley Demonstration Project	
Total Waste Activity	662,286



# RH-TRU Inventory (cont.)

Site Name	Major Reported Radionuclides
Hanford Reservation	Co-60, Ba-137m, Cs-137, Sr-90, Y-90, Am-241, Am-243, Np-237, Pu-238, Pu-239, Pu-240, Pu-241, Pu-242
Idaho National Engineering and Environmental Laboratory	Co-60, Tc-99, Ba-137m, Cs-137, Sr-90, Y-90, Am-241, Pu-238, U-235
Los Alamos National Laboratory	Ba-137m, Cs-137, Sr-90, Y-90, Am-241, Pu-238, Pu-239
Oak Ridge National Laboratory	Co-60, Ba-137m, Cs-137, Sr-90, Y-90, Eu-152, Eu-154, Am-241, Pu-238, Pu-239, Pu-241, Cm-244
<b>Small-Quantity Sites</b>	
Argonne National Laboratory - East	Ba-137m, Cs-137, Co-60, Sr-90, Y-90, Pu-241
Argonne National Laboratory - West	Co-60, Cs-137, Ba-137m, Sr-90, Y-90, Am-241, Pu-239, U-235, U-238
Battelle Columbus Laboratories	Ba-137m, Cs-137, Sr-90, Y-90, Am-241, Pu-239, Pu-240, Pu-241
Bettis Atomic Power Laboratory	Ba-137m, Cs-137, Co-60, Sr-90, Y-90, Pu-241
Energy Technology Engineering Center	Ba-137m, Cs-137, Co-60, Sr-90, Y-90, Pu-241
General Electric-Vallecitos Nuclear Center	Ba-137m, Cs-137, Co-60, Sr-90, Y-90, Pu-241
Knolls Atomic Power Laboratory	Ba-137m, Cs-137, Sr-90, Y-90
Sandia National Laboratories	Am-241
West Valley Demonstration Project	Ba-137m, Cs-137, Sr-90, Y-90

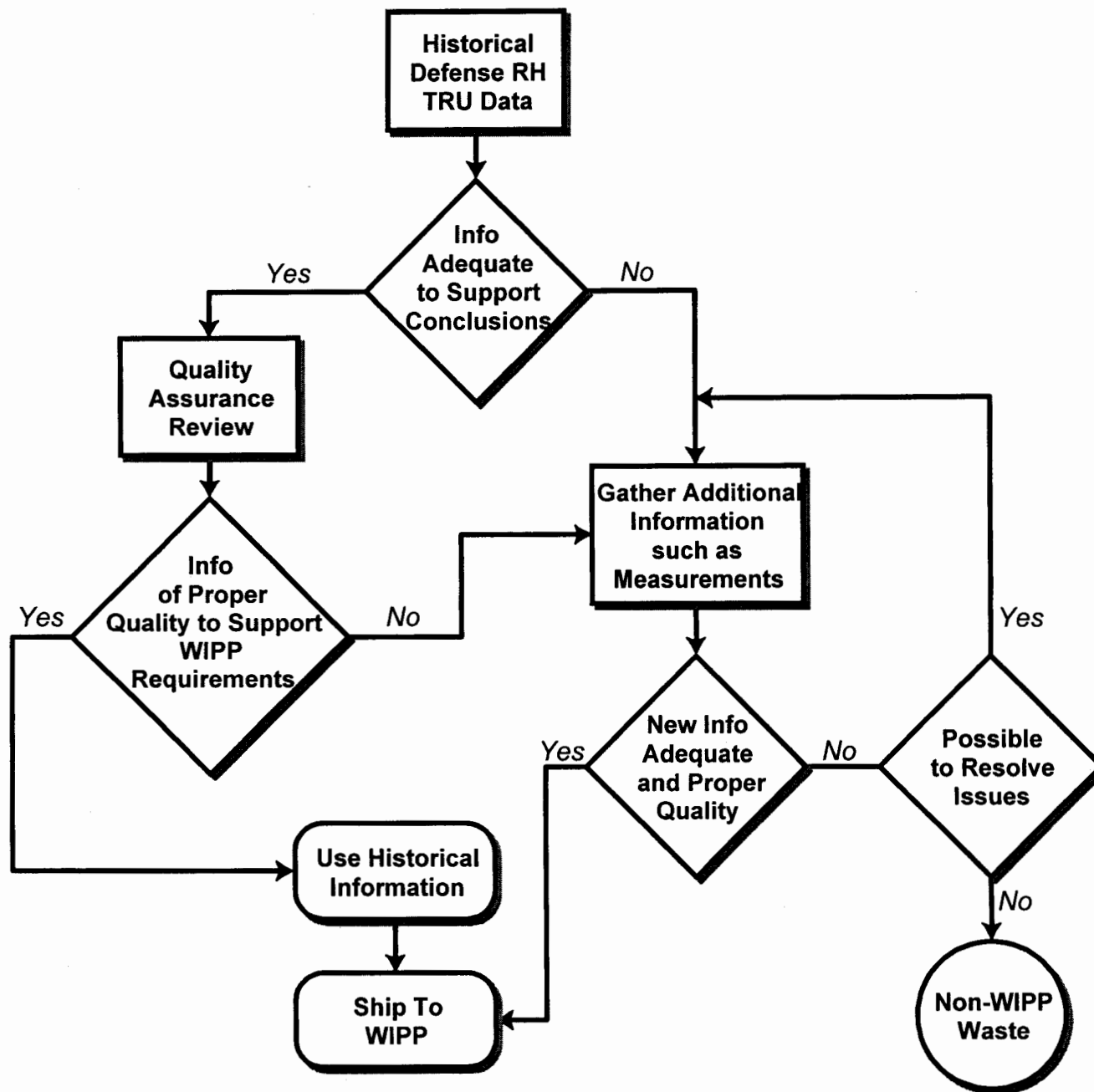
# RH-TRU Inventory (cont.)

10/12/01

	SURFACE DOSE RATE ESTIMATES			
	0.2 to 1.0 rem/h	1 to 10 rem/h	10 to 100 rem/h	100 to 1000 rem/h
SITE	Packaged%	Packaged%	Packaged%	Packaged%
HAN	5	40	50	5
INEEL	75	12	13	
INTEC		32	63	5
LANL		80	20	
ORNL	10	40	40	10
ANLE	50	50		
ANLW		80	20	
BCL	22	28	44	6
BAPL		80	20	
ETEC	100			
GE		80	20	
KAPL		80	20	
Estimated Volume Weighted Dose Rate Average for Package	18	39	39.5	3.5

# **Steps Toward Acceptable Knowledge Standardization**

- **Understanding acceptable knowledge as a process and not a database**
  - **Understanding the regulatory role of the acceptable knowledge process**
  - **Delineating specific acceptable knowledge information needs for RH-TRU decision making**
    - **What information**
    - **How much information**
    - **Quality of the information**
-



# **Data Quality Objectives (DQOs)**

**DQOs are qualitative and quantitative statements that clarify program technical and quality objectives, define appropriate types of data, and specify tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions**

# **Information Needed for WIPP**

- **RCRA-related DQO**
    - Prohibited items
    - Physical form
    - Hazardous waste number
  
  - **40 CFR 191/194-related DQO**
    - Cellulosics, plastic, rubber
    - Liquids
    - Surface dose rate
    - TRU activity
    - Total activity
-

# **Sources of Acceptable Knowledge Information**

- **Acceptable knowledge information used by others for decisions**
  - Generators
  - Intermediate facilities
  - Transporters
- **New information**
  - Gather additional acceptable knowledge information
  - Collect new information (testing)

# **Determining Acceptable Knowledge Information Adequacy for Decision Making**

- **Satisfying each DQO**
    - **What specific information must be collected**
    - **How much information is sufficient**
-



# **CH-TRU AK Information Accuracy**

- **How good is acceptable knowledge information?**
  - **The WIPP CH-TRU permit requires generator sites to prepare an Acceptable Knowledge Information Accuracy Report (Attachment B4-3e)**
  - **Two measures are specified:**
    - **Percentage of waste containers that require reassignment to a new Waste Matrix Code**
    - **Percentage of waste containers that require designation of different hazardous waste numbers**

# **CH-TRU AK Information**

## **Accuracy *(cont.)***

- **Acceptable knowledge information accuracy is determined as the result of Acceptable Knowledge Information Confirmation (Attachment B4-3d)**
- **Generators are to use radiography or visual examination, headspace gas sampling and analysis, and/or solids sampling and analysis to confirm acceptable knowledge information accuracy**

# **CH-TRU AK Information**

## **Accuracy *(cont.)***

- **Effectiveness of the CH-TRU acceptable knowledge process is demonstrated by the Acceptable Knowledge Information Accuracy Reports from the various generator/storage sites**

# CH-TRU AK Information

## Accuracy *(cont.)*

Waste Matrix Code				Hazardous Waste Number		
Site	New WMC	Total	Accuracy	New HWN	Total	Accuracy
RFETS	7	4,683	99.85%	142	4,226	96.6%
INEEL	113	21,359	99.47%	Note 1	3,492	80%
SRS	28	592	95%	0	592	100%
LANL	7	849	99%	17	253	93%
Hanford	0	300	100%	0	300	100%

*Note 1 INEEL did not assign new codes on a container basis*

# **PROPOSED RH-AK Information Accuracy**

- **10% of the waste is “confirmed”**
  - Radiography
  - Visual examination
- **Parameters compared**
  - Physical form
  - Prohibited items
  - Waste Matrix Code  
(including indicators of hazardous waste)
- **25% action level**

# **Surveillance Procedures**

- **Performed in accordance with Carlsbad Field Office (CBFO) Management Procedure MP-10.2, *Surveillances***
- **This procedure implements the requirements of the CBFO Quality Assurance Program Document (QAPD)**

# **Technical Elements Assessed**

- **Acceptable knowledge**
- **Radiological characterization**
- **Visual examination (VE)**

# **BCLDP Surveillance Overall Conclusions**

- **The surveillance team concluded that BCLDP can quantify the five waste attributes of interest using AK, in concert with visual examination during packaging and dose rate measurements**



# **Path Forward**

## **As Of 10/12/01**

- **Submit RCRA Permit Mod to NMED** **12/01**
- **Submit 40CFR194.4 Change  
Notification to EPA** **12/01**
- **Post-submittal meeting with NMED** **01/02**
- **Post-submittal Meeting with EPA** **01/02**
- **Public Meeting on Submittals** **01/02**

# **Path Forward (Con't)**

- **NMED Public Hearings** **06/02**
- **EPA Approval** **01/03**
- **NMED Approval** **01/03**
- **ORR Completion** **05/03**
- **Begin RH Shipment** **06/03**

