Soils Sub-Project Current Investigations – CAUs 374, 375, 106 and 372

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Federal Sub-Project Director
Nevada Site Specific Advisory Board
November 2, 2010

Topics for Discussion

- Soils Sub-Project Strategy
- Soil Sites Corrective Action Units (CAUs)
  - CAU 374: Area 20 Schooner Unit Crater
  - CAU 375: Area 30 Buggy Unit Craters
  - CAU 106: Areas 5, 11 Frenchman Flat Atmospheric Sites
  - CAU 372: Area 20 Cabriolet/Palanquin Unit Craters

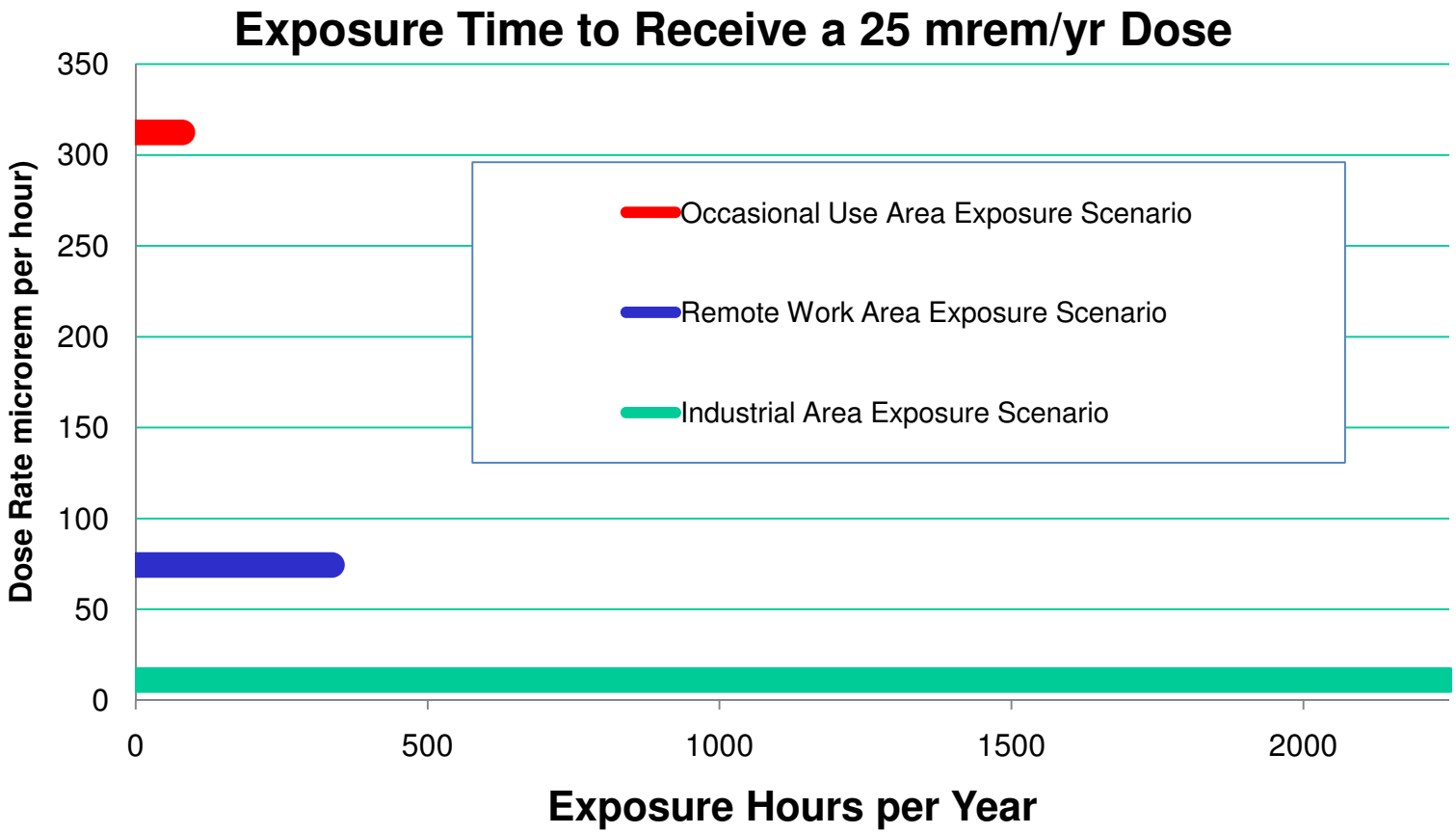
Soils Sub-Project Strategy

- Federal Facility Agreement and Consent Order (FFACO) is the Resource Conservation and Recovery Act (RCRA) risk-based Corrective Action Process for the Nevada National Security Site (NNSS)
- By agreement:
  - annual dose is used for risk-based decisions
  - 25 mrem/yr dose limit is the action level

Determination of Dose

- Dose rate at a site is relatively constant
- Annual dose received from the site depends on the time exposed
- Therefore, dose must be converted to an annual potential dose using one of the three established exposure scenarios:
  - Industrial Area (2,250 hours per year)
  - Remote Work Area (336 hours per year)
  - Occasional Use Area (80 hours per year)

Determination of Dose
(continued)



Determination of Dose
(continued)

- Total annual dose estimated by separate estimates of the internal and external dose components
- Some site may present predominantly internal or external dose. In general:
  - Efficient weapons effects tests external dose dominates
  - Safety tests using plutonium devices internal dose dominates

Determination of Dose

- Calculation of internal dose:
  - Analytical results of sieved surface soil
- Calculation of external dose:
  - TLD results

Any dose exceeding 25 mrem/yr (using appropriate exposure scenario) will require a corrective action

Corrective Action Alternatives

- FFACO describes three alternatives:
  - No Further Action
  - Clean Closure
  - Closure in Place
- Each alternative evaluated using Environmental Protection Agency screening and scoring methodology

Data Quality Objectives (DQO) Extent Decision

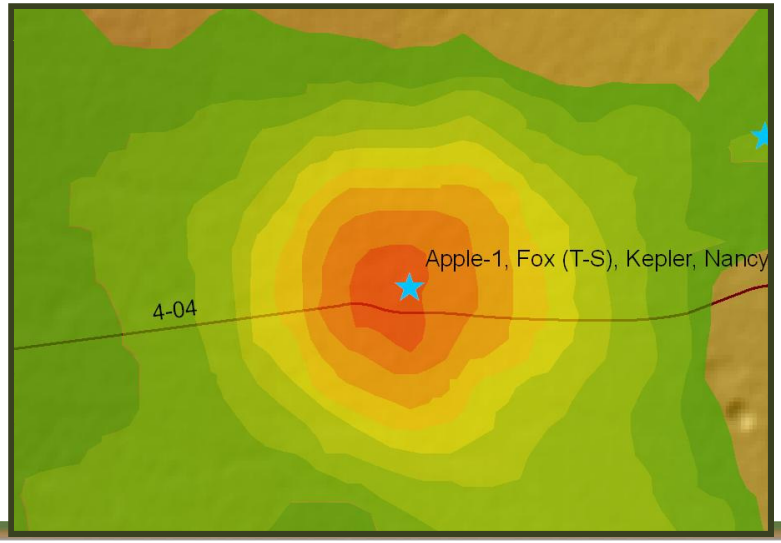
- Basic Strategy for Determining Corrective Action Boundaries
  - Define pattern of contaminant distribution (radiation surveys)
  - Define sample locations (above and below action level)
  - Correlate dose to survey values
  - Use survey isopleths(s) corresponding to action level

