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HAZARDOUS WASTE  
INSTALLATION ASSESSMENT REPORT

COPY

BY  
DAVID N. FAUVER

MAY 1986

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## ABSTRACT

The objective of the Hazardous Waste Installation Assessment Project was to identify and evaluate inactive sites on DOE/NV installations where hazardous substances may have been released into the environment. The "Installation Assessments" were the first phase of the DOE/NV effort intended to satisfy the requirements DOE Order 5480.14, "Comprehensive Environmental Response, Compensation, and Liability Act Program."

Ten installations were investigated including the Nevada Test Site (NTS), Shoal Test Site, Central Nevada Test Site (CNTS), Gasbuggy Test Site, Gnome Test Site, Rio Blanco Test Site, Rulison Test Site, Tatum Dome Test Site, Tonopah Test Range (TTR), and Amchitka Test Site.

There was no written documentation identifying the release or disposal of non-radioactive hazardous material at any of the installation investigated. However, potential mixed waste streams were identified through interviews with project participants. These waste streams were from decontamination and cleaning operations, as well as small laboratory operations.

Hazardous substances were identified at three of the ten installations; NTS, Amchitka Test Site, and CNTS. Chemical materials were detected in samples collected at Amchitka and CNTS. Radioactivity was identified at NTS.

Hazardous ranking calculations were performed for the above three installations. Using conservative values of the "Waste Quantity" factor, the resulting mHRS scores were all less than one, indicating a very small risk of the hazardous material migrating and posing a risk to health, safety, and the environment.

Using the criteria described in DOE Order 5480.14, Comprehensive Environmental Surveys, Phase II, do not appear to be justified as there seems to be no significant potential for environmental impact at these sites. However, more work may be justified at the CNTS and Amchitka Test Site on the grounds that the findings were unexpected and undocumented. It may be prudent to have a better understanding of the type and quantity of materials present at these two installations before the DOE/NV CERCLA effort is concluded.

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## INSTALLATION ASSESSMENT REPORT

### 1.0 INTRODUCTION

There is increasing state and federal regulatory emphasis on hazardous material control making it important to identify and assess conditions at Department of Energy (DOE) installations that have a potential for adversely affecting the environment. In response to this increased emphasis, the DOE/NV Office provided funding for Reynolds Electrical & Engineering Co., Inc., (REECO) to initiate the Hazardous Waste Installation Assessment Project.

The objective of this project was to identify and evaluate inactive sites on DOE/NV installations where hazardous substances, as defined in DOE Order 5480.14, may have been released into the environment. These "Installation Assessments" are the first phase of the DOE/NV effort intended to satisfy the requirements of DOE Order 5480.14, "Comprehensive Environmental Response, Compensation, and Liability Act Program."

Ten installations were investigated, two of which, the Nevada Test Site (NTS) and the Tonopah Test Range (TTR), are currently operational. The ten installations are:

1. Nevada Test Site
2. Shoal Test Site
3. Central Nevada Test Site
6. Rio Blanco Test Site
7. Rulison Test Site
8. Tatum Dome Test Site

4. Gasbuggy Test Site

9. Tonopah Test Range

5. Gnome Test Site

10. Amchitka Test Site

Each investigation included a historical records search, a site inspection including preliminary sampling, and a brief hydrogeological survey. The relative potential for health and environmental impacts from the migration of hazardous substances were then calculated using DOE's Modified Hazard Ranking System. Based on the above information, a decision was made concerning the need for further evaluation (i.e., PHASE II).

## 2.0 INSTALLATION DESCRIPTIONS

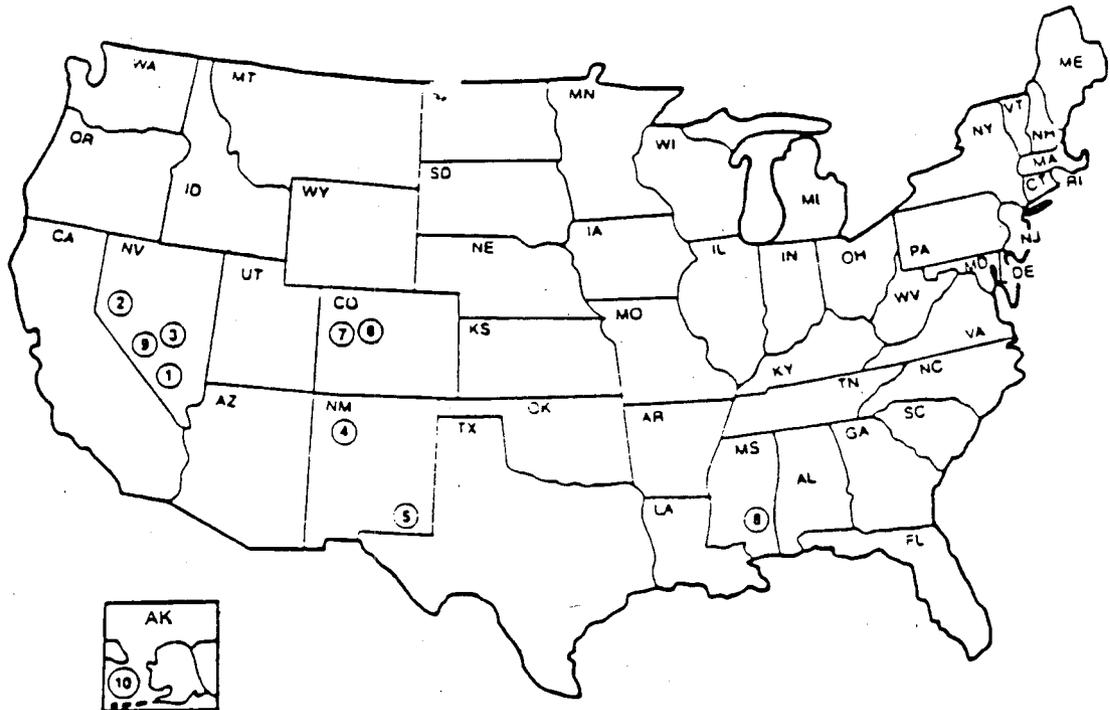
A brief description of each installation investigated is presented in Appendix A. The description includes the location, mission, and pertinent operational information for each installation. Figure 1 shows the location of each installation.