# TRU Waste Dosimetry

*Chuan Wu, Ph.D., CHP*

*Casey Gadbury, NRRPT*

*DOE Carlsbad Field Office*

76<sup>th</sup> Quarterly EEG Meeting

Albuquerque, NM

October 23, 2001



# PRESENTATION OUTLINE

- TRU Waste Dosimetry Requirements
- TRU Waste Characterization
- TRU Waste Transportation – Common Perspectives
- WIPP Dosimetry Data – 1999 to 2001 CH TRU Operations
- WIPP Site RH TRU Dose Estimates



# TRU WASTE DOSIMETRY REQUIREMENTS

- 10 CFR 835, *Occupational Radiation Protection*
  - All radiological activities must maintain radiation dose levels ALARA
  - Occupational dose limit --- 5 rem/y
    - DOE administrative dose limit --- 2 rem/y
    - facility/site admin. dose limit --- 1 rem/y at WIPP
- TRU Waste Container Surface Dose Rates
  - CH TRU --- < 200 mrem/h
  - RH TRU --- Between 200 mrem/h and 1,000 rem/h
- Transportation Requirements per 10 CFR 71
  - Applicable to CH and RH TRU shipments in DOT Type B transportation casks
    - cask surface --- < 200 mrem/h
    - 2 m (6.6 ft) from cask surface --- < 10 mrem/h
    - any occupied location --- < 2 mrem/h



# CH TRU CHARACTERIZATION

- Worker Doses Depend on
  - Number of drums characterized
  - Types of sampling and measurement conducted
  - Number of workers conducting characterization
  - Worker experience/training, facility, equipment, and shielding.
- Worker Dose from CH TRU Characterization --- 15 – 60 mrem/drum
  - Average drum surface dose rate --- 5 – 10 mrem/h (2.5 – 5% of limit)
  - Characterization time --- 15 – 30 h/drum
  - Dose reduction factor of 5 to account for distance between worker and drum surface
  - Workers are not conducting TRU waste characterization full time, dose measurement does not distinguish exposures from various activities
  - Assuming a worker spends 1,000 h performing CH TRU charac., he/she would receive 1 – 2 rem/y



# RH TRU WASTE CHARACTERIZATION

- Estimated Average RH Drum Surface Dose Rate at Individual Sites --- 3.1 – 79 rem/h (volume-weighted mean 47 rem/h)
- Remote Handling Significantly Reduces Worker Doses
- Required Facilities & Instruments for RH Sampling and Measurement are Costly
- Operational Data on Doses from RH TRU Characterization (Sampling & Measurement) are Limited and Will Depend on Final RH WAP - BCL, ORNL, LANL, etc.



# TRU TRANSPORTATION – CH & RH COMMON PERSPECTIVES

- Actual Dose Rates are Much Less than Regulatory Limits (200 mrem/h on cask surface, 10 mrem/h at 2 m, 2 mrem/h at driver location)
- Doses to Truck Drivers Depend on Dose Rates and Transportation Duration
- CH TRU Truck Driver Dose ---  $< 0.001$  person-rem/shipment



# WIPP CH TRU WASTE DOSE RATES

- **TRUPACT and Payload Dose Rate Information (WWIS)**

- **Container surface dose rates**

- photons (gamma & X-ray, major component) and beta (negligible)
    - neutron (minor component, < 10%)

- **Shipment dose rates**

- total dose rates on transportation cask surface
    - total dose rates at 1 m and 2 m from cask surface

- **Payload Dose Rate Information (RCT Surveys)**

- **Payload dose rates at 30 cm**

- photons (gamma & X-ray, major component) and beta (negligible)
    - neutron (minor component, < 10%)



# DOSES FROM WIPP CH TRU WASTE

- **Worker Dose Information**

- Personnel (including truck drivers) dose recorded at the WIPP facility by a DOE LAP-accredited Harshaw TLD system capable of measuring beta, gamma, X-ray and neutron doses
- LLD per readout : 10 mrem deep dose, 35 mrem shallow dose



## WIPP CH TRU Shipments and Average Dose Rates, 3/1999 – 6/2001

	1999	2000	2001
# TRUPACT-IIs / # Shipments Received	105 / 44	224 / 84	365 / 155
TRUPACT Surface Dose Rate, (Average & Highest)	0.34 mrem/h (highest 2 mrem/h)	0.19 mrem/h (highest 1 mrem/h)	0.22 mrem/h (highest 1 mrem/h)
Container Surface Dose Rate (Average & Highest)	0.95 mrem/h (highest 4 mrem/h)	1.63 mrem/h (highest 46 mrem/h)	2.95 mrem/h (highest 151 mrem/h)



# WIPP CH TRU Operational Dose, 3/1999 – 6/2001

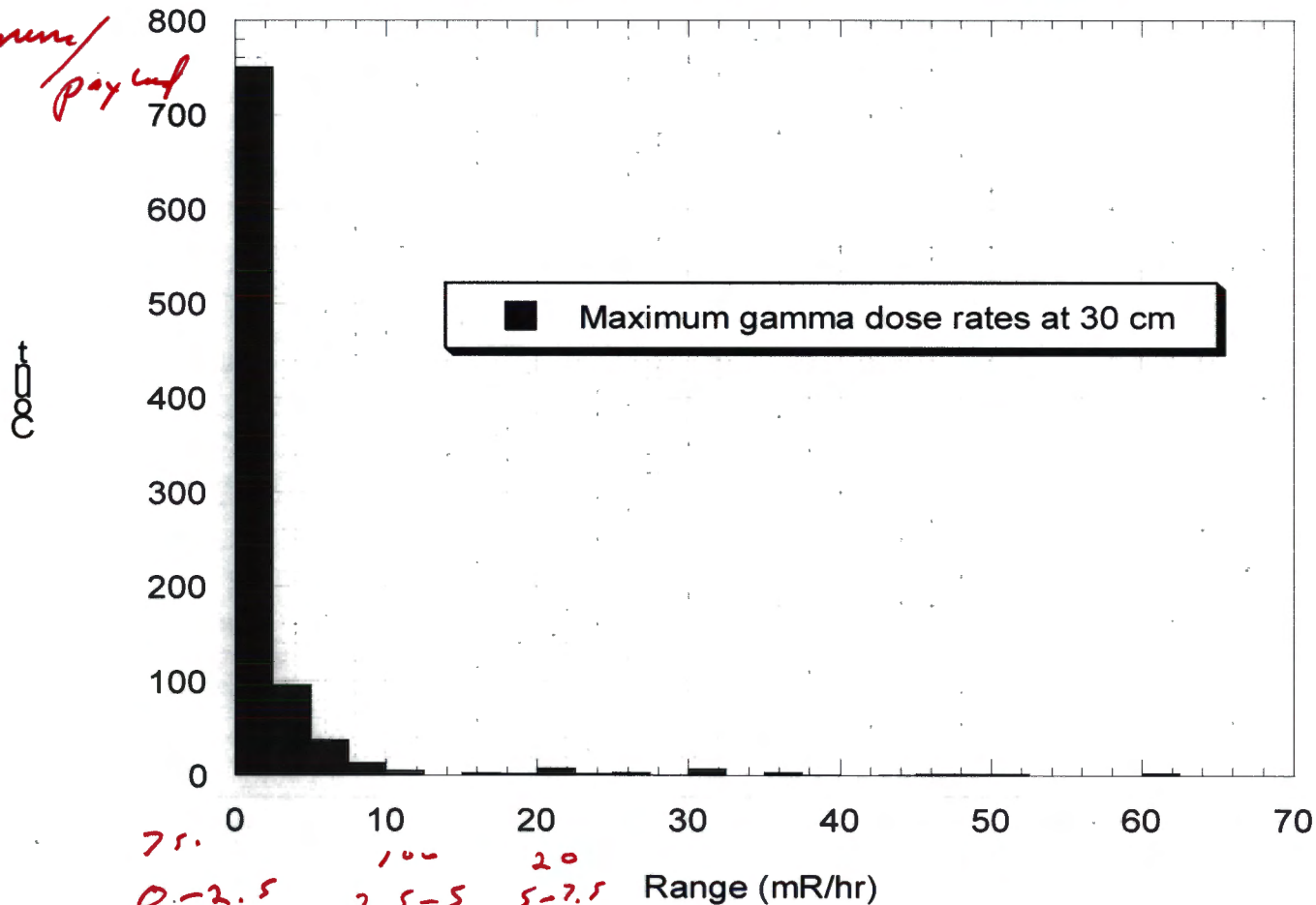
	<i>1999 (Dose / # of Workers with Positive Dose)</i>	<i>2000</i>	<i>2001</i>
<i>Waste Handling</i>	52 mrem / 4	45 mrem / 2 (highest 31 mrem)	70 mrem / 6
<i>RadCon</i>	14 mrem / 1	11 mrem / 1	90 mrem / 6 (highest 24 mrem)
<i>Truck Drivers</i>	96 mrem / 3 (highest 39 mrem)	55 mrem / 4	49 mrem / 3
<i>Others</i>	169 mrem / 12	21 mrem / 1	85 mrem / 7
<b><i>Total</i></b>	<b>0.331 person-rem / 20</b>	<b>0.132 person-rem / 8</b>	<b>0.294 person-rem / 22</b>