DQO Extent Decision

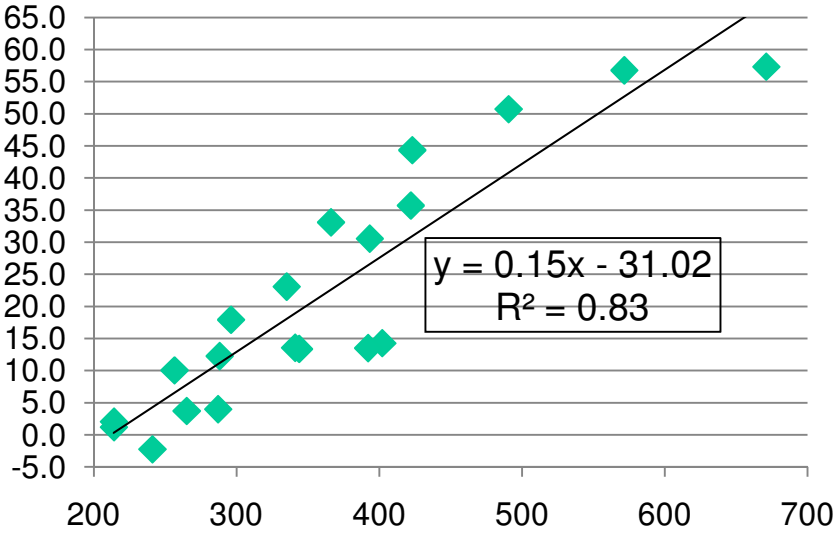
(continued)

- Underlying assumption:

  Dose rates are generally correlated to the distribution patterns observed in the radiation surveys

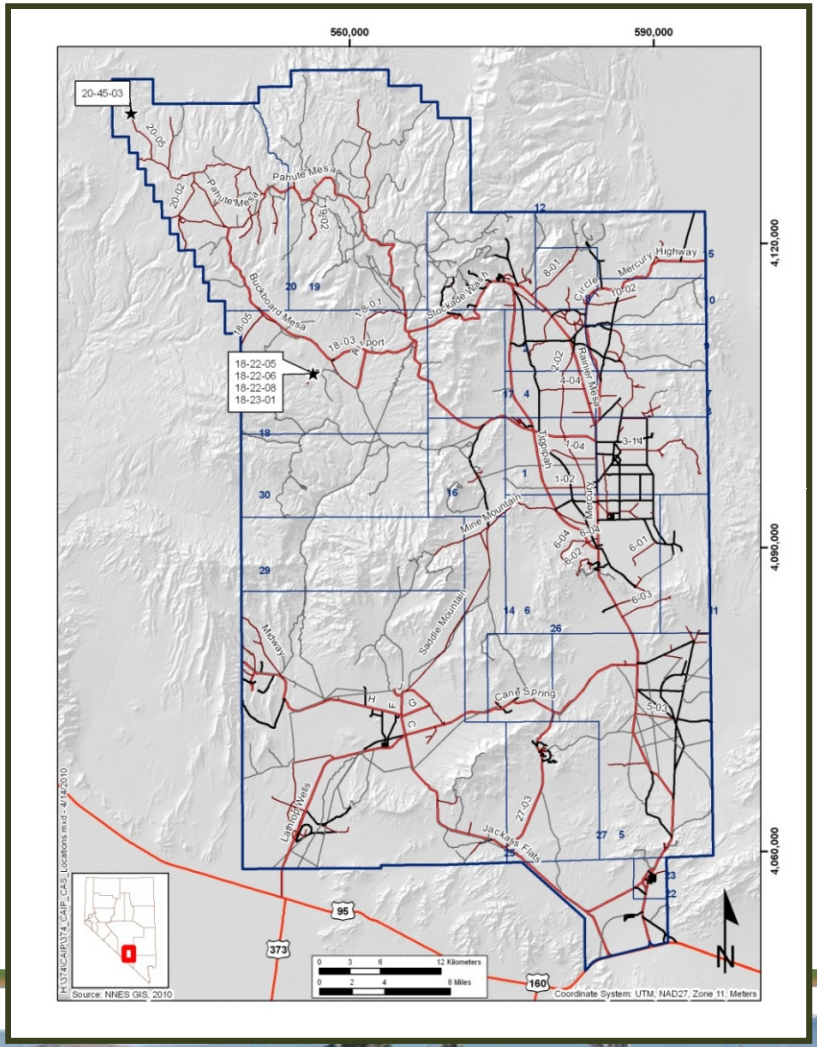


- Extent based on correlation of isopleths to dose



CAU 374: Schooner Unit Crater Map

- Corrective Action Site (CAS) 20-45-03, Schooner
- CAS 18-23-01, Danny Boy
- CAS 18-22-05, Drum
- CAS 18-22-06, Drums (20)
- CAS 18-22-08, Drum

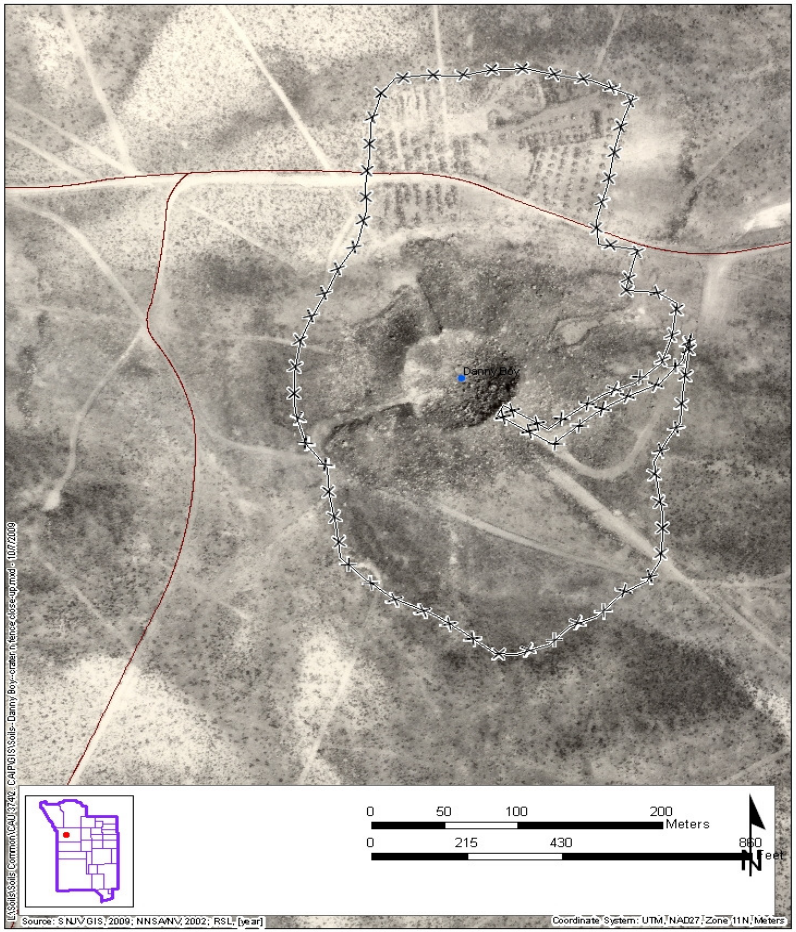


CAU 374
Schooner

- Plowshare experiment
- Yield of 30 kilotons
- Detonated December 8, 1968
- Depth of burial was 111.2 m
- Crater is 260 m in diameter, and 63.4 m deep

CAU 374
Danny Boy

- Weapons effects test
- Yield of 0.43 kilotons
- Detonated March 5, 1962
- Depth of burial was 33.5 m
- Crater is 80.8 m in diameter and 25.6 m deep