## 3.0 METHODOLOGY

The methods used for the historical records search, site inspection and sampling, and sample analyses are detailed below.

### 3.1 Historical Records Search

The historical records search consisted of two tasks: 1) review and evaluate all documentation which may include information pertaining to



- |   |                          |   |                      |
|---|--------------------------|---|----------------------|
| ① | NEVADA TEST SITE         | ⑥ | RIO BLANCO TEST SITE |
| ② | SHOAL TEST SITE          | ⑦ | RULISON TEST SITE    |
| ③ | CENTRAL NEVADA TEST SITE | ⑧ | TATUM DOME TEST SITE |
| ④ | GASBUGGY TEST SITE       | ⑨ | TONOPAH TEST RANGE   |
| ⑤ | GNOME TEST SITE          | ⑩ | AMCHITKA TEST SITE   |

Fig. 1 - DOE/NV installation investigated for potential CERCLA hazardous waste release sites.

hazardous waste release sites; and, 2) interview past and present employees who were involved with projects carried out at the above ten installations. The records search was conducted by REECo and THERMO ELECTRON Eberline Analytical Corporation. Eberline's input was requested since they were responsible for the radiological support for several of the DOE/NV projects.

Using information gathered during the records search, a list of sites where hazardous substances were potentially released to the environment was generated for each installation. Each site identified was investigated. Appendix B contains a list of the documents referenced.

### 3.2 Site Inspection And Sampling

After a list of potential hazardous substances released sites were compiled for a given installation, an installation inspection was conducted. At least one soil sample was collected at all identified sites. The sampling and analysis was designed to augment the information gathered during the records search, not to provide a comprehensive inventory of each site. Since the sampling was a limited, qualitative effort, the analytical results alone do not provide sufficient information to determine the presence or absence of hazardous material. The results of the sample analysis must be interpreted in light of the information provided by the records search.

For mixed waste sites, only samples with a survey instrument contact reading of less than 70  $\mu$ R/h were shipped. This limitation affected the

choice of samples to be analyzed from NTS sites, but not the other nine installations.

One sample was collected from the majority of the sites identified on non-NTS installations. The depth of the sample ranged from the surface to six feet, depending upon the characteristics of the particular site.

For the NTS sites, a more detailed sampling program was followed due to the larger area of each site and the extent of each site's past usage. Several samples were collected at various depths from each site identified on the NTS.

### 3.3 Chemical Analysis

Up to two soil samples from each potential chemical release site were analyzed by UNBTL, Inc. These samples were prepared for analysis by the "EP" Toxicity Leaching Method as described in the EPA manual of "Test Methods of Evaluating Solid Wastes," Publication No. SW-846. The resulting leachate was analyzed for pesticides by EPA 608, herbicides by EPA 615, and metals by atomic absorption. The soil samples were also analyzed for volatile halocarbons by EPA Method 8240.

Appendix C contains a list of the target substances of the chemical analyses.

### 3.4. Radioanalytical Analysis

Each soil sample collected at the Nevada Test Site was submitted to the REECo Environmental Sciences Department (ESD) Laboratory for gamma spectroscopy analyses. Only the samples collected at the Nevada Test Site were analyzed for radioactivity since extensive decontamination and decommissioning work was carried out at the other nine installations (see references in Appendix B). No further analysis for radioactivity was deemed necessary at the nonNTS sites. All radionuclides identified at NTS, other than naturally occurring, was reported.

### 4.0 HYDROGEOLOGICAL SURVEY

Information which can be used to assess the potential for migration of hazardous substances via the groundwater migration route is provided for each installation. Title 40 CFR, Part 300, Appendix A was used as guidance in selecting the appropriate geological, hydrological, and environmental factors to consider, as well as the techniques for determining these factors. The groundwater route of migration is seen as the only migration route of concern for the installation in question.

The hydrogeological data was derived from published documents. More detailed surveys entailing field measurements and investigations, may be appropriate if a comprehensive site characterization is deemed necessary. The factors investigated included depth of aquifer of concern, net precipitation, hydraulic conductivity, groundwater use of aquifer of concern, and distance to the nearest well.

The results of the hydrogeological survey of each installation is summarized in Table 1.

## 5.0 MODIFIED HAZARD RANKING SYSTEM

The relative potential for environmental impact from the release of hazardous materials can be evaluated by using the Modified Hazard Ranking System (mHRS). The mHRS is described in the draft manual "Modified Hazard Ranking System For Sites With Mixed Radioactive and Hazardous Wastes - Users Manual," by K. A. Hawley, R. A. Peloquin, and R. D. Stenner. An mHRS/HRS computer code has been developed by Pacific Northwest Laboratory to provide a uniform code for DOE facilities to use in performing their CERCLA Phase I mHRS/HRS calculations. This code was used to perform mHRS evaluations on the worst site identified at three DOE/NV installations, NTS, Amchitka Test Site, and CNTS. There was no hazardous waste identified at the remaining seven installations investigated.

Due to the remote locations and favorable geologies of the sites investigated (see Table 1), as well as the relatively small quantities of hazardous material identified, the mHRS scores were extremely small, i.e., less than one. The calculations were based on the best data available. However, the "Waste Quantity" and "Targets" factors were overestimated to produce a conservative (i.e., maximum) score.