# HISTOGRAM OF HIGHEST GAMMA DOSE RATES AT 30 cm FROM PAYLOADS, 3/1999 – 10/2001

*~ Payloads  
943 Survey*

30 cm maximum gamma dose rates

*14 Drums/  
payload*



*75*

*0-2.5  
mR/hr*

*100*

*2.5-5*

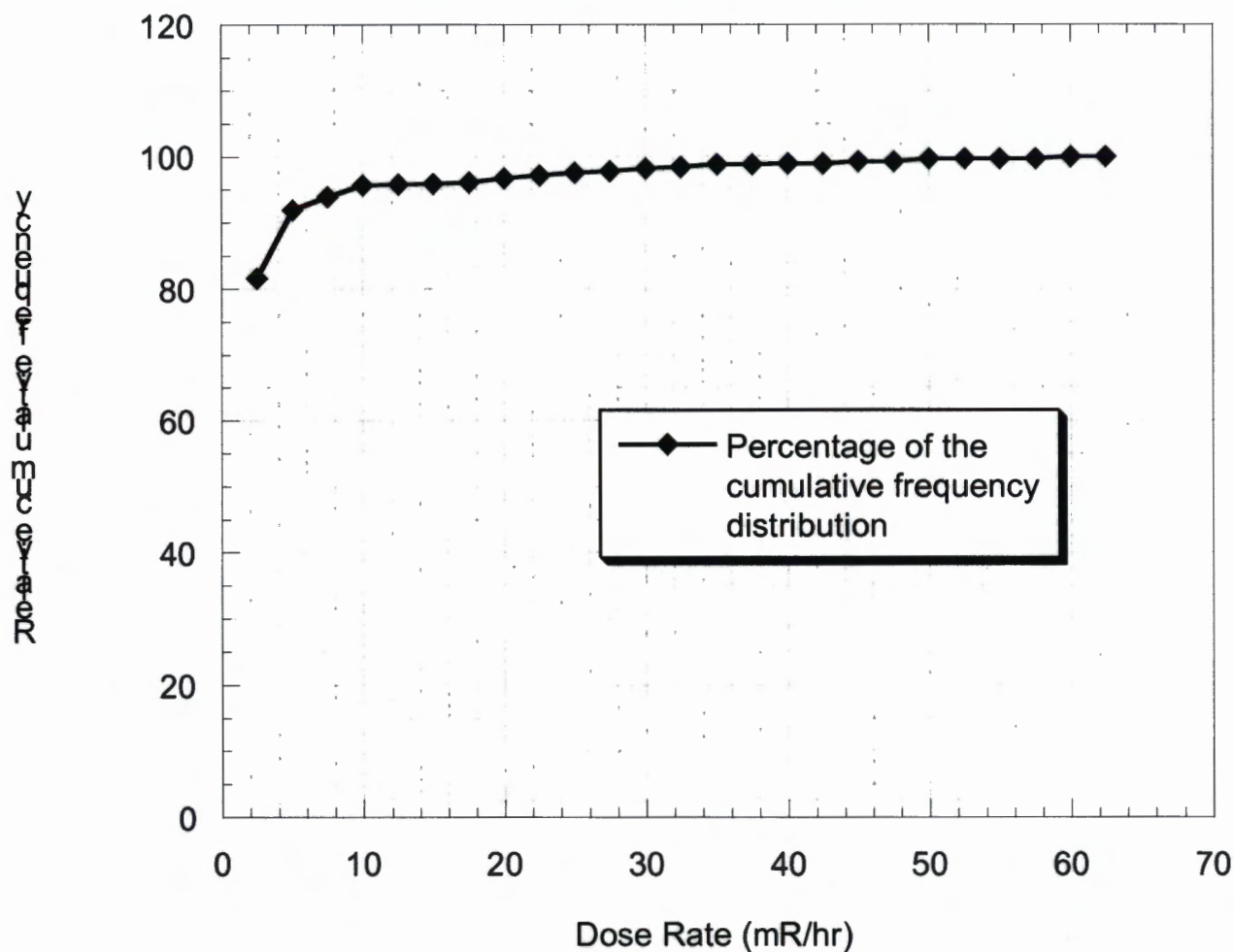
*20*

*5-7.5*

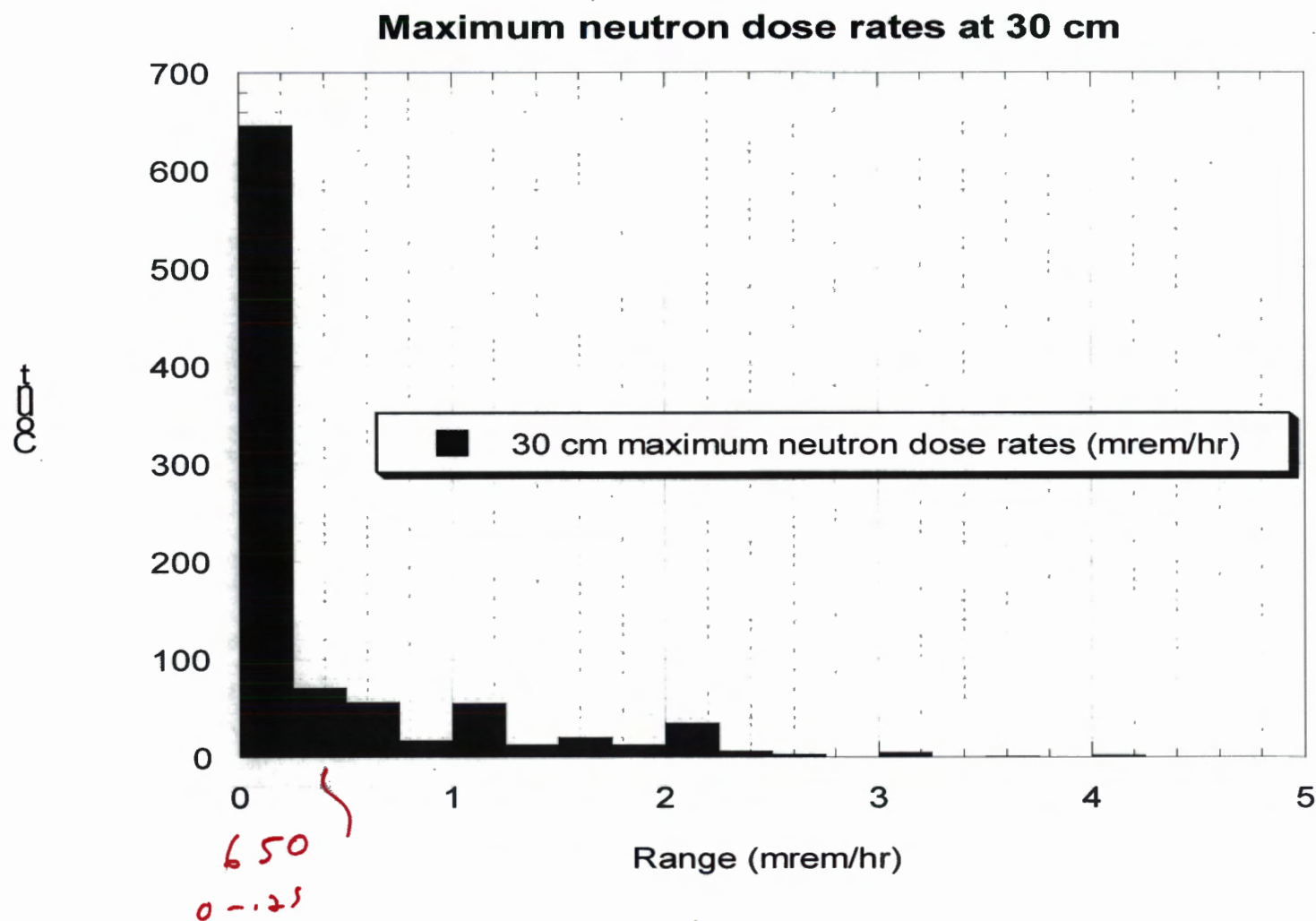


# RELATIVE CUMULATIVE FREQUENCY DISTRIBUTION OF HIGHEST GAMMA DOSE RATES AT 30 cm FROM PAYLOADS, 3/1999 – 10/2001

Maximum gamma dose rates at 30 cm

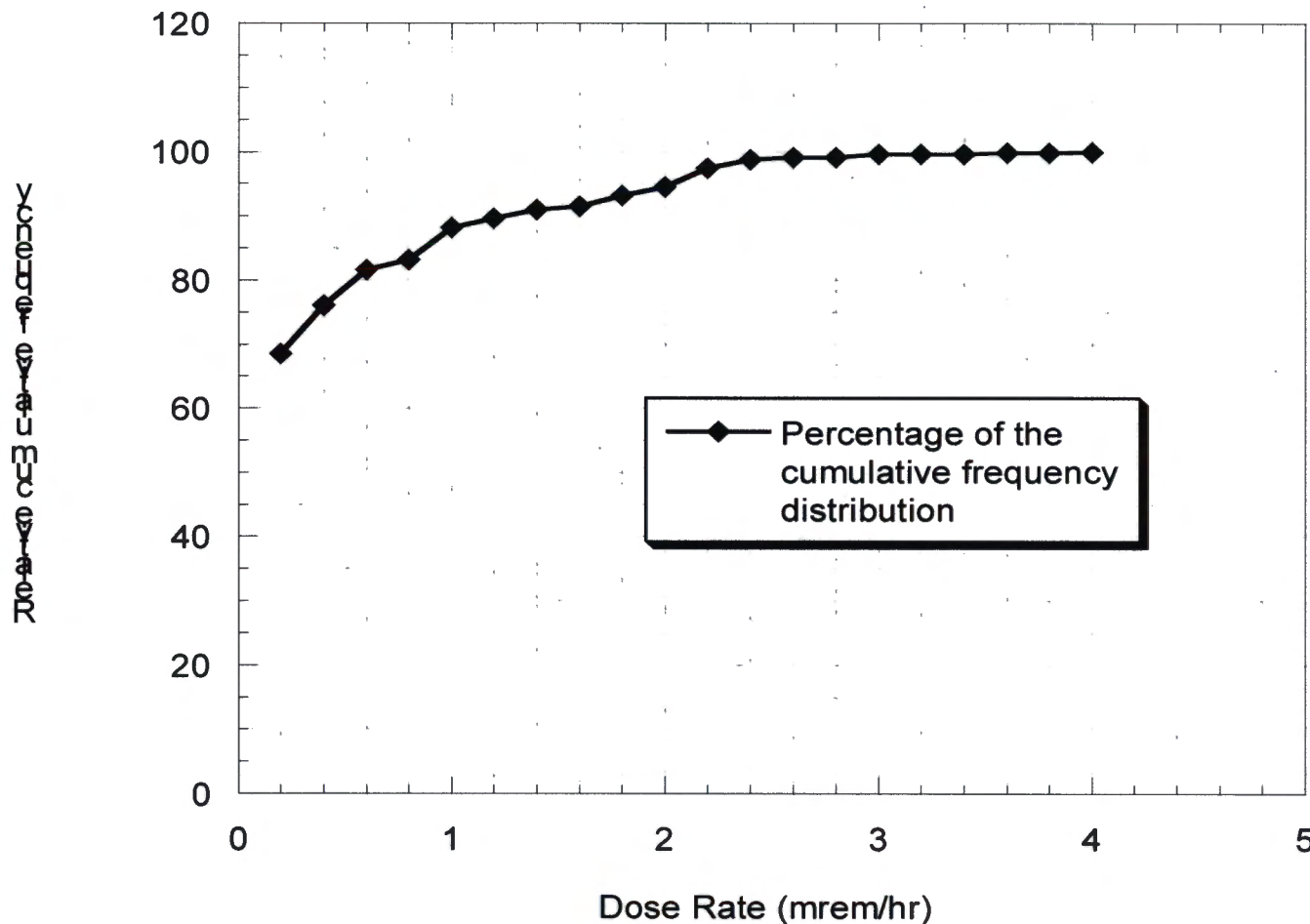


# HISTOGRAM OF HIGHEST NEUTRON DOSE RATES AT 30 cm FROM PAYLOADS, 3/1999 – 10/2001



# RELATIVE CUMULATIVE FREQUENCY DISTRIBUTION OF HIGHEST NEUTRON DOSE RATES AT 30 cm FROM PAYLOADS, 3/1999 – 10/2001

Maximum neutron dose rates at 30 cm





# WIPP RH TRU WASTE HANDLING DOSE ESTIMATES – 72-B

- Dose Rate Prediction for RH TRU Waste at WIPP
  - Utilized average RH TRU waste matrix and radionuclide source terms
  - Accounted for 72-B canister shielding
- WIPP Worker Dose Estimate for RH TRU
  - Time-motion study of RH receipt, handling and emplacement process
  - Dose estimates by tasks and worker types