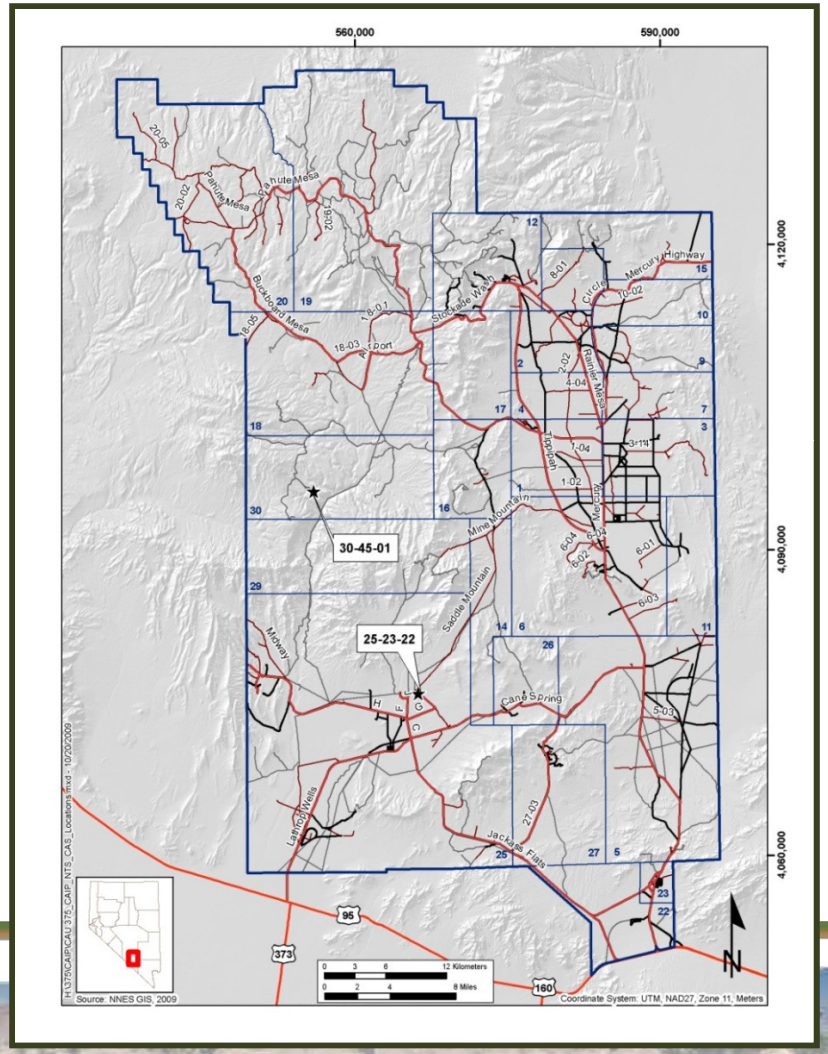


CAU 374 Status

- Corrective Action Investigation Plan approved February 2010
- May - June 2010: TLD placement and sampling conducted at the Schooner and Danny Boy CASs
- June 2010: Debris inspection and sampling conducted at the three drum CASs
- Radiological Walkover Surveys are planned for October - November 2010
- Expect final results late November 2010

CAU 375: Area 30 Buggy Unit Craters Map

- CAS 30-45-01, Buggy
- CAS 25-23-22, Test Cell A

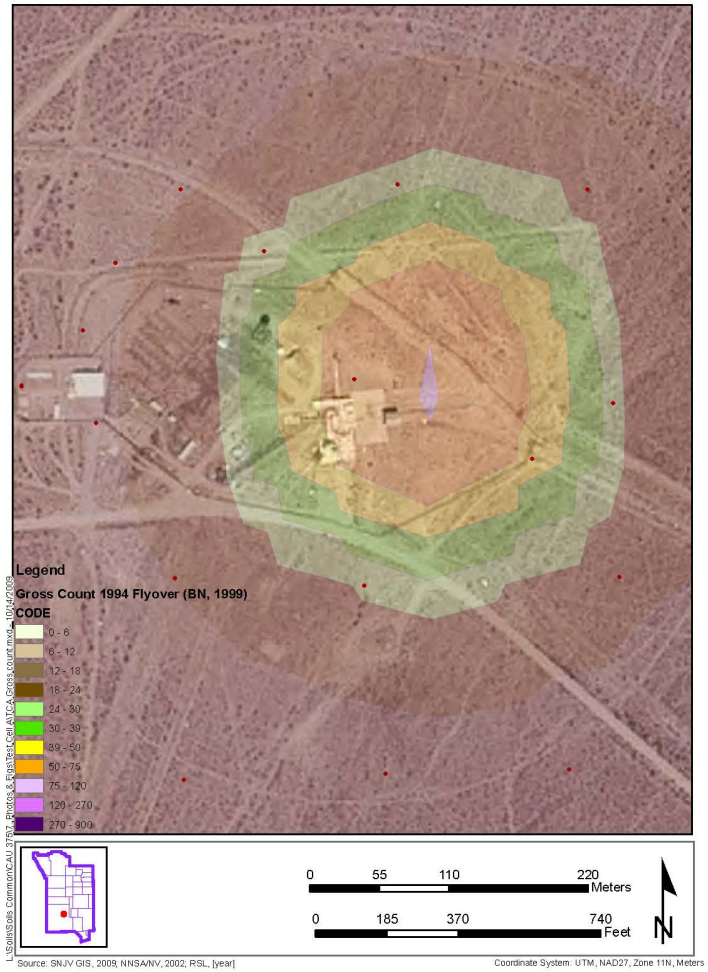


CAU 375
Buggy

- Plowshare experiment
- Five 1.08 kiloton devices detonated simultaneously
- Detonated March 12, 1968

CAU 375
Test Cell A

- Nuclear rocket testing
- Unshielded nuclear reactor
- Operated from 1958 through 1966

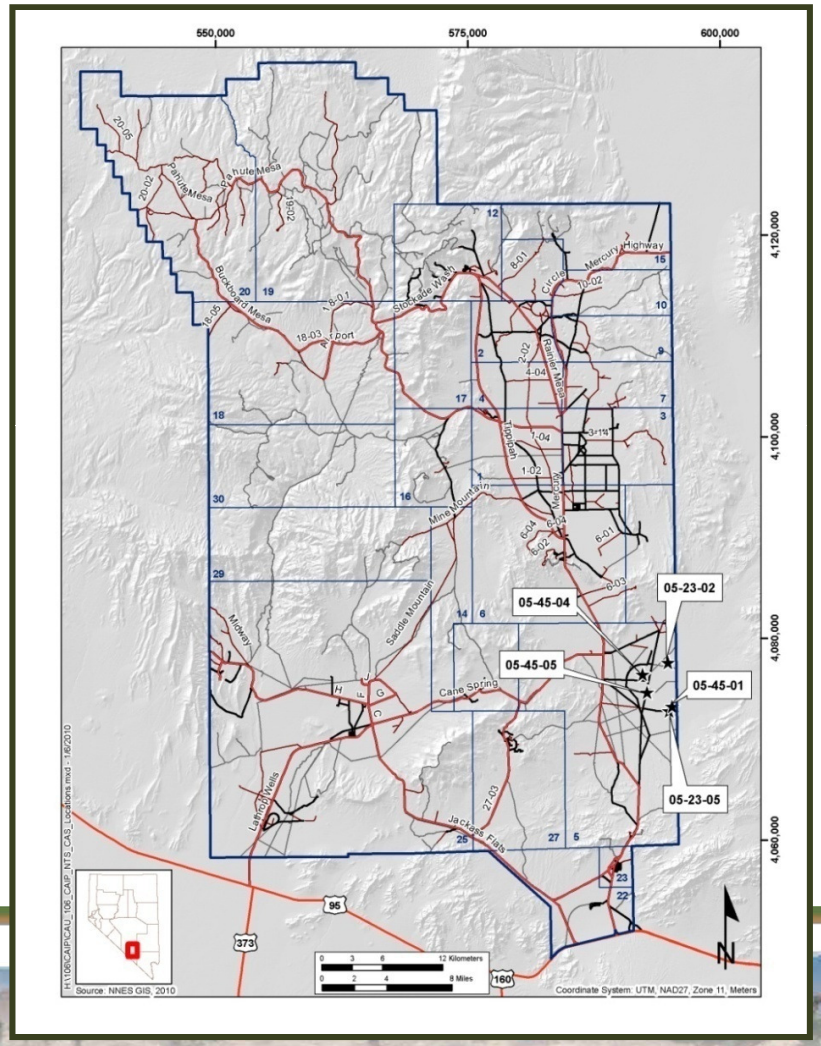


CAU 375 Status

- Corrective Action Investigation Plan approved March 2010
- July/August 2010: TLD placement at Buggy
  September 2010: TLD placement at Test Cell A
- September 2010: Soil samples collected at Buggy
  October 2010: Soil samples collected at Test Cell A
- Buggy TLDs to be collected in October/November 2010
  Test Cell A TLDs to be collected in December 2010
- Expect final results in late December