TABLE 1

## SUMMARY OF THE HYDROGEOLOGICAL DATA FOR EACH INSTALLATION

| Installation             | Depth to Aquifer of Concern (Feet) | Net Precipitation (Inches) | Hydraulic Conductivity (cm/sec) | Groundwater Use                                | Distance to Nearest Well (Miles) |
|--------------------------|------------------------------------|----------------------------|---------------------------------|--|----------------------------------|
| Nevada Test Site         | 1040                               | - 59                       | $10^{-7} - 10^{-10}$            | Domestic, Stock<br>Industrial,<br>Irrigation   | 12                               |
| Shoal Test Site          | 361 - 968                          | - 43                       | $1 \times 10^{-6}$              | Stock  | 5                                |
| Central Nevada Test Site | 500                                | - 50                       | $2 \times 10^{-3}$              | Stock  | 3                                |
| Gasbuggy Test Site       | 50 - 3600                          | - 29                       | $6 \times 10^{-5}$              | Stock  | 3                                |
| Gnome Test Site          | 500                                | - 58                       | $2 \times 10^{-5}$              | Stock  | 4                                |
| Rio Blanco Test Site     | 45                                 | - 14                       | $4 \times 10^{-3}$              | Stock & Irrigation                             | 6                                |
| Rulison Test Site        | 20                                 | - 9                        | $4 \times 10^{-6}$              | Domestic, Stock &<br>Irrigation                | 4                                |
| Tatum Dome Test Site     | 0 - 40                             | + 14                       | $2 \times 10^{-5}$              | Domestic, Stock,<br>Municipal, &<br>Irrigation | 1                                |
| Anchitka Test Site       | 0 - 100                            | + 33                       | $10^{-3} - 10^{-5}$             | None   | 23                               |

The "mHRS Hazard Ranking System Facility Report" and the "mHRS Groundwater Worksheet" for the three sites evaluated are contained in Appendix E.

The mHRS scores are listed below:

| <u>Installation</u>      | <u>Score (groundwater route)</u> |
|--------------------------|----------------------------------|
| Nevada Test Site         | 0.08                             |
| Central Nevada Test Site | 0.36                             |
| Amchitka Test Site       | 0.58                             |

## 6.0 FINDINGS

The potential release sites investigated on NTS were identified through written documentation and interviews with project participants. These sites were well known and easily identified. However, for non-NTS installations, it was much more difficult to get firsthand information, i.e., from personal interviews, resulting in a more conservative approach entailing the investigation of "operational areas," which could possibly have been the site of an undocumented release, as well as sites specifically identified as potential release sites. "Operational areas" were investigated since there was no documented information to confirm or deny a release.

### 6.1 Nevada Test Site (NTS)

Eleven release sites were identified on the NTS. All eleven sites were known to contain radioactive material although the total quantity of

radioactive material released at each site is undocumented. Six of the identified sites potentially contain non-radioactive hazardous material.

These six sites are:

CP-2 Leachfield 06-05-01  
R-MAD Leachfield 25-05-03 / 25-05-02  
Test Cell-A Leachfield 25-05-01  
Test Cell-C Leachfield 25-05-02  
Area-26 Leachfield 26-05-07 (or 26-05-06)  
E-MAD Leachfield 25-05-01

There was no written documentation on the type or quantity of chemical waste released at these sites. However, personal interviews indicated that solvents used for the decontamination of equipment, laundry, reactor facilities, etc., were released at the above leachfields.

A description of each of the eleven sites identified is presented below. The location of each site is shown on Figure 2.

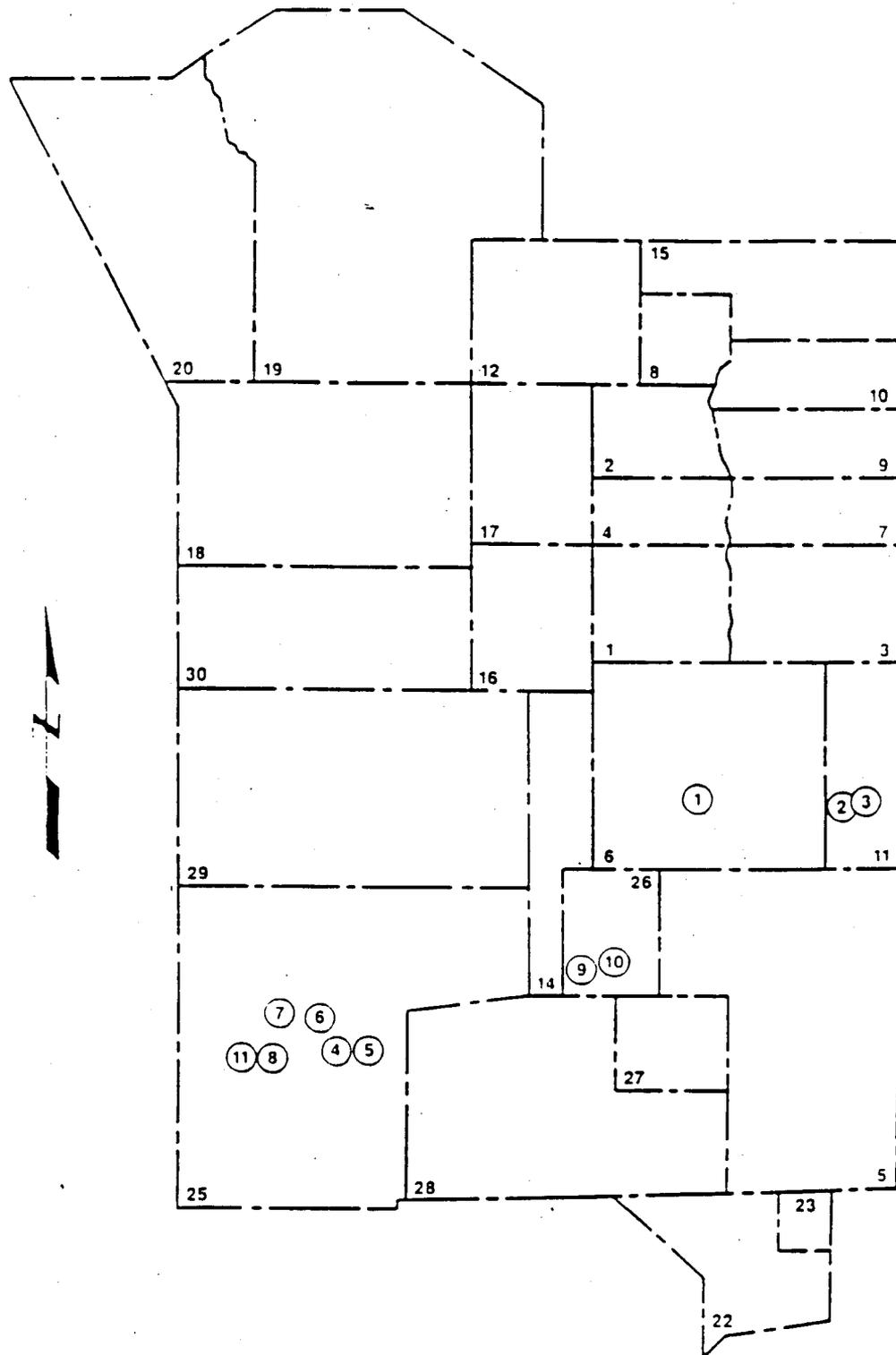


Fig. 2 NTS Locator - Potential hazardous waste release sites investigated at NTS. A description of each site identified is given in Section 5.1.