# RH TRU DOSE ESTIMATES

- Estimates could be subject to uncertainties mainly due to assumptions on radionuclide source terms and waste matrices.
- Projected 0.005 person-rem per 72-B Shipment or
  - Waste Handlers – 0.004 person-rem
  - Radiological Control Technicians – 0.001 person-rem
  - Others (including security) ~ 0 person-rem
- Note: 1999-2001 CH TRU Waste Handling Average ~ 0.008 person-rem per TRUPACT-II

# NM Task Force Quarterly Report 9/30/01

## Draft

### **b. Accomplishments: enter bullet list of accomplishments for the quarter**

#### **1. Task Force – Energy, Minerals and Natural Resources Department**

- Hired new Task Force Coordinator, Anne deLain W. Clark, on July 9, 2001.
- July 24 – Attended Weapons of Mass Destruction Executive Briefing presented by DPS.
- July 31 – Received basic WIPP tour.
- August 1-3 – Attended High Risk Communication training in Sacramento.
- Conducted NM WIPP Working Group meetings on August 14 September 4.
- August 18 – Participated in WIPPTRAX in Cibola County.
- August 20-22 – Met with DOE CBFO staff.
- August 28 – Conference call on WIPP with WGA
- September 7 – Attended DOE Permit Modification Workshop.
- September 10-14 – Attended mediation/facilitation training.
- September 19 – Received orientation from NMED Hazardous Waste Bureau on the WIPP RCRA permit.
- September 26-27 – Attended website development training.
- September 26 – Conference call with DOE CBFO & Ron Ross concerning effective communication between DOE and the State of New Mexico

#### **2. Department of Health**

- DTPA Inventory Completed and reported to REAC/TS in Early August 2001
- Spoke with Hospitals along I-40 route west of Albuquerque about stocking DTPA for upcoming future shipments
- Participated in EMS Statewide Conference July 23 – July 28th at the Albuquerque convention center and answered questions from EMT's, Physicians and RN's about New Mexico's Medical Preparedness for an accident, should one occur. Most people I spoke with want training.
- Evaluated the Cibola County WIPPTRAX Exercise held in Grants in August 11<sup>th</sup>. Evaluated EMS and Fire Department Response and patient care capabilities.
- August 8<sup>th</sup>, 2001 - Taught the Hospital Response to Hazardous Materials Course in Carlsbad, including a presentation on WIPP and hands on Geiger Counter training with the Ludlum. Course taught at Carlsbad Medical Center. RN's and other medical professionals attended from the hospital.

- August 27<sup>th</sup> – Attended EMS Operations meeting at IP & EMS Bureau
- September 4<sup>th</sup> – Attended WIPP Working Group Meeting at EMNR
- September 10<sup>th</sup> – Attended the Department of Health's Division Staff Meeting
- September 13 – Taught the Hospital Response to Hazardous Materials Course, including a presentation on WIPP, and offered hands on training to 35 medical professionals at Artesia General Hospital. Training included a presentation on Radiation. Geiger Counter training will be offered at later date.
- September 14<sup>th</sup> – 2 Recalibrated Ludlum Geiger counters exchanged with Artesia General Hospital
- September 19<sup>th</sup> and 20<sup>th</sup> – Attended the EMS infrastructure meetings in Ruidoso, New Mexico
- September 20<sup>th</sup> – Met with Region II EMS about scheduling RMC Courses, Hospital Equipment purchases, and other budget items. Meeting held in Ruidoso.
- September 25 – Geiger Counters (Ludlums) traded for fresh recalibrated instruments with Los Alamos and Espanola Hospitals
- September 26 – Attended the Emergency Management Systems meeting to review plan for disaster preparation with DOH.
- September 27 – Geiger Counters (Ludlums) traded with Colfax Miners Hospital and the Fire Department in Raton. Also visited Las Vegas Medical Center and traded Ludlums with that facility to give them current recalibrated instruments.
- September 28 – Traded Ludlums with University Hospital

### 3. Department of Public Safety (TESD & NMSP)

- July 6: Participated in exercise planning meeting at Grants for WIPPTRAX 2001.
- July 7: Presented WIPP/HAZMAT Awareness class, Bloomfield, NM.
- July 9: Conducted TRANSCOM training for NMSPD District 1 Dispatchers.
- July 11: Presented WIPP/HAZMAT Awareness Class, WIPP Road Show display and public outreach at NMSHTD Albuquerque District Office.
- July 13: Conducted TRANSCOM training for NMSPD District 1 Dispatchers.
- July 27-28: Support Acoma Pueblo Full-scale Exercise (CHER-CAP)
- July 31: Coordinated and funded air travel for personnel to a tour of the WIPP facility.

- August 3: Coordinated safe parking for WIPP shipments at Gallup and Grants NM National Guard Armories.
- August 3-4: Conducted Public Outreach at Cibola County Commission Center for Tri-State Fire Fighters' Conference.
- August 8: Exercise planning meeting with Cibola County Emergency Coordinator.
- August 16: WIPPTRAX 2002 exercise development meeting with Santa Fe County.
- August 17-18: Participated in WIPPTRAX 2001 Full-scale Exercise, Grants, Cibola County, NM.
- August 20: Coordinated WIPP Road Show and presented NM WIPP Safe Transportation overview for National Association of State Highway Departments (US/Canada).
- August 21: Coordinated WIPP Road Show, public outreach and presented WIPP/HAZMAT Awareness class at Laguna Pueblo.
- August 22: Observed DOE/CBFO STEP training at Laguna Pueblo.
- August 23: Attended NM Emergency Management Association Annual Conference. Cited for exceptional performance in support of the NM DPS WIPP Safe Transportation Program.
- September 12-13: Presented WIPP/HAZMAT Awareness class to Sheriffs' and Police Chiefs' Association Conference at Ruidoso, NM.
- September 24: WIPPTRAX 2002 Tabletop Exercise development meeting.
- 9 State Police ERO's attended the Haz Mat Challenge at LANL on August 15-17.
- 6 State Police ERO's attended the NM Emergency Management Conference on August 20-23.

#### 4. Department of Public Safety (Motor Transportation Division)

- En-route inspections (both radiological & safety) have been conducted at the Raton Port of Entry for all shipments from RFETS (56), INEEL(38) and HNFD (3) during the quarter.
- En-route inspections (both radiological & safety) have been conducted at the Loving Inspection Site for the shipment that originated from SRS during the quarter (total of 4).
- Pre-trip inspections (both radiological & safety) were conducted on all shipments originating from LANL (total of 2).
- Post-trip inspections (both radiological & safety) were conducted on a random basis on shipments from INEEL and LANL. Random post-trip inspection procedures were implemented by MTD after the first 20 shipments from INEEL & LANL. Post trip inspections were conducted on all shipments from HNFD. No post trip



inspections were conducted on shipments originating from SRS due to location of en-route inspection. No discrepancies have been detected during any of the post-trip inspections.

- MTD WIPP Coordinator continued to conduct Level I, Level I Hazmat and Level I Cargo Tank inspections and Level VI inspections along the WIPP route at the Raton POE.
- MTD WIPP Coordinator attended New Mexico Hazardous Materials Safety Board Meeting during the quarter as the MTD representative/member.
- MTD WIPP Coordinator attended the NM WIPP Working Group Meeting held during the quarter.
- MTD WIPP Coordinator participated in meeting between DOE and the State held during the quarter.
- MTD conducted on-hands training for drivers from CAST and Tri-State Motor Transit. The drivers worked with MTD District II at the Raton POE and District III personnel at the HOBBS POE in order to get the needed practical inspection experience to become a certified WIPP driver.
- New field equipment such as creepers, chock blocks, ruler, flashlights and other inspections tools were purchased for Level VI certified personnel.
- MTD conducted CVSA Level VI refresher training as required for inspectors to remain certified to conduct inspections of WIPP vehicles.
- MTD personnel from Headquarters and District I participated in the WIPPTRAX Exercise held in Grants, NM during August 2001.
- MTD WIPP Coordinator attended the CVSA Annual Conference held in San Diego, California. The MTD WIPP Coordinator participated in the CVSA RAM Sub-committee meeting to address issue relating to the transportation of transuranic waste.

## 5. Environment Department

- In coordination with the Department of Health, calibrated Ludlum 14C/44-9 GM instruments were exchanged with local hospitals to operate on the WIPP route. Every hospital received two calibrated instruments.
- Standard operating procedures (SOPs) written for all NMED field office operations. SOPs outline and detail field office staff involvement in case of a WIPP transportation accident. Guidelines coincide with mandates outlined in the State of New Mexico's Hazardous Materials Emergency Response Plan, which delineates the required training and certification for each field staff member. All NMED field offices operating or having jurisdiction in areas near or on the WIPP route will receive training in the awareness

and operation levels. Director of the Field Operation Division has approved the plan and will implement it by memorandum.

- The NM State Highway & Transportation Department has given permission and approved the engineering drawings to begin the construction of the Raton Port-of-Entry radiation monitoring system. The system is designed to monitor all commercial carriers entering the State at the Raton Pass. Communication links and communication software have been finalized and are ready for implementation. The Raton Port of Entry office is being wired for housing the related telephone lines and hardware.
- All background soil data for various radio-nuclide concentrations have been completed and entered into the database. Data include natural background concentration as well as some transuranic elements, i.e., Pu-238, Pu-239/Pu-240, and Am-241. Data will be utilized for mitigation purposes in case of a radiological release associated with a WIPP transportation accident. All WIPP designated routes have been quantified plus the I-40 section, entering on the eastern part of the State, although this section will not be utilized to transport WIPP waste shipments.

**c. Problems/Unresolved Issues**

- WIPP Shipment en route notification/communication protocols.
- Weather/Highway status conference calls, Safe Parking protocols and interface between CMR and NMSP District 1 need to be reviewed.
- There is still no resolution of NM request to monitor empty and road show travel.
- Ongoing TRANSCOM related issues.

**9. Status Assessment and Forecast:**

- a. DPS is placing emphasis on public outreach, equipping and training first responders along the I-40 corridor.
- b. New Mexico continues to enforce, resolve or refine the WGA WIPP shipping protocols.
- c. Negotiations are in progress with NM National Guard to establish the NMNG Armory at Gallup and Grants as safe parking areas.