CAU 106: Areas 5, 11 Frenchman Flat Atmospheric Sites Map

- CAS 05-23-02, GMX
- CAS 05-23-05, Able
- CAS 05-45-01, Hamilton
- CAS 05-45-04, 306 Ground Zero (GZ)
- CAS 05-45-05, 307 GZ



CAU 106

GMX

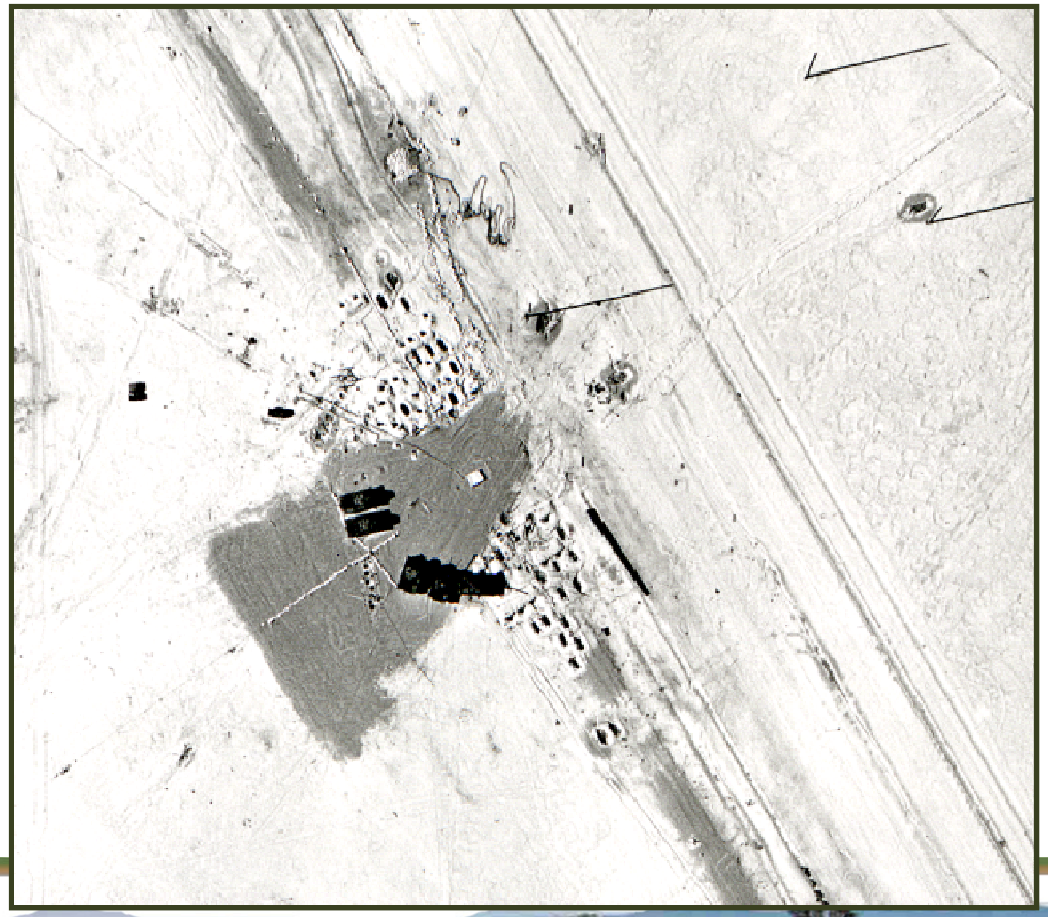
- Series of 24 “equation of state” experiments, conducted 1954 to 1956

Able

- Air drop test
- Conducted April 1, 1952 as part of Operation Tumbler-Snapper

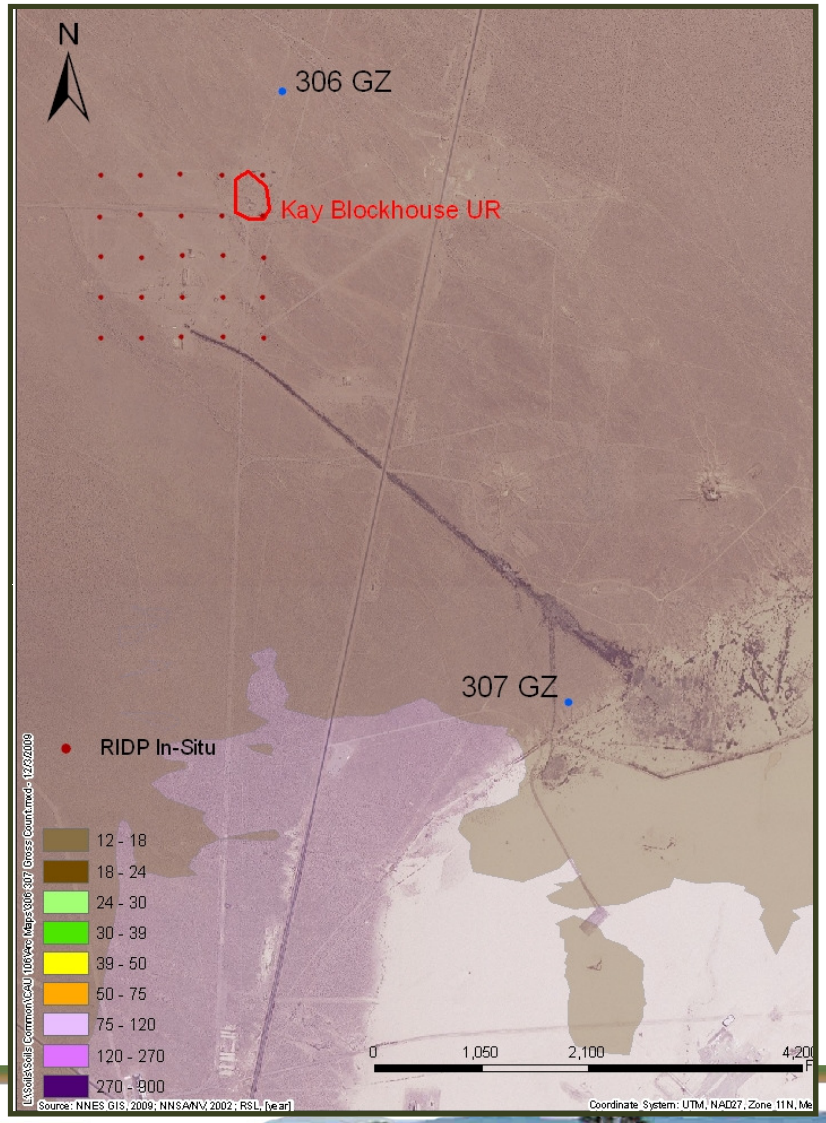
CAU 106
Hamilton

- Conducted October 15, 1958 on a 50 ft wood tower
- Yield: 1.2 tons



CAU 106 "306" and "307" GZ

- CASs consist of potential releases to surface and subsurface soil associated with activities at Underground Radioactive Material Areas and a Contamination Area
- Metal and depleted uranium debris present on ground surface