SITE #1 - CP-2 Leachfield 06-05-01

The CP-2 leachfield is located in Area 6. It was operational between 1951 and 1971. The CP-2 Leachfield was used for the disposal of liquid wastes from the decontamination of laundry and equipment. The liquid wastes contained radioactive isotopes, as well as chemical solvents and degreasers used in conjunction with the decontamination process.

The release of radioactive material into this leachfield was documented. There was no documentation as to the type or quantity of solvents released at this site.

SITE #2 - Contaminated Waste Dump #1 11-07-01

The CWD #1 is located in Area 11. This pit was used for the disposal of Pu-239 contaminated wastes generated during safety shots from 1955-1957. There was no documented or suspected release of non-radioactive hazardous waste at this site.

SITE #3 - Contaminated Waste Dump #2 11-08-02

Same as Site #2.

SITE #4 - Reactor Maintenance Assembly and Disassembly Facility (R-MAD)

Contaminated Waste Dump 25-23-09

Located in Area 25, this dump was used to dispose of solid radioactive waste material from R-MAD between 1958 and 1979. The R-MAD facility was used for assembly before and disassembly after testing of Kiwi Reactors. There was no documented or suspected release of non-radioactive hazardous waste at this site.

SITE #5 - R-MAD Leachfield 25-08-01/25-02-01

Located in Area 25, the R-MAD leachfield was used to dispose of liquid wastes generated primarily by decontamination operations. This site was operational between 1958 and 1973. The only known chemical released was trichlorethene, a solvent. The release of radioactive material to the R-MAD leachfield was documented. With the exception of trichlorethene, the type of solvents or degreasers released is unknown.

SITE #6 - Reactor Test Cell-A Leachfield 25-02-01

Located in Area 25, this leachfield was used for the disposal of liquid waste from Test Cell-A, which was designed for testing nuclear reactors for use as rocket engines. The liquid waste was generated primarily by decontamination operations. A chemical laboratory used in conjunction with equipment testing could also have contributed to the liquid waste stream. This site was operational between 1958 and 1966. The Test Cell-A leachfield is known to contain radioactive material. Suspected

non-radioactive materials released include solvents, degreasers, acids, etc. The types and quantities of chemical waste released to the Test Cell-C leachfield is unknown.

SITE #7 - Reactor Test Cell-C Leachfield 20-01-07

Located in Area 25, this leachfield was used to dispose of liquid waste generated by the decontamination of test reactors and the cleaning of stainless steel pipe in Test Cell-C. Test Cell-C was used for testing nuclear reactors for rocket engine development. It was operational between 1961 and 1973.

The liquid waste released contained radioactive material, i.e., fission products, as well as chemical solvents used during the decontamination and cleaning. The only known solvent used was trichlorethene, although the quantity released is unknown. With the exception of trichlorethene, the type and quantity of chemical waste released to the Test Cell-C leachfield is unknown.

SITE #8 - Engine Maintenance Assembly and Disassembly Facility (E-MAD)

Contaminated Waste Dump 20-20-08

Located in Area 25, this CWD contains solid radioactive contaminated wastes generated by operations at E-MAD. This site was operational between 1966 and 1973. There was no documented or suspected release of non-radioactive hazardous waste at the E-MAD contaminated waste dump (CWD).

SITE #9 - Tory Reactor Leachfield

26-01-07

Located in Area 26, this leachfield was used to dispose of liquid wastes generated by decontamination operations at the Tory Reactor from 1958 to 1964. The liquid waste contained radioactive material and possibly chemical solvents. The type and quantity of chemical waste released to the Tory Reactor leachfield, if any, is unknown.

SITE #10 - Tory Reactor Contaminated Waste Dump

26-19-01

Located in Area 26, this contaminated waste dump contains high level waste, including fuel elements, generated by the operation of the Tory Reactor. This site was operational between 1959 and 1964. There was no documented or suspected release of non-radioactive hazardous waste at this site.

SITE #11 - E-MAD Leachfield

26-07-01

Located in Area 25, the E-MAD Leachfield was used to dispose of liquid wastes generated primarily by decontamination operations at the E-MAD facility. The release of radioactive material was documented. The type and quantity of solvents or degreasers released is unknown. This site was operational between 1966 and 1973.

The radionuclides detected by gamma spectroscopy, other than naturally occurring, in soil samples collected at the eleven sites identified on NTS are listed in Appendix D.

Table 2 lists all of the hazardous chemicals or metals which were measured at concentrations above the detection limit in samples from each of the six NTS sites identified as potentially containing non-radioactive hazardous material. The results of the EP Toxicity Test are reported in mg per liter of extract. To determine if these concentrations are hazardous, they are compared to a list presented in <sup>49</sup>CFR 261.24. The results of the analysis for volatile halocarbons are reported in  $\mu\text{g}$  per kg of soil. The concentration of the halocarbons detected can be compared to quantities listed in <sup>49</sup>CFR 261.33 F.

## 6.2 Shoal Test Site

The historical records search indicated no chemical hazardous waste release sites at Shoal. The only material buried at the Shoal Test Site was soil slightly contaminated with radioactivity during drillback operations. This contaminated soil was consolidated and buried under several feet of uncontaminated earth.

There was one "operational area" investigated at Shoal. A description of the site is presented below. The location of the site is shown in Figure 3.