# **WIPP Emergency Preparedness**

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**J.R. Galle**

**Department of Energy**

**Program Manager, Security  
and Emergency Operations**

**Carlsbad Field Office**



# **Waste Isolation Pilot Plant**

## **External Reviews**

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⌚ June 11, 2001, DOE Headquarters EM-5 conducted an Emergency Management Readiness Assurance Appraisal at the Waste Isolation Pilot Plant.

⌚ No Deficiencies (draft report).

⌚ July 31, 2001 DOE Headquarters SO-40 conducted an Emergency Management Readiness Assurance Appraisal using a no-notice exercise.

⌚ No Deficiencies (verbal closeout-no report yet)

# Waste Isolation Pilot Plant Reviews

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⌚ September 2001 WIPP internal Quality Assurance Department Audit of the Emergency Management Program.

⌚ No Findings

⌚ FY 2001 WIPP completed, twenty-two (22) drills/Exercises demonstrating readiness to respond to all types of emergencies.

⌚ No Findings

# WIPP's Emergency Management Program

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- ⌚ WIPP Emergency Management Interfaces with outside agencies that have MOU's to assist in an emergency.
  
- ⌚ WIPP emergency response capabilities have been maintained at or above the levels required by DOE Order.
  - ⌚ Fire:
  - ⌚ Medical:
  - ⌚ Hazardous Materials:
  - ⌚ Industrial Rescue:
  - ⌚ Mine Rescue:

# WIPP Actions in relation to September 11 Events

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- ⌚ Activation of Emergency Operations Center on September 12.
- ⌚ Heightened Security level.
- ⌚ Established direct communication with DOE AL and other DOE facilities.
- ⌚ WIPP Emergency Response personnel placed on stand-by for possible deployment. (RAP and Mine Rescue)

# Transportation Emergency Preparedness

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Training has been conducted since 1988 in accordance with the WIPP Land Withdrawal Act.

Training materials were reviewed and approved by OSHA in 1993, 1997 and 2001.

RH has been included in the training material since 1992

# Transportation Emergency Preparedness

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Nationally over 18,000 emergency responders from 21 states have been students in our training programs

26 Full scale exercises have been conducted in seven states with eight of those being in New Mexico

Texas, Nevada, California, and Louisiana are coordinating exercises at this time

# Transportation Emergency Preparedness

---

New Mexico assumed responsibility for training in New Mexico in 1995

Prior to 1995 CBFO had trained 3401 students in New Mexico

Exercises continue to be supported in New Mexico

Full scale exercise supported in Grants, NM on August 18, 2001

# Transportation Emergency Preparedness

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The current States and Tribal Education Program is being incorporated into the Transportation Emergency Preparedness Program, Modular Emergency Response Radiological Transportation Training (MERRTT), to create a single national training program for the DOE.

This new training product will continue to meet the requirements of the WIPP LWA



# Transportation Emergency Preparedness

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Four Train-the-Trainer courses are scheduled in Carlsbad, for  
FY 2002

Training is ongoing with classes scheduled in California,  
Nevada, Georgia, Arizona, and Colorado at this time.

# Station D Air Sampling Skid Timeline

**September 5, 2001** – Completed modification of new Station D design at the location which complies with *HPS*/ANSI N13.1-1999 as qualified by Texas A&M University.

**September 6, 2001** – EEG began routine collection of sampling filters for an independent 30-day gravimetrics test to evaluate the skid's ability to ensure that the 3 samples are balanced and representative.

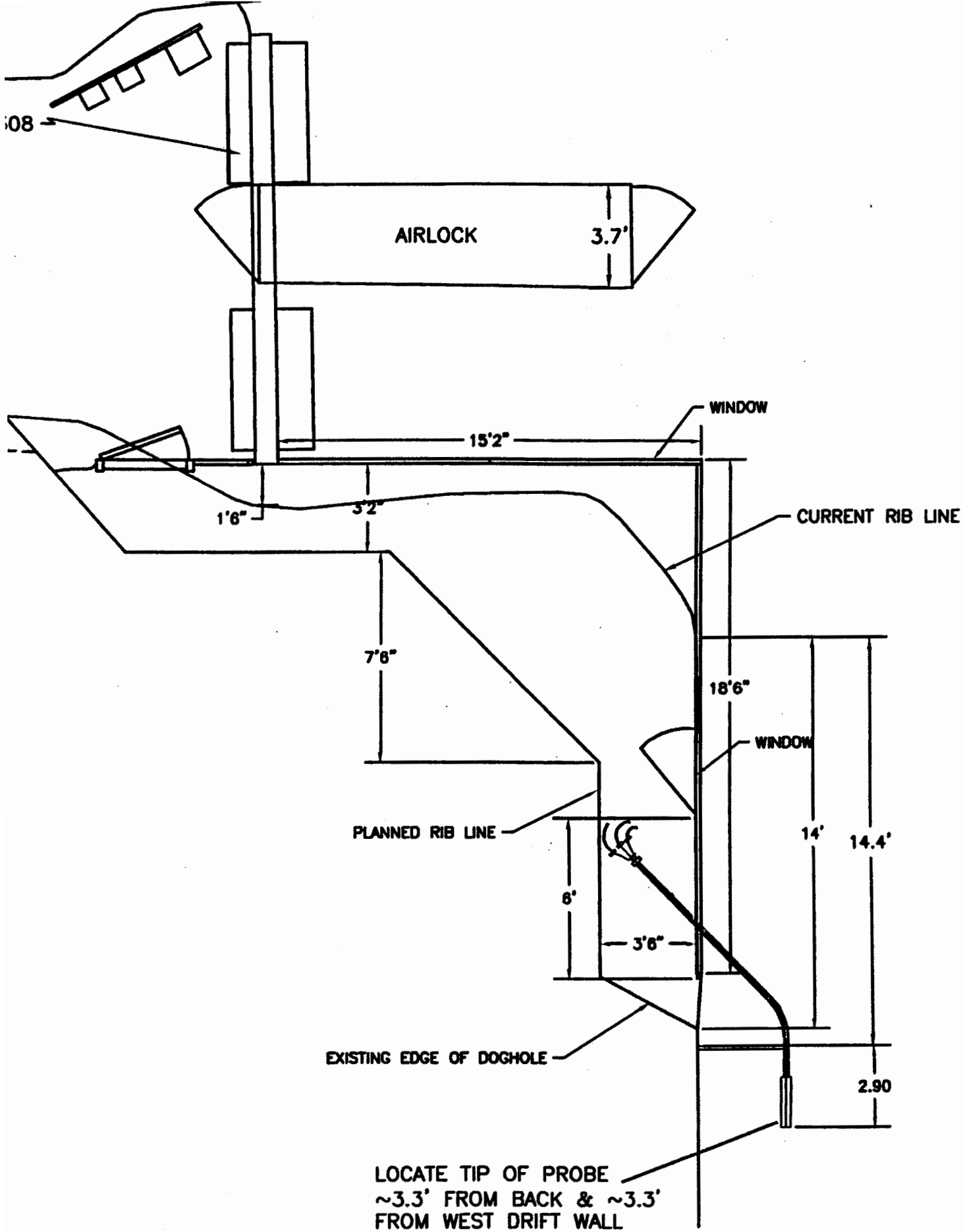
# Station D Air Sampling Skid Timeline (continued)

**October 8, 2001** – EEG completed the independent 30-day gravimetrics test, concluding that particulate collection through the 3-way splitter was both balanced and representative.