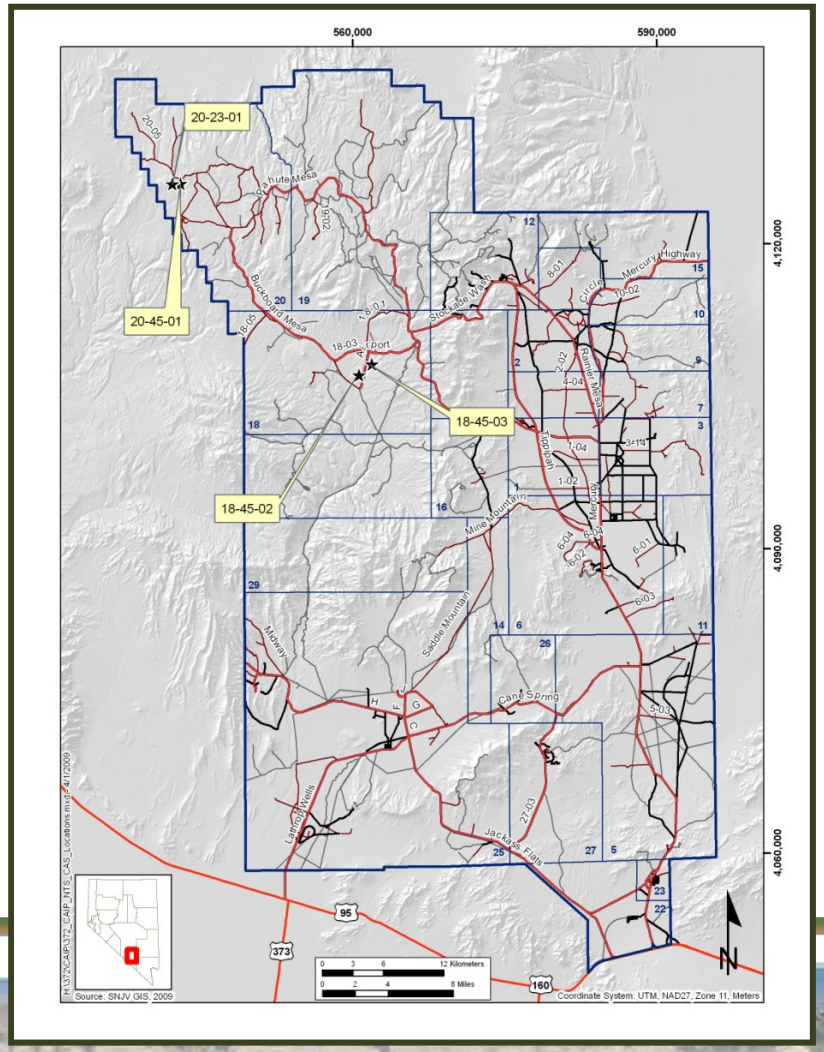


CAU 106 Status

- Corrective Action Investigation Plan approved April 2010
- Field activities started October 2010 with expected completion date of January 2011
- Field investigation activities being performed:
  - Walkover radiological surveys
  - Geophysical surveys to identify potential buried wastes
  - Soil sampling of test and non-test releases
  - TLD placement/retrieval
- Expect final results February 2011

CAU 372: Area 20 Cabriolet/Palanquin Unit Craters Map

- CAS 18-45-02, Little Feller I
- CAS 18-45-03, Little Feller II
- CAS 20-23-01, Palanquin
- CAS 20-45-01, Cabriolet



CAU 372
Little Feller I

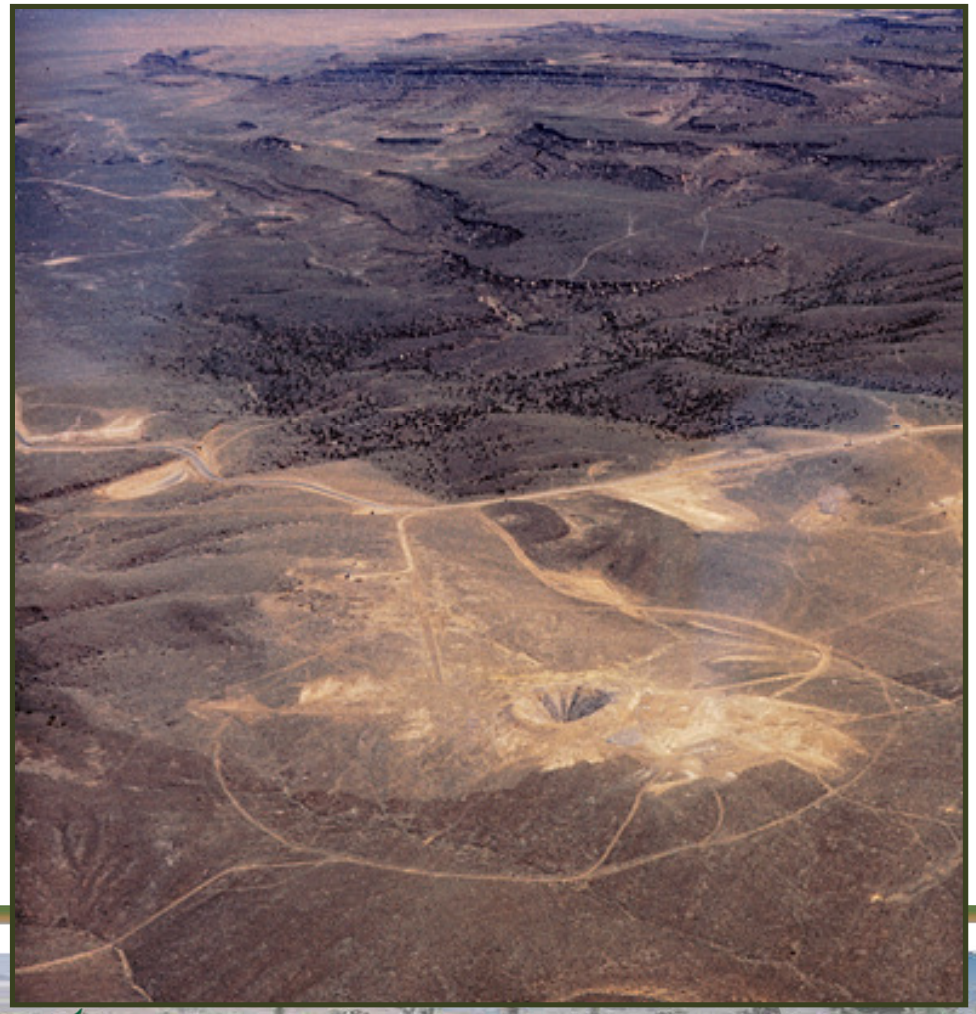
- Weapons effects test
- Detonated July 17, 1962
- Detonated approximately one meter above ground surface

CAU 372
Little Feller II

- Weapons effects test
- Detonated July 7, 1962
- Detonated one meter above ground surface

CAU 372
Palanquin Test

- Plowshare experiment
- Yield of 4.3 kilotons
- Detonated April 14, 1965
- Depth of burial was 85 meters



CAU 372
Cabriolet Test

- Plowshare experiment
- Yield of 2.3 kilotons
- Detonated January 26, 1968
- Depth of burial was 52 meters

CAU 372 Status

- Corrective Action Investigation Plan approved June 2009
- November 2009 – August 2010: Completed initial field investigation activities
- August 2010: Meeting conducted with State of Nevada Division of Environmental Protection (NDEP) and the Nevada Site Office to discuss preliminary results and need for step-out sampling/additional TLD placement
- September – October 2010: Soil sampling and TLD placement conducted/completed. Expect final results January 2011
- Preliminary Results – Refer to handouts

NSSAB Involvement

- Recommend exposure scenarios (Industrial, Remote Work, Occasional Use) for application to each CAS
- Recommend Corrective Action Alternative (No Further Action, Clean Closure, Closure in Place) for each CAS
- November 10, 2010 deadline for recommendation on CAU 372
- Additional committee meetings on other sites when data available with recommendation due date for CAUs 374, 375, and 106 tentatively scheduled for January 2011

Corrective Action Unit (CAU) 566 - Engine Maintenance Assembly and Disassembly Compound