### SITE #1 - Post Shot Mud Pit

Located north of the Rad-Safe facility (see Figure 3), the post shot mud pit was used for the disposal of drilling mud. Historical records indicated that several feet of earth had been placed over the contaminated

TABLE 2

## NON-RADIOACTIVE HAZARDOUS SUBSTANCES DETECTED

## AT THE NEVADA TEST SITE

| SITE                   | CHEMICAL<br>OR<br>METAL | EP TOXICITY        |                      | HALOCARBON                |                     |
|------------------------|-------------------------|--------------------|----------------------|---------------------------|---------------------|
|                        |                         | DETECTED<br>(mg/l) | HAZARDOUS<br>(mg/l)* | DETECTED<br>( $\mu$ g/kg) | HAZARDOUS<br>(kg)** |
| CP-2 Leachfield        | Cadmium                 | 0.04               | 1.00                 |                           |                     |
|                        | Silver                  | 0.05               | 5.00                 |                           |                     |
| Test Cell-A Leachfield | Cadmium                 | 0.01               | 1.00                 |                           |                     |
|                        | Methylene<br>Chloride   |                    |                      | 64                        | 1000                |
| Test Cell-C Leachfield | Cadmium                 | 0.02               | 1.0                  |                           |                     |

\* Hazardous concentrations as list in 49 CFR 261.24.

\*\* Hazardous quantity as listed in 49 CFR 261.33.

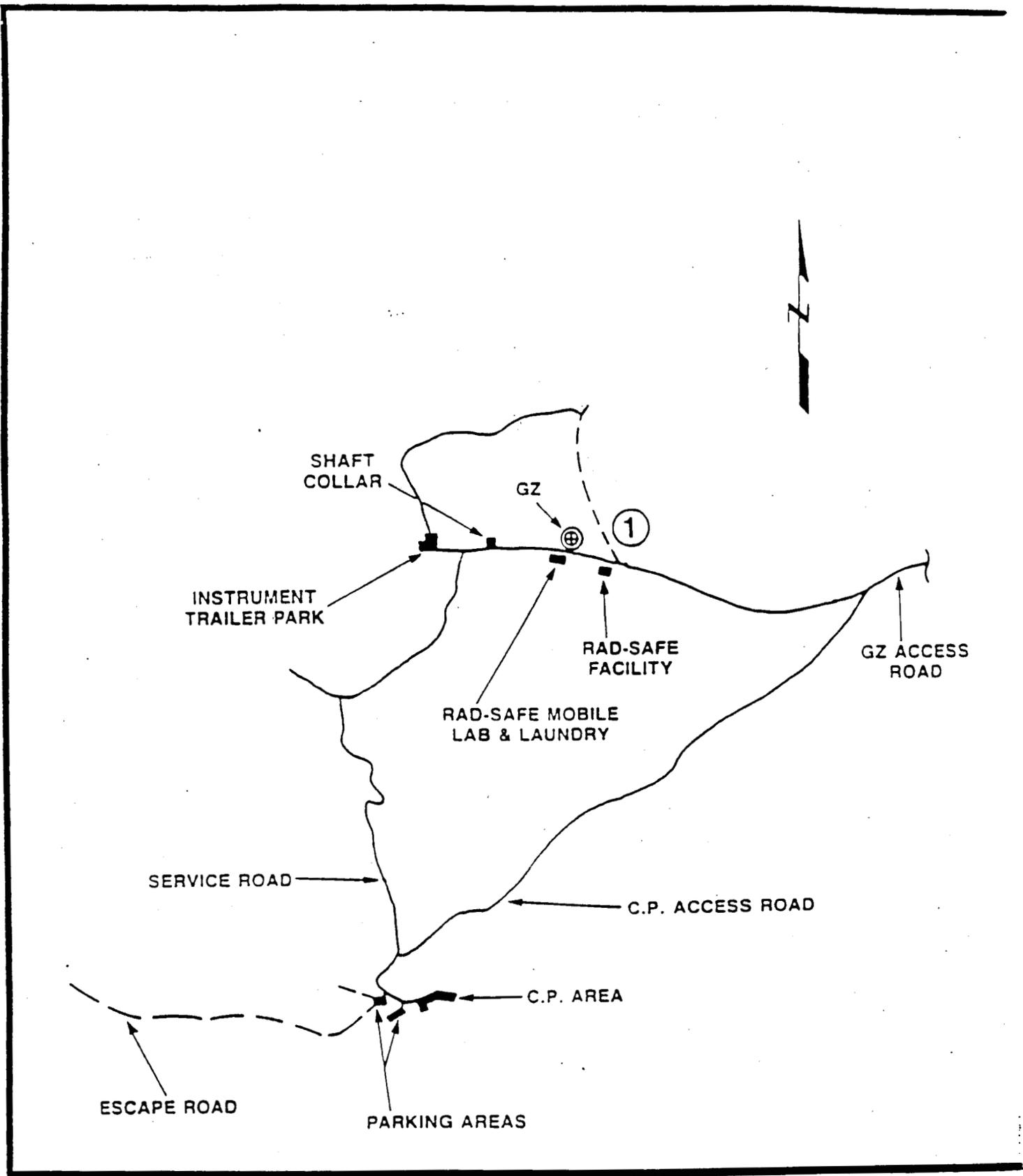


Fig. 3 - Potential hazardous waste release site investigated at Shoal Test Site. A site description is given in Section 5.2.

mud. There was no documented release of non-radioactive hazardous material.

One soil sample was collected at the surface of this site, i.e., from the fill dirt. A small concentration of barium, i.e., 8.2 mg/l, was detected in this sample. This is 8% of the concentration considered hazardous in 49 CFR 261.24.

### 6.3 Central Nevada Nevada Test Site

The documentation indicated no chemical or radioactive release sites. A radiological survey and sampling of the Project Faultless Site, conducted in April 1973, detected no radioactivity other than naturally occurring. However, two "operational areas" with potential for being the sites of undocumented release were investigated and sampled. A description of each site is presented below. The location of each site is shown on Figure 4.

#### SITE #1 - Runoff Ditch

A surface sample was collected from a runoff ditch ten feet southwest of UC-1 and PS-2 (an emplacement well and a post shot hole).