**October 15, 2001** – both EEG and WTS began routine daily collection of Station D air sampling filters.

# **Station D Primary Purpose**

**Station D now provides alternative compliance air sampling (to Station A) in the event of an accidental release.**



E300

# Station D Transport Line Through Enclosure Bulkhead

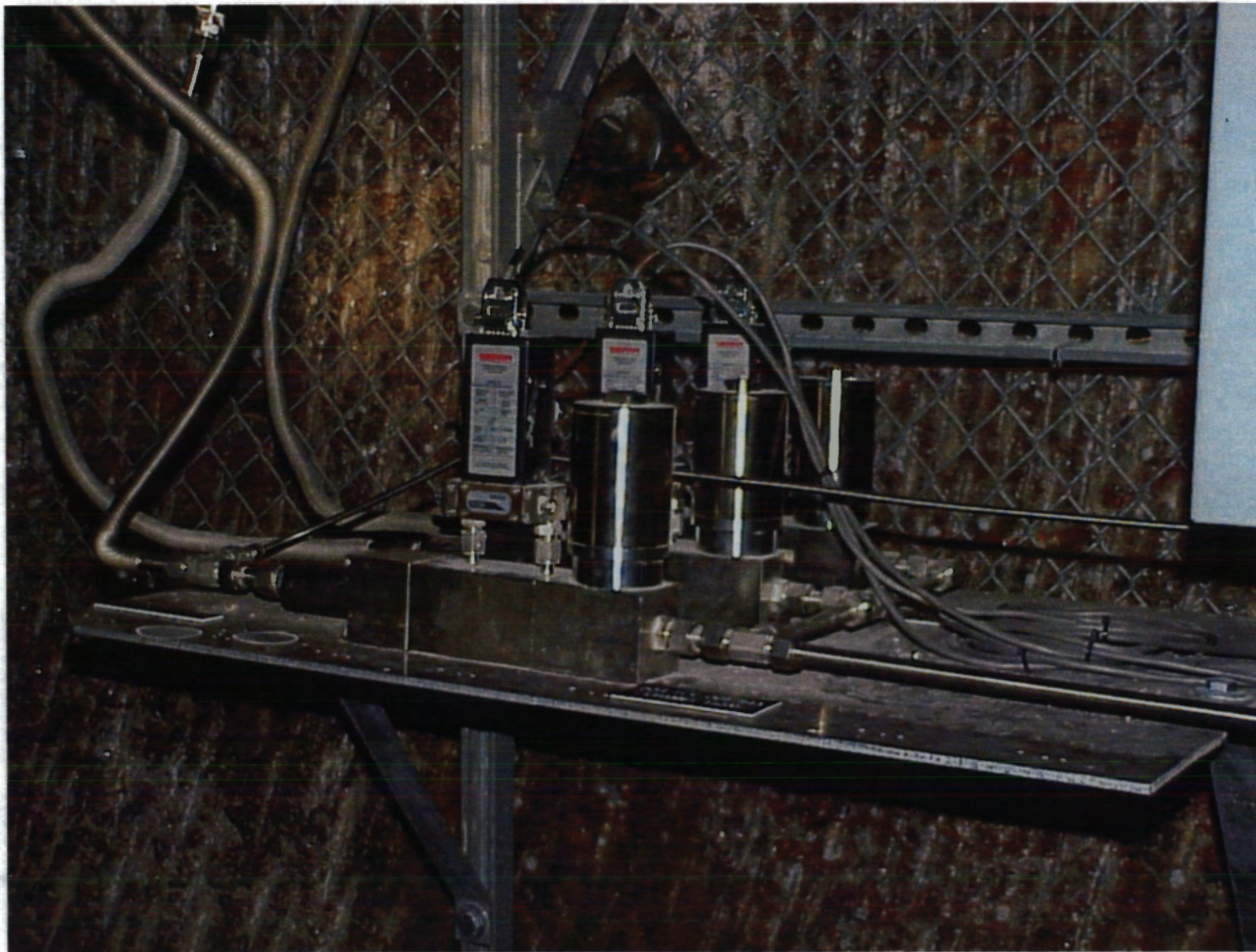




# Station D 3-Way Splitter and FAS Heads

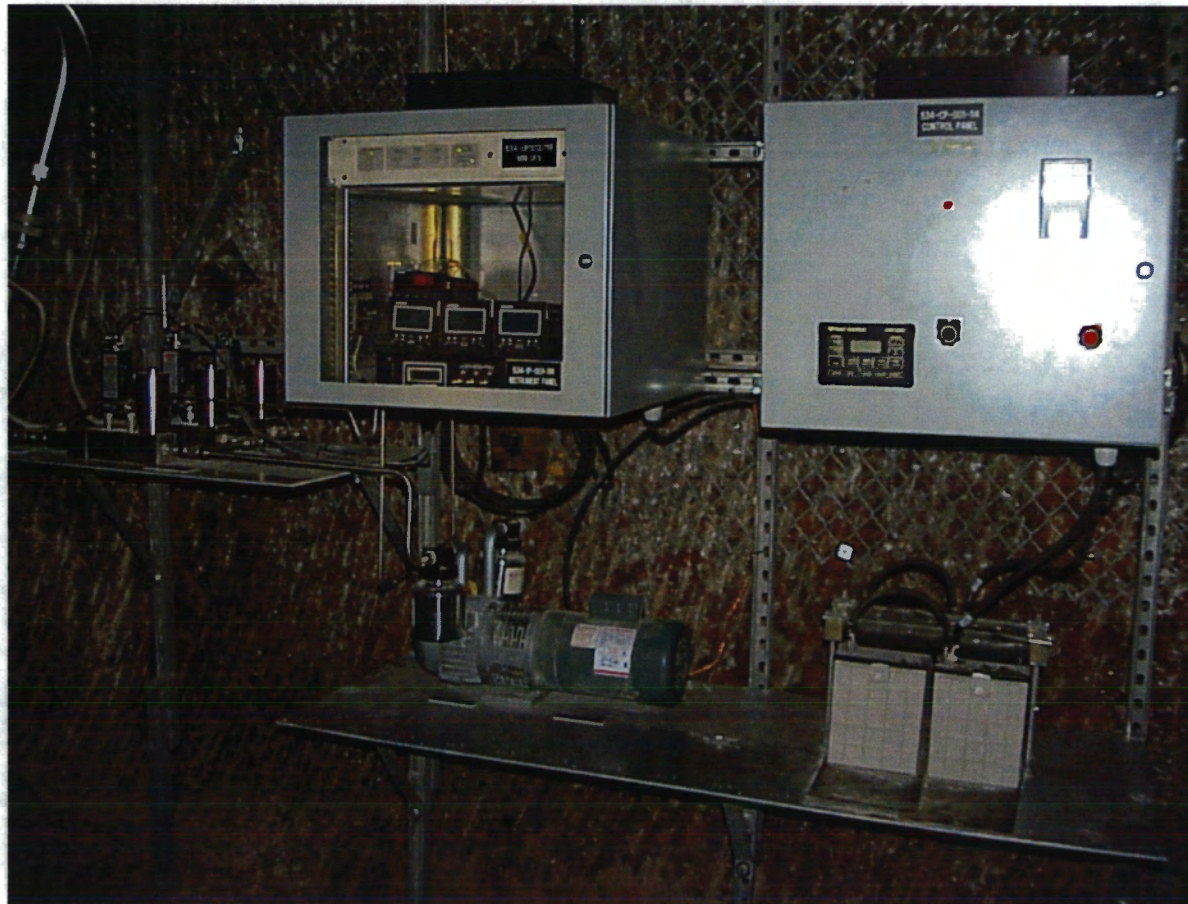


# Station D Flow Controllers





# Station D Flow Box, Dataloggers, Pump, Controller, and Backup Power Supply



# **CBFO QAPD Revision 4**

## **76<sup>th</sup> Quarter Meeting**

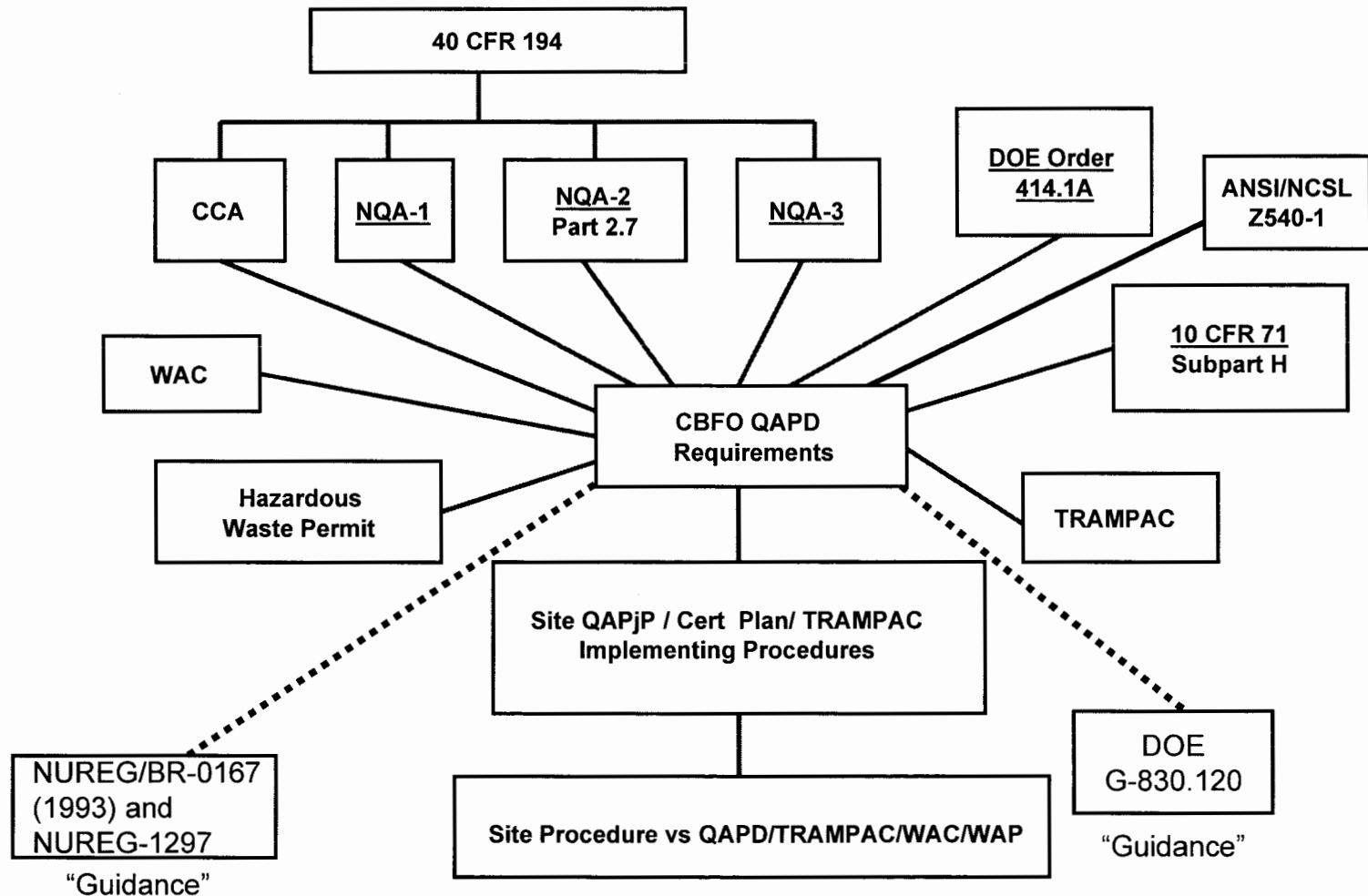
**October 23, 2001**

**Albuquerque, NM**

**Chuan Wu and Jerry Reese**  
**Carlsbad Field Office**



# QA Drivers/Requirements Flow Down



# **CBFO QAPD Drivers**

- **40 CFR Section 194.22 and WIPP Hazardous Waste Facility Permit (HWFP) and DOE Orders establish quality assurance (QA) requirements for the WIPP**
- **Section 194.22 also lists EPA requirement documents, that are addressed in the CBFO QAPD**
- **The HWFP identifies NMED requirements that are addressed in the QAPD**
- **QA controls ensure confidence in the reliability of technical data and analyses relative to the CCA and the characterization of transuranic defense waste**

# **Drivers *(cont.)***

- **Section 194.22 requires DOE to adhere to a QA program that implements the requirements of the following:**
  - **ASME NQA-1-1989 edition. Provides quality assurance program requirements for nuclear facilities**
  - **ASME NQA-2a-1990 addenda part 2/7. Provides quality assurance requirements for computer software development, acquisition, and use**

# **Drivers *(cont.)***

- **ASME NQA-3-1989 edition**
  - **Provides quality assurance program requirements for the collection of scientific and technical information for the characterization of the WIPP repository**
- **NUREG-1297 (1988)**
  - **Provides requirements for the performance of peer reviews**

# **Drivers (cont.)**

## **Other EPA/NMED associated requirements documents:**

- **DOE/WIPP-069, Waste Acceptance Criteria For the WIPP.** Summarizes the radiological waste acceptance criteria that CH-TRU waste must meet before it can be transported, managed and disposed of at the WIPP
- **WIPP HAZARDOUS WASTE FACILITY PERMIT NM4890139088-TSDF, ATTACHMENT B.** Includes test methods, details of planned waste sampling and analysis, a description of the waste shipment screening and the verification process, and a description of the QA/QC program requirements

# **Drivers *(cont.)***

## **NRC QA requirements documents include:**

- **10 CFR Part 71, Subpart H, Packaging and Transportation of Radioactive Material, Quality Assurance**
  - **Requires a QA program be in place prior to the transportation of radioactive materials**
- **Safety Analysis Reports for WIPP CH-TRU Waste, RH-TRU 72B Waste Package, and HalfPACT Shipping Package. Document the safety analysis and the adequacy of the CH-TRU, RH-TRU, and HalfPACT safety bases necessary to ensure the safety of workers, the public, and the environment**