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November 2, 2010

Engine Maintenance Assembly and Disassembly (EMAD) Rail Cars

- As of October 25, there are seven rail cars located at the EMAD compound:
  - Two Locomotives
  - One Cable Spool Car
  - Two Flat Cars
  - One Manned Control Car
  - One Emplacement Installation Vehicle
- On October 21, the L 2 Locomotive (tugger) was removed from EMAD and transferred to the Nevada State Railroad Museum (Boulder City)

Locomotives

Cable Spool Car and Flatcar

Flatcar

Emplacement Installation Vehicle/Manned Control Car

Planned Disposition

- Investigate, decontaminate as necessary, and drain fluids regardless of the ultimate disposition (cable spool car and both flat cars are currently posted as radiologically contaminated)
- Disposition Alternatives upon remediation
  - Provide to Railroad Museum intact
  - Disassemble for parts and provide to museum
  - Disassemble and dispose on-site
  - Leave in place

Path Forward

- Continue Rail Car field investigation efforts that are currently underway
- Work with interested parties to identify an economical and useful disposition for the rail cars
- Receive a recommendation from the Nevada Site Specific Advisory Board regarding their preferred path forward
  - Recommendation needed by March 2011

Path Forward
(continued)

- Document in accordance with the Federal Facility Agreement and Consent Order the investigation results and final resolution for the rail cars
- All decisions/plans for removal of cars/parts/engines are subject to requirements of DOE Orders regarding the removal of property

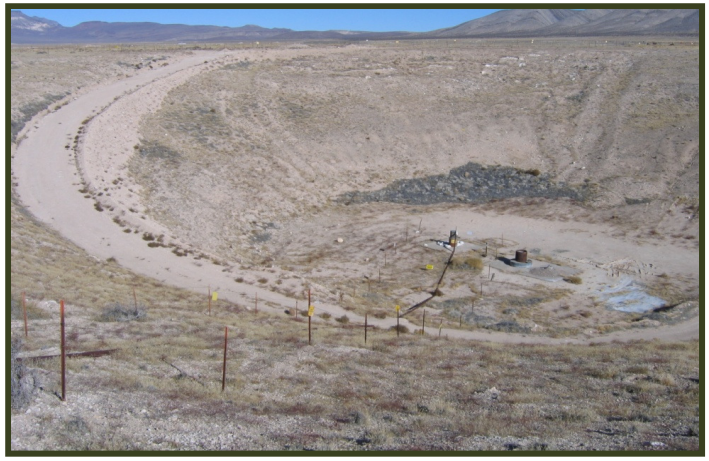
CAU 547
Miscellaneous Contaminated Waste Sites

Rob Boehlecke
Environmental Restoration Federal Project Director
Nevada Site Specific Advisory Board
November 2, 2010

Corrective Action Unit (CAU) 547

- Background
  - CAU 547 is comprised of three Correction Action Sites (CAS)
    - 09-99-06 Player
    - 02-37-02 Mullet
    - 03-99-19 Bernalillo
  - The primary component of each of CAS is piping that contains plutonium (Pu)
  - The piping and Pu remain from underground safety tests
  - Pu is present above the transuranic (TRU) waste limit of 100 nCi/g

CAS 09-99-06 Player



- Conducted in 1964 by Lawrence Livermore National Laboratory (LLNL)
- Total pipe length is 650 feet
- Portion of pipe on crater slope
- Soil covers only short lengths of pipe
- Small tanks and accelerometer

CAS 02-37-02 Mullet

- Conducted October 1963 by LLNL
- Total Length approximately 400 feet
- Partially disassembled
- Soil contamination is present
- Very little soil cover over pipe

CAS 03-99-10 Bernalillo

ISOCS unit
(in-situ object
counting system)

- Tejon test conducted May 1963 by Los Alamos National Laboratory (LANL)
- Bernalillo was receiving location
- 140 feet of pipe above grade – covered with soil
- 300 feet of pipe is below grade
- Some structures within contamination area
- Only 2 feet of piping is exposed

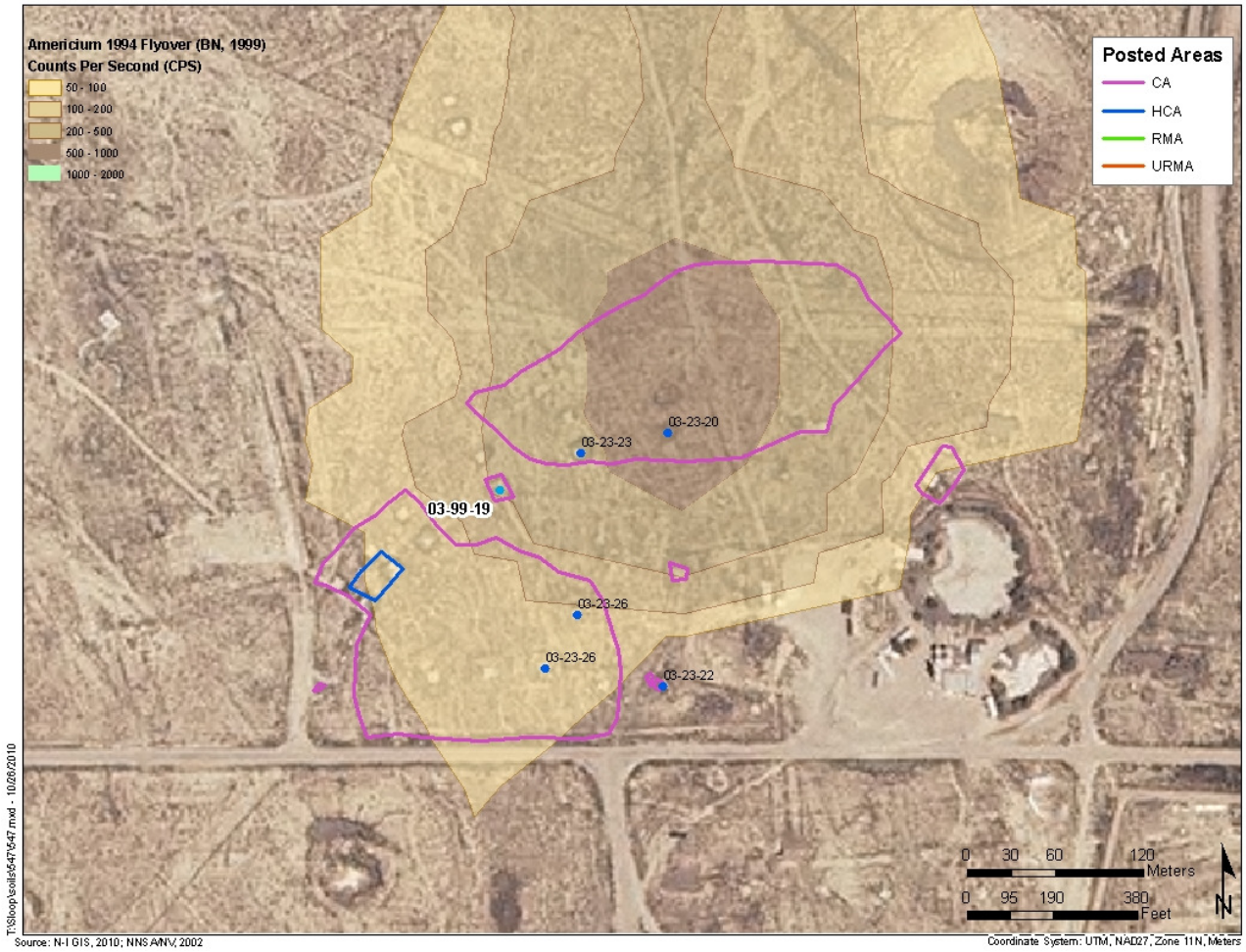
Safety Tests Document

- Review of 64 Safety Tests conducted at 58 sites
  - Documentation and drawings review
  - Site visits
  - ISOCS surveys at select sites
- Categorized by type of test and surface features
- 8 sites identified for further investigation (ISOCS)
  - ISOCS investigation confirmed contamination concentrations at Player and Mullet exceed transuranic levels
  - ISOCS investigation identified 3rd site exceeding transuranic levels of contamination – Bernalillo
- Present status- Three similar sites requiring corrective action