#### SITE #2 - Central Mud Pit

The central mud pit is located southeast of UC-1 (see Figure 4). It was used for the disposal of drilling mud. Upon inspection the mud pit was

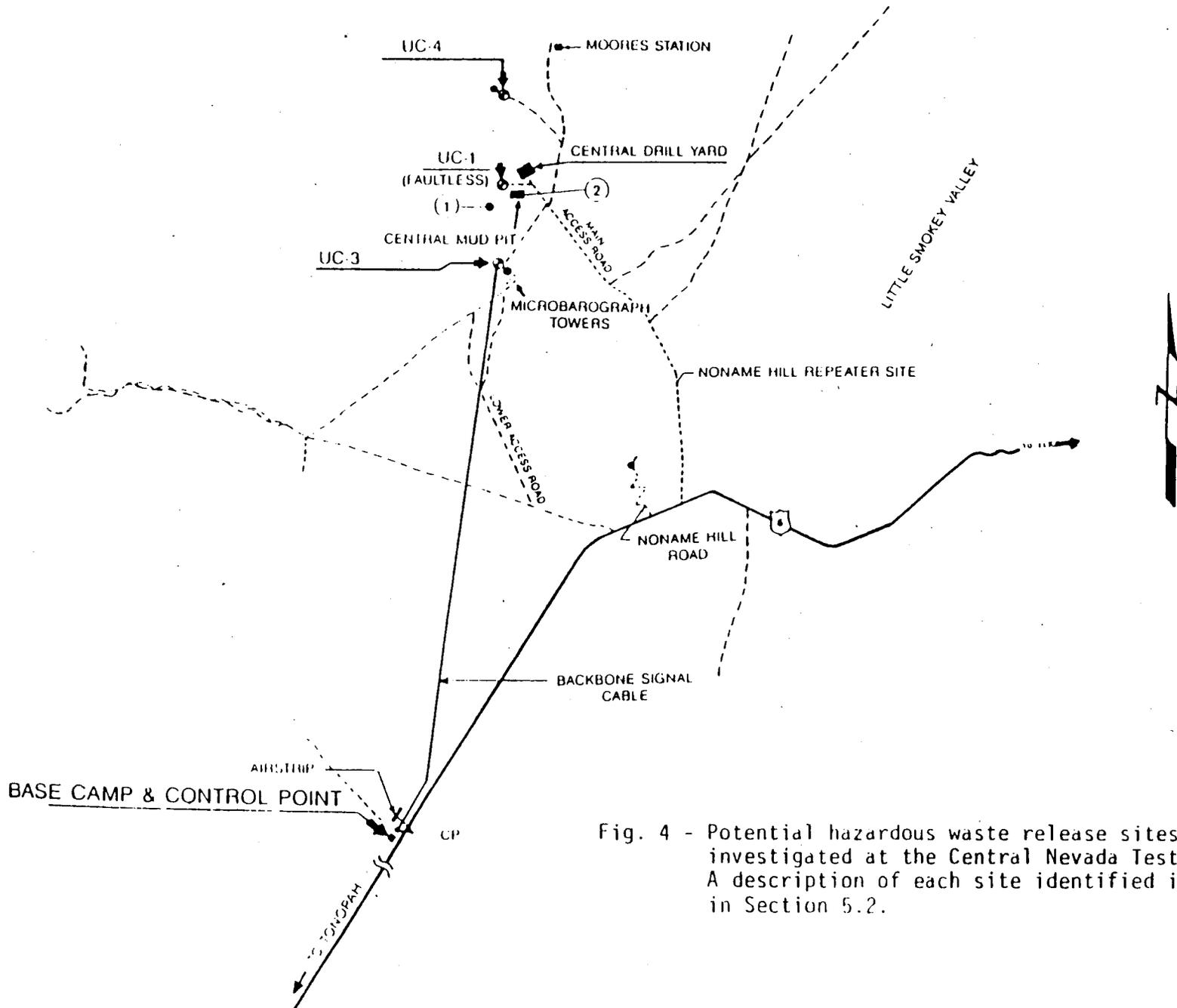


Fig. 4 - Potential hazardous waste release sites investigated at the Central Nevada Test Site. A description of each site identified is given in Section 5.2.

found to be covered with a "dried oily-looking crust". Samples of "oily dirt" and "oily crust" were collected and analyzed.

The non-radioactive hazardous materials detected in samples collected at the Central Nevada Test Site are listed in Table 3. Note that the samples collected at the Central Mud Pit contain concentrations of chromium, i.e., 8 mg/l, which exceeds the concentration considered hazardous in ~~49~~<sup>40</sup> CFR 261.24, i.e., 5 mg/l. Since only two samples were collected, both at the fringe of the mud pit, the extent of the chromium contamination cannot be determined at this time. However, there is roughly 10,000 cubic ~~feet~~<sup>yds</sup> of soil in the mud pit which has the "oily" appearance of the samples collected. The source of the chromium is unknown.

#### 6.4 Gasbuggy Test Site

The historical records search indicated no potential hazardous waste release sites at Gasbuggy, either radioactive or non-radioactive. There was no documented burial of hazardous material at this installation. All decontamination operations were performed by steam cleaning. The installation contained a concrete decontamination pad and plastic-lined sump which were never used. Due to a lack of first-hand information nine "operational areas" were sampled. These sites are listed in Table 4. The location of the sites are shown on Figure 5.

There were no hazardous substances detected in the samples collected at the Gasbuggy Test Site.

TABLE 3

NON-RADIOACTIVE HAZARDOUS SUBSTANCES DETECTED  
AT THE CENTRAL NEVADA TEST SITE

| SITE            | SITE NUMBER                     | CHEMICAL<br>OR<br>METAL | EP TOXICITY        |                      | HALOCARBON          |                     |
|-----------------|---------------------------------|-------------------------|--------------------|----------------------|---------------------|---------------------|
|                 |                                 |                         | DETECTED<br>(mg/l) | HAZARDOUS<br>(mg/l)* | DETECTED<br>(µg/kg) | HAZARDOUS<br>(kg)** |
| Runoff Ditch    | 1                               | Lead                    | 0.3                | 5.0                  |                     |                     |
| Central Mud Pit | 2 (oily crust)<br>2 (oily dirt) | Chromium                | 7.9                | 5.0                  | 37                  | 3,000               |
|                 |                                 | 2-Butanone              |                    |                      |                     |                     |
|                 |                                 | Chromium                | 8.1                | 5.0                  |                     |                     |

\* Hazardous concentrations as list in 49 CFR 261.24.

\*\* Hazardous quantity as listed in 49 CFR 261.33.