# **Drivers *(cont.)***

## **DOE commitment documents:**

- **DOE O 414a, Quality Assurance**
  - **Requires implementation of quality assurance criteria in a manner sufficient to achieve adequate protection of workers, the public, and the environment**
- **ANSI/NCSL Z540-1, General Requirements for Calibration Laboratories and Measuring and Test Equipment**
  - **Sets the general and specific requirements that a calibration laboratory must meet to demonstrate the capability to operate and carry out calibrations**

# **Drivers *(cont.)***

## **Guidance documents:**

- **DOE, Division of Nuclear Safety, G-830.120, Implementation Guide for Use with 10 CFR Part 830.120, Quality Assurance**
  - **Establishes quality assurance requirements for contractors conducting activities, including items and services that affect, or may affect, the nuclear safety of DOE Nuclear Facilities**

# **Drivers *(cont.)***

## **Guidance documents *(cont.)*:**

- **NUREG/BR-0167 (1993), Software Quality Assurance Program and Guidelines**
  - **Provides guidelines for implementing the software life cycle, verification and validation activities, documentation and deliverables, project management, configuration management, nonconformance reporting and corrective action, and quality assessment and improvement activities**

**Planned  
CBFO QAPD  
Revision 4  
Changes**

# Changes

- **Incorporate the name change of the Department of Energy Carlsbad Area Office (CAO) to the Carlsbad Field Office (CBFO) throughout the document**
- **Move the qualification of existing data to Section 1 of the QAPD to allow the qualification of TRU waste characterization data**
- **Several minor changes (additions and deletions) to be made based on the results of a detailed evaluation of the “Authorization Basis” for the CBFO QAPD**

# **Authorization Bases Effort**

- **Evaluated each QAPD requirement entry against requirements documents in the authorization bases**
- **Searched for “Orphan requirements”; found no significant orphan requirements**
- **Identified minor additions and deletions to existing requirements presented in the QAPD**
- **Incorporated these minor changes in Draft B of Revision 4 to the QAPD**



# **Changes** *(cont.)*

- **Remove the requirement for the CBFO approval of participant grading procedures; no upper tier requirement exists**
- **Delete the designation of “General Requirements” and “Additional Requirements” (except for Section 6 due to the distinction between RCRA software requirements and NQA-2 requirements)**

# **Changes *(cont.)***

## **Revision 4 Review schedule:**

- **CBFO QA Manager preliminary review – Oct. 19**
- **Preliminary comments incorporated – Nov. 5**
- **QAPD Revision 4 Draft B out for formal review – Nov. 7**
- **Review comments due back ten work days from receipt Nov. 21**
- **Expect to issue Rev. 4 QAPD in Dec. 2001**

# Summary

- It is essential to keep the WIPP QA Program current
- Several agencies and regulators (e.g., DOE, NRC, EPA, NMED, etc.) set the regulatory requirement documents the QA Program must meet
- As the WIPP Program matures, requirements documents change or are added
- The QAPD must in turn be updated to satisfy the addition or deletion of new or no-longer-applicable requirements, or to reflect commitment change to existing requirements
- Revision 4 implements minor changes to meet the latest requirements and demonstrates good management practices

# **WIPP Subsidence Monument Leveling Survey 2000**

October 2000



**Waste Isolation Pilot Plant**

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### List of Acronyms

DOE	Department of Energy
DOY	Day of year
FGCS	Federal Geodetic Control Subcommittee
M&TE	Measurement and Test Equipment
NGS	National Geodetic Survey
WID	Waste Isolation Division
WIPP	Waste Isolation Pilot Plant

### References

*Classification, Standards of Accuracy, and General Specifications of Geodetic Control Surveys*, Federal Geodetic Control Committee (now Federal Geodetic Control Subcommittee), [1975] 1980, Reprint.

*Interim FGCS Specifications and Procedures to Incorporate Electronic Digital / Bar-Code Leveling Systems*, Federal Geodetic Control Subcommittee, ver. 4.0, dated July 15, 1994.

*WIPP Subsidence Monument Leveling Surveys 1986-1997*, DOE / WIPP 98-2293, June 1998.

*WIPP Subsidence Monument Leveling Surveys 1998*, DOE / WIPP 99-2293, October 1998.

*WIPP Subsidence Monument Leveling Surveys 1999*, DOE / WIPP 00-2293, October 1999.



## **1. Introduction**

Sections 2 through 7 of this report define the result of the 2000 leveling survey through the subsidence monuments at the WIPP site. Approximately 18 miles of leveling was completed through ten vertical control loops. The 2000 survey includes the determination of elevation on each of the 51 existing subsidence monuments and the WIPP baseline survey, and 14 of the National Geodetic Survey's (NGS) vertical control points. Digital leveling techniques were utilized to achieve better than Second Order Class II loop closures as outlined by the Federal Geodetic Control Subcommittee (FGCS). The field observations were completed during September and October of 2000 by personnel from the Waste Isolation Division (WID) Surveying Group, Technical Support Section, Engineering Department.

Finally, Section 8 contains Table F, which summarizes the elevations for all surveys from 1986 through 2000, inclusive. A detailed listing of the 1986 through 1997 surveys is contained in the report, *WIPP Subsidence Monument Leveling Surveys 1986-1997*, DOE/WIPP 98-2293. A reference to the summary reports for each year after 1997 is listed in the reference section of this document.

## **2. Equipment**

The observations were taken with the WILD NA3003 Electronic Digital Level (WIPP M&TE ID# DM0021) manufactured by Leica, and bar coded leveling staffs. The calibration for the NA3003 is valid from February 24, 2000, through February 24, 2002. The data were recorded electronically on the Leica GRM10 REC-Module, which is built into the instrument. In addition to the electronic record, a written field log was maintained to record information that is not stored in the electronic record.

## **3. Office Processing**

Each day the data were downloaded from the GRM10 REC-Module to the survey group computer. The original raw data files were maintained intact, and further processing was performed on a copy of the original raw data file.

Listing of the data, and the adjustment of the loops, was completed with the DIGILEV software (version 10.94d) from Leica Canada. The results, as summarized below, were extracted from the output of the DIGILEV software.

## **4. Methodology**

The weather conditions during the observations of the 2000 survey were generally mild with moderate temperatures and light to moderate breezes.

The elevations for the 2000 survey are computed from the adjusted observations based on the elevation of the subsidence monument, S-37 (3,423.874 feet). S-37 is the WIPP monument that is furthest from the influence of the

underground excavations, and has been held fixed for all of the subsidence leveling surveys since 1993. The condition of the individual monuments was substantially the same as the previous subsidence survey. No points were missing or significantly damaged.

For visual reference, Figure 1 shows a graphic display of the individual loops, the total survey, and the relationship to the underground excavations.

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## 5. General Summary of Results

Table A below describes the ten leveling loops that were measured to obtain the elevations of the subsidence monuments. The table contains the start date of the observations, a loop number, and the points that are contained within the loop.

**Table A. Description of 2000 Leveling Loops**

Start Date (DOY)	Loop	Points
September 11, 2000 (255)	1	S-43, PT-10, S-43
September 12, 2000 (256)	2	C-419, S-37, D-419, S-51, S-38, C-419
September 26, 2000 (270)	3	C-419, B-419, A-419, Y-347, Z-418, Y-418, X-418, W-418, V-418, S-41, U-418, Y-418, A-419, C-419
September 20 & 21, 2000 (264 & 265)	4	U-418, S-18, S-17, S-43, S-20, S-42, S-40, S-21, S-39, S-19, S-41, U-418
September 27, 2000 (271)	5	U-418, T-418, K-349, S-46, S-418, K-349, T-418, U-418
Sept. 28 & Oct. 02, 2000 (272 & 276)	6	T-418, S-01, S-03, S-53, S-45, PT-10, S-14, S-15, T-418, S-16, S-44, T-418
October 31, 2000 (305)	7	K-349, S-24, S-23, S-22, PT-31, PT-30, S-09, S-45, S-10, PT-32, K-349
September 13, 2000 (257)	8	K-349, S-52, S-24, S-25, S-26, S-49, S-48, S-13, PT-33, S-12, K-349
October 05, 2000 (279)	9	S-418, S-34, S-33, S-32, S-27, PT-21, S-22, S-28, S-29, S-46, S-418
September 18, 2000 (262)	10	S-418, S-34, S-35, S-36, S-50, S-31, S-47, S-30, S-418

Table B summarizes the results of the leveling loops in terms of vertical closure and accuracy. The requirement for Second Order Class II loop closure accuracy was achieved in all cases.

**Table B. Summary of Distance and Accuracy for 2000 Leveling Loops**

Loop	Cumulative Distance (ft.)	Vertical Closure (ft.)	Accuracy (ft.√mile)	Allowable Accuracy (ft.√mile)
1	2,986.91	0.0002	0.000	0.025
2	9,834.98	0.0011	0.001	0.045
3	13,860.10	-0.0017	0.001	0.053
4	9,125.14	-0.0015	0.001	0.043
5	12,004.02	-0.0021	0.001	0.050
6	10,138.93	-0.0075	0.005	0.046
7	9,141.02	-0.0025	0.002	0.043
8	8,376.53	-0.0055	0.004	0.042
9	10,236.06	-0.0055	0.004	0.046
10	7,857.72	-0.0021	0.002	0.040

## 5.1 Accuracy Summary by Loop

Table C shows a detailed summary of the observations in the leveling loops for the 2000 survey. The information in the table for each loop includes:

Between each benchmark in the loop:

- The distance leveled between benchmarks along the loop.
- The number of instrument setups between each of the benchmarks.
- The difference in elevation from each benchmark to the next.

For each loop as a whole:

- The cumulative, or total, distance of each loop.
- The vertical closure of the loop.
- The accuracy of leveling.
- Allowable accuracy for each loop.

The accuracy of the leveling is given in terms of feet times the square root of the length of the loop in miles. The actual accuracy of leveling is computed in the DIGILEV software, and is based on the actual vertical closure of the loop. The maximum allowable accuracy is based on the allowable accuracy of a loop as stated in the FGCS interim specification for digital leveling. The FGCS specification for Second Order Class II loop closure permits a maximum of  $8\text{mm}\sqrt{\text{Km}}$  (8mm times the square root of the length of the loop in Km). This converts to  $0.033\text{ft}\sqrt{\text{mile}}$  (0.033 feet times the square root of the length of the loop in miles) when stated in feet. All values indicated in this summary are expressed in feet.

Inspection of the following tables shows that in every case the actual accuracy is well below the maximum allowable accuracy for each loop. The column in each table that is labeled "Difference" is the vertical difference from one point to the next. It is important to note that the vertical difference figures have been rounded, and a slight difference may exist in the vertical closure figure from the algebraic sum of the column.