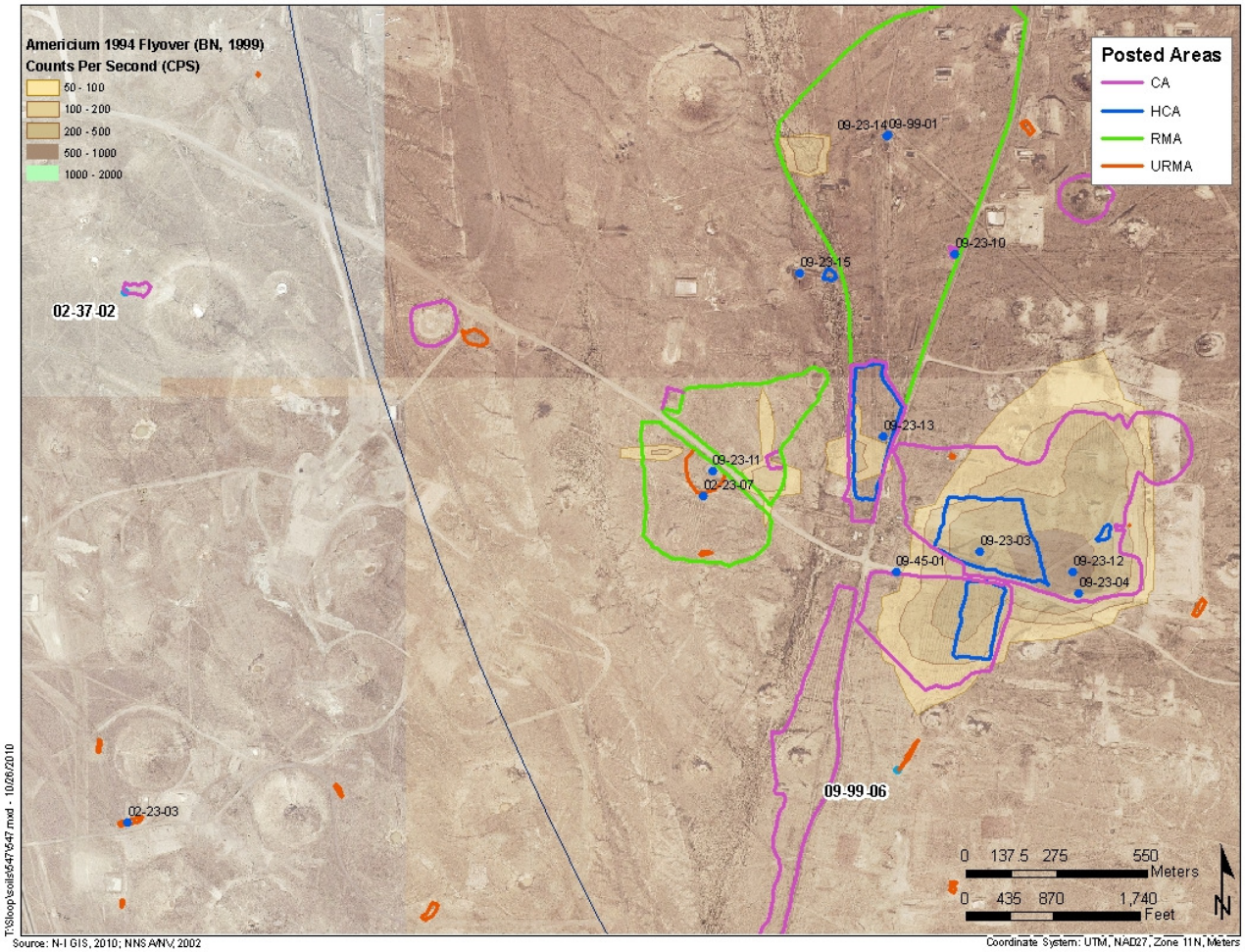
Comparison of Pu Quantity to Soil Sites

- Pu quantity at CAU 547
  - Estimated 172 grams in piping at CAS 09-99-06 (Player)
  - Estimated 223 grams in piping at CAS 03-99-19 (Bernalillo)
  - Estimated 0.97 grams in piping at CAS 02-37-02 (Mullet)
- CAU 105 near the CAU 547 site
  - ~ 1,000 grams
- Pu Valley (Area 11)
  - > 1,000 grams
- Oberon/Ceres (Area 8)
  - ~1,333 grams

Soils Sites near Player and Mullet



Soils Sites near Bernalillo



Remediation Strategy

- Currently considering two remediation options
  - Clean Closure – Cover with soil with long term monitoring
  - Close in Place – Remove piping and dispose as TRU Waste
- Multiple options were reviewed for closure strategy
  - Remove pipe and dispose at location
  - Remove pipe in large lengths and ship off-site
  - Grout pipe and leave in place
  - Flush pipe and leave in place
- Key drivers in finalizing the strategy:
  - Nuclear Safety
  - Worker Safety
  - Long-term hazard to personnel
  - Regulatory (Department of Energy [DOE] Orders)
  - Technical Execution/Cost

Clean Closure Option

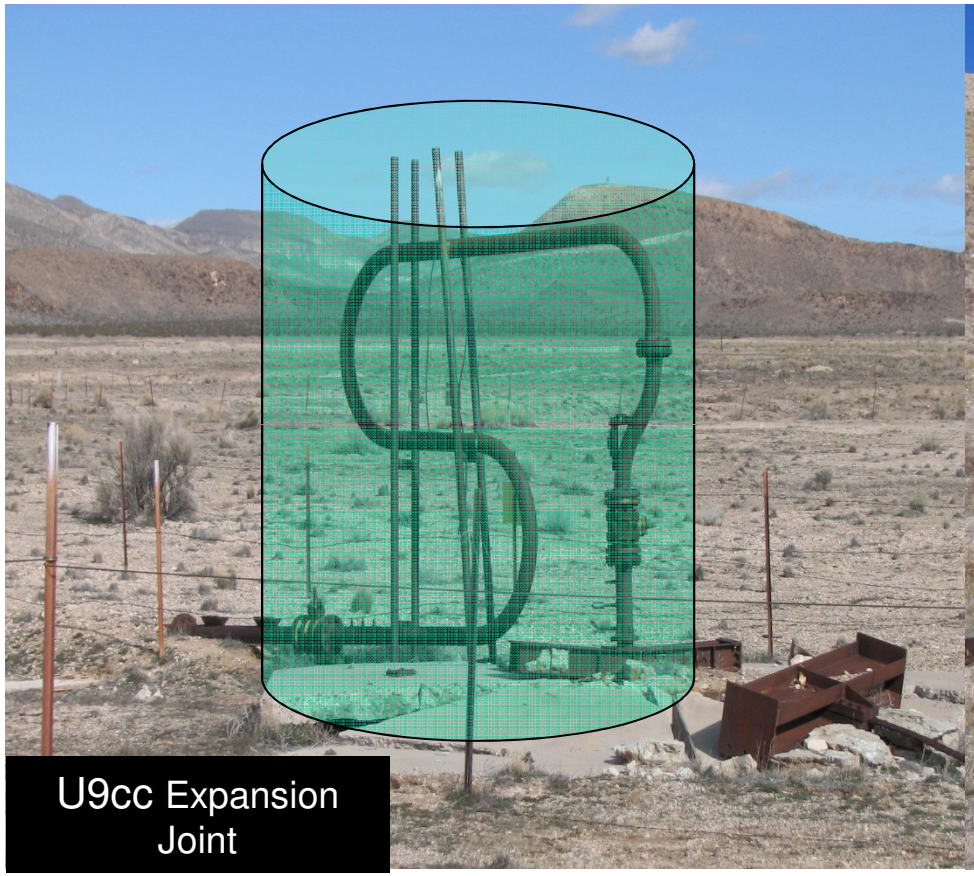
- Pipe is cut in place, and placed in containers
  - Pipe requires management as TRU waste
    - Containers will be staged at Area 5 Radioactive Waste Management Site (RWMS) TRU Pad
    - Storage under existing nuclear facility requirement
    - Upon completion of clean closure, containers transported to Idaho for final characterization and shipment to Waste Isolation Pilot Plant (WIPP) in New Mexico
  - Work can be segmented so as not to reach nuclear facility status
  - Low Level Waste (LLW) generated on-site (i.e. personal protective equipment, glovebags, soil) disposed at RWMS
  - Clean closure is estimated between $6M and $40M