TABLE 4

## OPERATIONAL AREAS INVESTIGATED AT GASBUGGY TEST SITE

| <u>SITE</u>           | <u>SITE NUMBER</u> | <u>SITE LOCATION</u>       | <u>DEPTH OF SOIL SAMPLES</u> |
|-----------------------|--------------------|----------------------------|------------------------------|
| Red Tank              | 1                  | 90' from GZ @ 355 degrees  | Surface                      |
| "Drip Pan Decon Area" | 2                  | 115' from GZ @ 16 degrees  | Composite - Surface to 6'    |
| "Drip Pan Decon Area" | 2                  | 110' from GZ @ 31 degrees  | Composite - Surface to 6'    |
| "Mud Pit Burial Area" | 3                  | 195' from GZ @ 37 degrees  | 3'                           |
| "Steamer" Area        | 4                  | 178' from GZ @ 31 degrees  | 3'                           |
| Flare Stack           | 5                  | 200' from GZ @ 41 degrees  | Composite - Surface to 0.5'  |
| Flare Stack           | 5                  | 200' from GZ @ 41 degrees  | Composite - 21" to 27"       |
| East of GZ            | 6                  | 6' from GZ @ 90 degrees    | Surface                      |
| Mud Pit D             | 7                  | 40' from GZ @ 318 degrees  | 5'                           |
| Mud Pit C             | 8                  | 223' from GZ @ 347 degrees | 3'                           |
| Mud Pit A             | 9                  | 282' from GZ @ 85 degrees  | 2.5'                         |

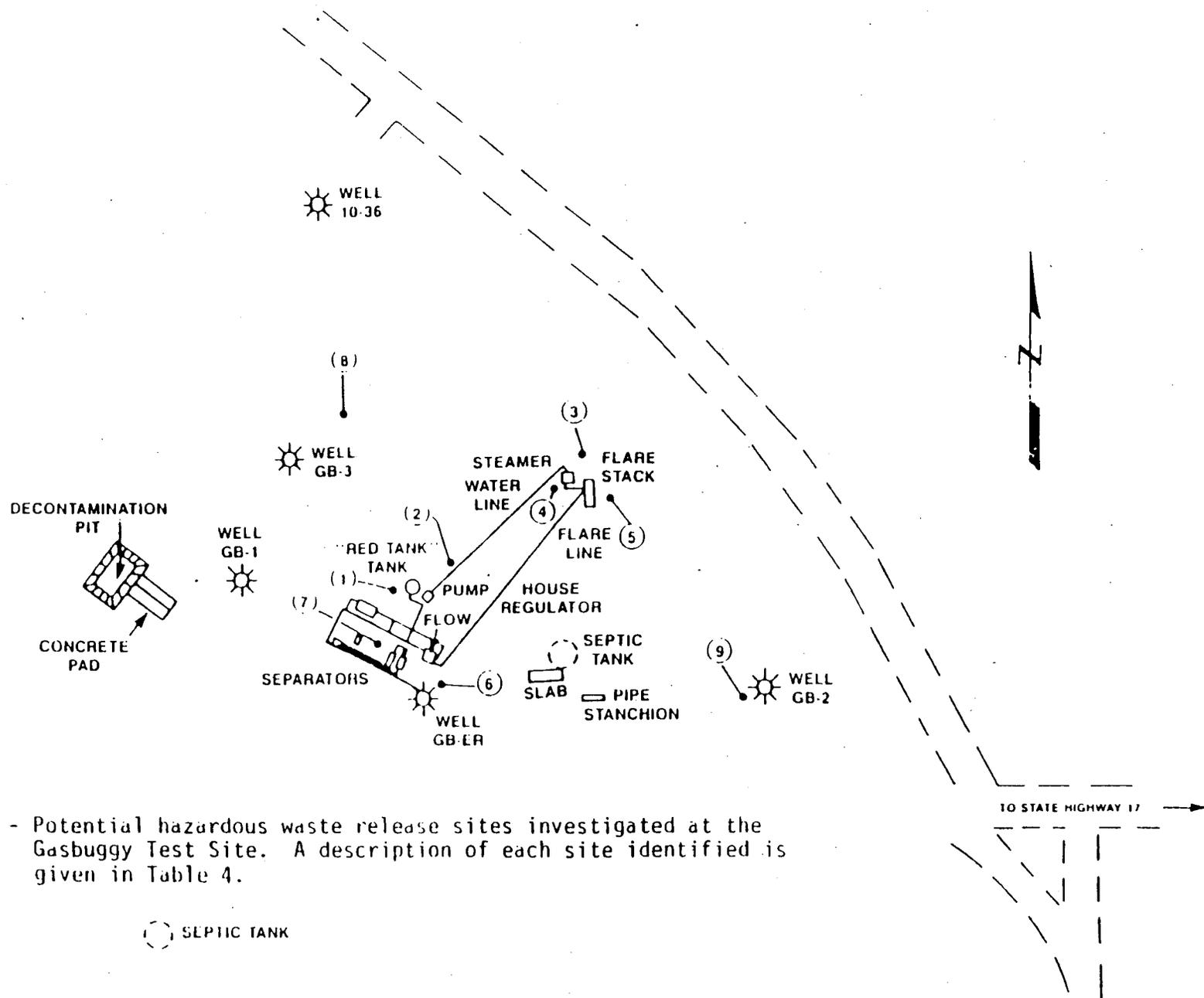


Fig. 5 - Potential hazardous waste release sites investigated at the Gasbuggy Test Site. A description of each site identified is given in Table 4.

○ SEPTIC TANK

VC

## 6.5 Gnome Test Site

There was no documentation indicating the release of chemical wastes at Gnome Test Site. Gnome underwent an extensive decontamination and decommissioning. However, "operational areas" were investigated. These sites are listed in Table 5 and their location is shown on Figure 6.

The only chemical substances detected at the Gnome Test Site were trace concentrations of arsenic, i.e., 0.02 mg/l, in samples collected at LRL #8. This is 0.4% of the concentration considered hazardous in 49 CFR 261.24.

## 6.6 Rio Blanco Test Site

There was no chemical release sites identified at the Rio Blanco Test Site. Radioactive contaminated liquid waste (mostly tritium) was injected into Fawn Creek Government Well No. 1 (FCG Well No. 1). No burial of radioactive (or chemical) material was made at the Rio Blanco Site. An in situ cleanup system was designed to facilitate cleanup of surface production equipment and interconnecting piping. This limited the need for extensive steam decontamination. Contaminated soil, solid waste, and solidified liquids resulting from decontamination and site cleanup were shipped to Beatty, Nevada for burial at the Nuclear Engineering Company facility.