Table C. Detailed Loop Measurements

Loop 1					Loop 5				
From	To	Distance	Setups	Difference	From	To	Distance	Setups	Difference
S-43	PT-10	1,490	14	-16.135	U-418	T-418	1,229	8	-9.362
PT-10	S-43	1,476	14	16.135	T-418	K-349	2,636	16	-12.753
Cumulative Distance:		2,986			K-349	S-46	1,182	8	-4.314
Vertical Closure:				0.000	S-46	S-418	1,003	8	1.860
Accuracy of Leveling:				0.000	S-418	K-349	2,080	14	2.456
Allowable Accuracy:				0.025	K-349	T-418	2,655	20	12.752
					T418	U-418	1,218	10	9.363
Loop 2					Cumulative Distance:		12,004		
From	To	Distance	Setups	Difference	Vertical Closure:			-0.002	
C-419	S-37	1,185	8	-13.786	Accuracy of Leveling:			0.001	
S-37	D-419	704	6	-0.624	Allowable Accuracy:			0.050	
D-419	S-51	2,929	22	14.479					
S-51	S-38	3,671	26	-7.976	Loop 6				
S-38	C-419	1,346	10	7.906	From	To	Distance	Setups	Difference
Cumulative Distance:		9,835			T-418	S-01	747	4	-7.303
Vertical Closure:				0.001	S-01	S-03	238	2	-0.815
Accuracy of Leveling:				0.001	S-03	S-53	561	4	-0.087
Allowable Accuracy:				0.045	S-53	S-45	1,226	8	-8.269
Loop 3					S-45	PT-10	1,162	8	7.253
From	To	Distance	Setups	Difference	PT-10	S-14	1,202	10	3.679
C-419	B-419	1,440	10	12.193	S-14	S-15	1,002	8	1.809
B-419	A-419	954	6	4.897	S-15	T-418	435	4	3.737
A-419	Y-347	538	4	0.560	T-418	S-16	646	6	4.369
Y-347	Z-418	397	4	5.800	S-16	S-44	1,175	8	6.819
Z-418	Y-418	1,224	8	4.014	S-44	T-418	1,745	14	-11.183
Y-418	X-418	585	4	-9.118	Cumulative Distance:		10,139		
X-418	W-418	574	4	-6.698	Vertical Closure:			-0.008	
W-418	V-418	643	6	-12.805	Accuracy of Leveling:			0.005	
V-418	S-41	441	4	-5.600	Allowable Accuracy:			0.046	
S-41	U-418	245	2	-4.628	Loop 7				
U-418	Y-418	2,345	16	38.848	From	To	Distance	Setups	Difference
Y-418	A-419	2,110	16	-10.374	K-349	S-24	929	6	-2.109
A-419	C-419	2,364	18	-17.087	S-24	S-23	1,024	8	-6.187
Cumulative Distance:		13,860			S-23	S-22	1,043	8	-8.134
Vertical Closure:				-0.002	S-22	PT-31	1,445	10	-2.674
Accuracy of Leveling:				0.001	PT-31	PT-30	1,023	8	7.718
Allowable Accuracy:				0.053	PT-30	S-09	170	2	-1.232
Loop 4					S-09	S-45	977	8	6.434
From	To	Distance	Setups	Difference	S-45	S-10	1,027	8	1.945
U-418	S-18	499	4	-1.409	S-10	PT-32	557	4	1.926
S-18	S-17	1,156	10	-2.424	PT-32	K-349	947	8	-0.149
S-17	S-43	782	8	1.381	Cumulative Distance:		9,141		
S-43	S-20	661	6	10.542	Vertical Closure:			-0.003	
S-20	S-42	697	6	-6.108	Accuracy of Leveling:			0.002	
S-42	S-40	570	4	6.192	Allowable Accuracy:			0.043	
S-40	S-21	1,182	8	7.510					
S-21	S-39	1,137	8	-3.811					
S-39	S-19	1,442	10	-12.005					
S-19	S-41	753	6	4.762					
S-41	U-418	245	2	-4.628					
Cumulative Distance:		9,125							
Vertical Closure:				-0.001					
Accuracy of Leveling:				0.001					
Allowable Accuracy:				0.043					

Table C continued on next page...



Table C. Detailed Loop Measurements (continued)

Loop 8					Loop 10				
From	To	Distance	Setups	Difference	From	To	Distance	Setups	Difference
K-349	S-52	253	2	3.374	S-418	S-34	1,199	8	-9.648
S-52	S-24	1,084	8	-5.480	S-34	S-35	1,046	8	8.452
S-24	S-25	1,013	8	5.825	S-35	S-36	979	8	9.036
S-25	S-26	1,006	8	11.996	S-36	S-50	1,506	12	16.314
S-26	S-49	952	8	12.735	S-50	S-31	968	8	-13.602
S-49	S-48	1,008	8	0.683	S-31	S-47	759	6	-3.084

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Table F. Comparison of Elevations 1986-2000 (continued)

	S-33	S-34	S-35	S-36	S-37	S-38	S-39	S-40	S-41
1986	3,379.090	3,392.130	3,400.600	3,409.580					
1987	3,379.093	3,392.128	3,400.597	3,409.583					
1989	3,379.073	3,392.137	3,400.583	3,409.584	3,423.888	3,429.736			
1992	3,379.090	3,392.138	3,400.591	3,409.605	3,423.874		3,438.146	3,434.469	3,430.931
1993	3,378.975	3,392.026	3,400.478	3,409.504	3,423.874	3,429.736	3,438.110	3,434.430	3,430.888
1994	3,379.006	3,392.042	3,400.490	3,409.518	3,423.874	3,429.740	3,438.115	3,434.425	3,430.888
1995	3,379.009	3,392.042	3,400.495	3,409.520	3,423.874	3,429.739	3,438.124	3,434.437	3,430.899
1996	3,378.992	3,392.028	3,400.483	3,409.501	3,423.874	3,429.744	3,438.118	3,434.436	3,430.891
1997	3,379.019	3,392.057	3,400.516	3,409.533	3,423.874	3,429.745	3,438.127	3,434.444	3,430.894
1998	3,379.028	3,392.066	3,400.516	3,409.539	3,423.874	3,429.750	3,438.134	3,434.442	3,430.901
1999	3,379.011	3,392.056	3,400.507	3,409.539	3,423.874	3,429.751	3,438.149	3,434.445	3,430.900
2000	3,379.012	3,392.053	3,400.505	3,409.541	3,423.874	3,429.754	3,438.145	3,434.445	3,430.902

	S-42	S-43	S-44	S-45	S-46	S-47	S-48	S-49	S-50
1986									
1987									
1989									
1992	3,428.279	3,423.849	3,428.146	3,400.501	3,399.946	3,409.236	3,433.308	3,432.635	3,425.868
1993	3,428.230	3,423.813	3,428.070	3,400.406	3,399.837	3,409.133	3,433.238	3,432.572	3,425.809
1994	3,428.228	3,423.820	3,428.066	3,400.419	3,399.865	3,409.163	3,433.264	3,432.596	3,425.830
1995	3,428.238	3,423.826	3,428.071	3,400.424	3,399.856	3,409.158	3,433.258	3,432.588	3,425.830
1996	3,428.238	3,423.823	3,428.078	3,400.423	3,399.856	3,409.157	3,433.256	3,432.585	3,425.816
1997	3,428.249	3,423.815	3,428.084	3,400.428	3,399.877	3,409.181	3,433.274	3,432.600	3,425.846
1998	3,428.252	3,423.822	3,428.086	3,400.440	3,399.876	3,409.178	3,433.276	3,432.598	3,425.838
1999	3,428.255	3,423.825	3,428.091	3,400.435	3,399.866	3,409.176	3,433.289	3,432.611	3,425.851
2000	3,428.254	3,423.820	3,428.095	3,400.434	3,399.842	3,409.168	3,433.288	3,432.606	3,425.854

	S-51	S-52	S-53	S-54	PT-10	PT-21	PT-30	PT-31	PT-32
1986									
1987									
1989									
1992	3,437.765	3,407.611	3,408.775	3,411.085	3,407.722		3,392.914	3,385.117	3,404.370
1993	3,437.746	3,407.523	3,408.670	(4)	3,407.664	3,383.821	3,392.823	3,385.027	3,404.296
1994	3,437.749	3,407.542	3,408.709		3,407.672	3,383.868	3,392.843	3,385.051	3,404.311
1995	3,437.746	3,407.542	3,408.702		3,407.671	3,383.862	3,392.844	3,385.050	3,404.322
1996	3,437.729	3,407.536	3,408.704		3,407.669	3,383.858	3,392.852	3,385.053	3,404.312
1997	3,437.725	3,407.544	3,408.702		3,407.675	3,383.874	3,392.857	3,385.063	3,404.321
1998	3,437.724	3,407.549	3,408.714		3,407.687	3,383.887	(5)	3,385.067	3,404.322
1999	3,437.729	3,407.544	3,408.709		3,407.689	3,383.868		3,385.053	3,404.315
2000	3,437.729	3,407.531	3,408.704		3,407.685	3,383.868		3,385.053	3,404.306

Note: (4) The subsidence monument, S-54, no longer exists after the 1992 survey.

(5) The monument, PT-30, has been physically disturbed and was removed from the 1998 survey.

**Table F. Comparison of Elevations 1986-2000 (continued)**

	PT-33	S-418	T-418	U-418	V-418	W-418	X-418	Y-347	Y-418
1986									
1987									
1989									
1992	3,419.939								
1993	3,419.853								
1994	3,419.884								
1995	3,419.869								
1996	3,419.865	3,401.696	3,416.902	3,426.267	3,436.481	3,449.276	3,455.969	3,455.274	3,465.080
1997	3,419.873	3,401.708	3,416.906	3,426.272	3,436.487	3,449.282	3,455.976	3,455.281	3,465.091
1998	3,419.879	3,401.715	3,416.915	3,426.279	3,436.497	3,449.292	3,455.987	3,455.291	3,465.101
1999	3,419.880	3,401.707	3,416.913	3,426.275	3,436.500	3,449.304	3,456.000	3,455.304	3,465.117
2000	3,419.872	3,401.702	3,416.911	3,426.273	3,436.502	3,449.307	3,456.005	3,455.309	3,465.123

	Z-418	A-419	B-419	C-419	D-419	K-349			
1986									
1987									
1989									
1992									
1993									
1994									
1995									
1996	3,461.073	3,454.714	3,449.825	3,437.633	3,423.234	3,404.152			
1997	3,461.082	3,454.720	3,449.829	3,437.642	3,423.238	3,404.162			
1998	3,461.091	3,454.730	3,449.835	3,437.648	3,423.242	3,404.173			
1999	3,461.105	3,454.744	3,449.848	3,437.657	3,423.247	3,404.169			
2000	3,461.109	3,454.749	3,449.853	3,437.660	3,423.250	3,404.157			