Close in Place Option

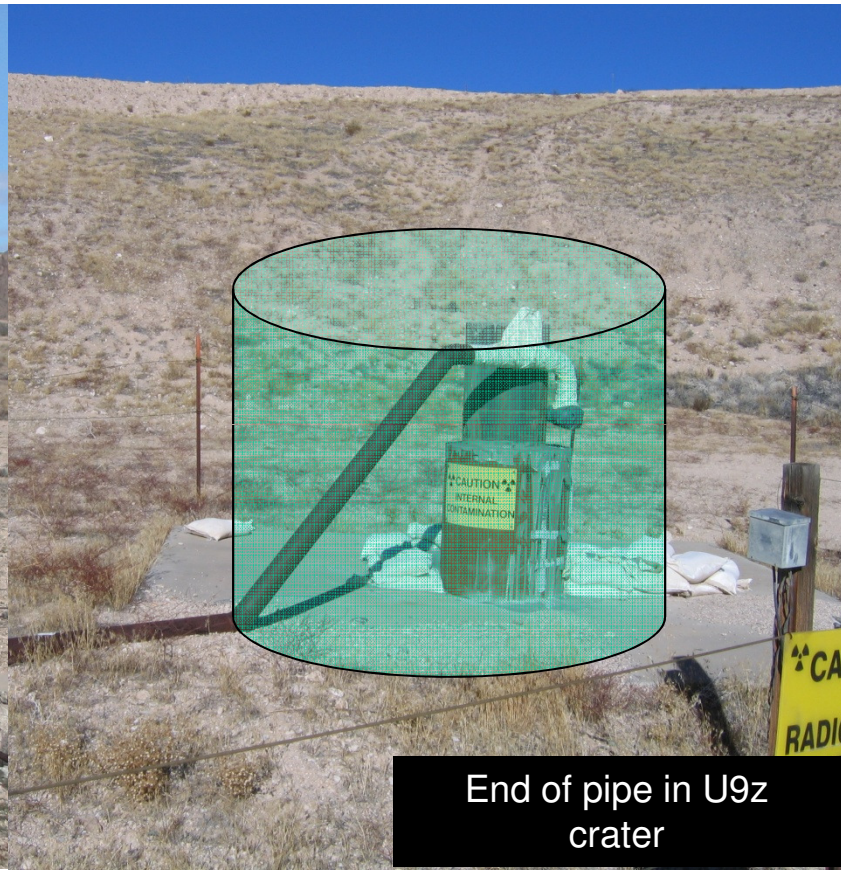
Close In Place with Use Restriction (UR)

- Player
  - Cover all components with at least 3 ft of soil without breaching the piping and install a geo-textile material, fill geo-textile cells with material that is unattractive to rodents
- Mullet
  - Cover all components and soil contamination areas with at least 3 feet of soil and install geo-textile material and fill cells
- Bernalillo
  - Supplement existing cover as needed and install geo-textile material and fill cells
  - Investigate Tejon Vault and determine if filling is necessary
- High profile features will be covered with soil using a retention structure
- Implement a UR and physical barriers (fencing) that prevents intrusion

Encasement of Surface Features at CAS 09-99-06 Player



U9cc Expansion Joint



End of pipe in U9z crater

Worker Safety is Priority for Both Remediation Options

- Planning and Execution focused on protecting worker
  - Clean Closure
    - Mobile glovebox
    - Establish contamination area
    - Respiratory protection and Personal Protective Equipment
  - Close in Place
    - Soil placed at perimeter and slowly worked onto pipe
    - Collars placed around elevated surface features
  - Safety for both options designed to prevent release while still protecting worker in the event of a release

Nuclear Safety

- Initial categorization of three sites as Hazardous Category (Haz Cat) 3
  - Pu-239 inventory greater than 8.4 grams
- NSO Nuclear Safety staff are in agreement that hazard analysis to demonstrate “less than Haz Cat 3” status is reasonable
  - No Documented Safety Analysis required
  - Standard Occupational Safety and Health Administration (OSHA) and Integrated Safety Management (ISM) programs constitute safety basis
- Develop Hazard Analysis by December 2010

Technical Execution/Costs

- Technical Execution
  - Clean Closure
    - Pipe cutting method and packaging
    - Use of mobile glovebox
    - Pipe on slope at Player
  - Close in Place
    - Depth of Soil Cover
    - Erosion Prevention
    - Long Term Monitoring
- Development of cost estimates for both options under development
- Due to differences at each site it may be possible to implement a mix of remediation strategies
  - For example: Clean Close Mullet and Close in Place Player and Bernalillo

Regulatory Questions

- Is the remediation consistent with DOE Complex-wide response and does justification exist to Close in Place?
  - Addressed through the review/documentation of EM work at other DOE sites and Risk Evaluation Document (provided to State of Nevada Division of Environmental Protection
  - Results from these documents will be incorporated in Streamlined Approach for Environmental Restoration (SAFER) for approval within the Federal Facility Agreement and Consent Order (FFACO) process
- Risk Document – evaluates remediation options based on risk and dose scenarios

Regulatory Questions
(continued)

- Risk Document – evaluates remediation options based on risk and dose scenarios
- DOE Complex-Wide Document – provides the results of similar sites and remediation solutions throughout DOE
  - Idaho National Laboratory, Oak Ridge National Laboratory, and Savannah River Site- Close in place has been performed with regulator approval
  - Hanford and LANL - Close in place has been proposed with final solution pending

Regulatory Framework for Closure

- Currently the site and proposed closure activities are not subject to DOE Order 435.1A
- Clean Closure – must comply with DOE 435.1A
- Close in Place - DOE 435.1A not applicable, but subject in the long term to FFACO and 10 Code of Federal Regulations (CFR) 835 requirements
- Final decision and documentation of compliance method will be described in the SAFER

Modeling for Close in Place

- Same model used to assess Area 3 RWMS with assumptions:
  - no credit for containment by pipe
  - one-dimensional model conservatively assumes that entire length of piping has the same conditions (e.g., burrowing is continuous along pipe)
  - release to surface soil by burrowing, plant uptake, liquid diffusion
  - no groundwater pathway
- Model assumes exposure is to a transient visitor for no more than 80 hours per year
- One foot of cover results in less than 25 mrem per year over 1,000 year period

Path Forward

- Close In Place approach discussed with DOE/Headquarters (HQ)
  - DOE/HQ verbally expressed agreement with Close in Place
- Continue to discuss merits of both options with NDEP
  - Close In Place scenario remains the preferred alternative
- Continue to evaluate considerations such as worker safety, long-term monitoring, nuclear facility compliance, and cost of closure options

Summary

- Two options for closure continue to be evaluated
- Continue discussions with NDEP
- SAFER will be finalized to describe the selected approach
- Current schedule for SAFER – May 31, 2011

NSSAB Role

- Provide recommendation on closure alternative:
  - Close in Place (if selected, provide recommendation on protective measures)
  - Clean Closure
  - Other option
- One additional committee meeting tentatively planned for December to update on any new information (e.g. estimates)
- Recommendation due for consideration at Full Board meeting January 12, 2011