Seven "operational areas" were investigated. These sites are listed in Table 6. The location of the sites are shown on Figure 7.

TABLE 5

## OPERATIONAL AREAS INVESTIGATED AT GNOME TEST SITE

| <u>SITE</u>                   | <u>SITE NUMBER</u> | <u>SITE LOCATION</u>                        | <u>DEPTH OF<br/>SOIL SAMPLE</u> |
|-------------------------------|--------------------|---|---------------------------------|
| Waste Tank - Evaporation Pond | 2                  | 210' North and 120' West of SGZ             | 6'                              |
| New Laundry Lab Trench        | 2                  | 200' East and 100' North of<br>Shaft Center | 5'                              |
| IRL #8                        | 3                  | 283' from shaft center at 135°              | Surface                         |

Fig. 6 - Potential hazardous waste release sites investigated at the Gnome Test Site. A description of each site identified is given in Table 5.

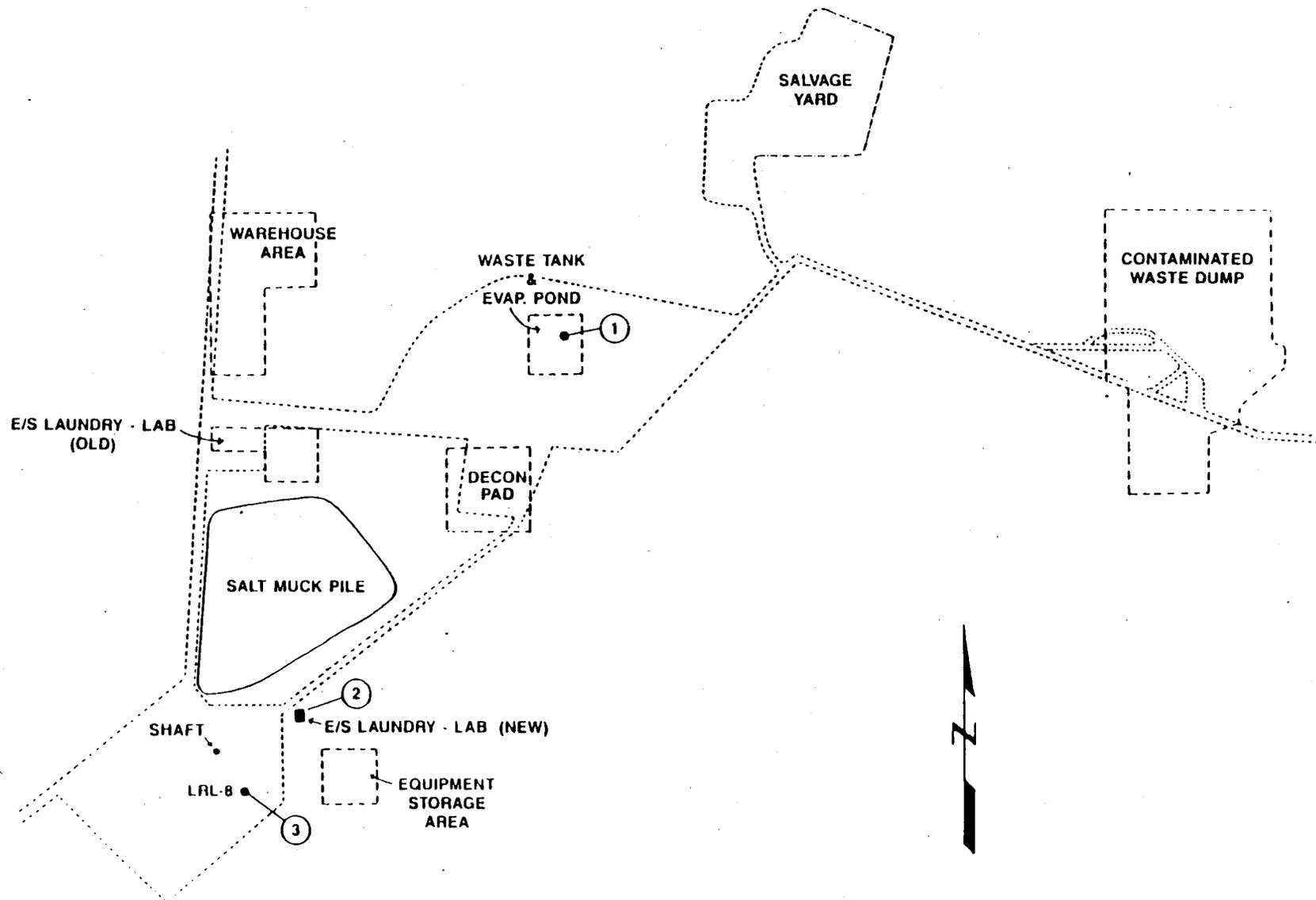


TABLE 6

OPERATIONAL AREAS INVESTIGATED AT RIO BLANCO TEST SITE

| <u>SITE</u>                             | <u>SITE NUMBER</u> | <u>SITE LOCATION</u>                      | <u>DEPTH OF SOIL SAMPLE</u> |
|---|--------------------|---|-----------------------------|
| Gas Burn Pit                            | 1                  | 197' from FCG Well No. 1                  | Surface                     |
| FCG Well No. 1                          | 2                  | 5' North of FCG Well No. 1                | Surface                     |
| Alternate Re-entry Well #2<br>(RB-AR-2) | 3                  | 197' + 18° (magnetic) from FCG Well No. 1 | Surface                     |
| Waste Water Holding Tanks Area          | 4                  | 90' + 240° (magnetic) from RB-E-01        | Surface                     |
| Flareline Separator Area                | 5                  | 200' + 280° (magnetic) from RB-E-01       | Surface, 2'                 |
| Flare Stack Area                        | 6                  | 540' + 312° (magnetic) from RB-E-01       | Surface                     |
| Emplacement Well RB-E-01                | 7                  | 10' North of RB-E-01                      | Surface                     |

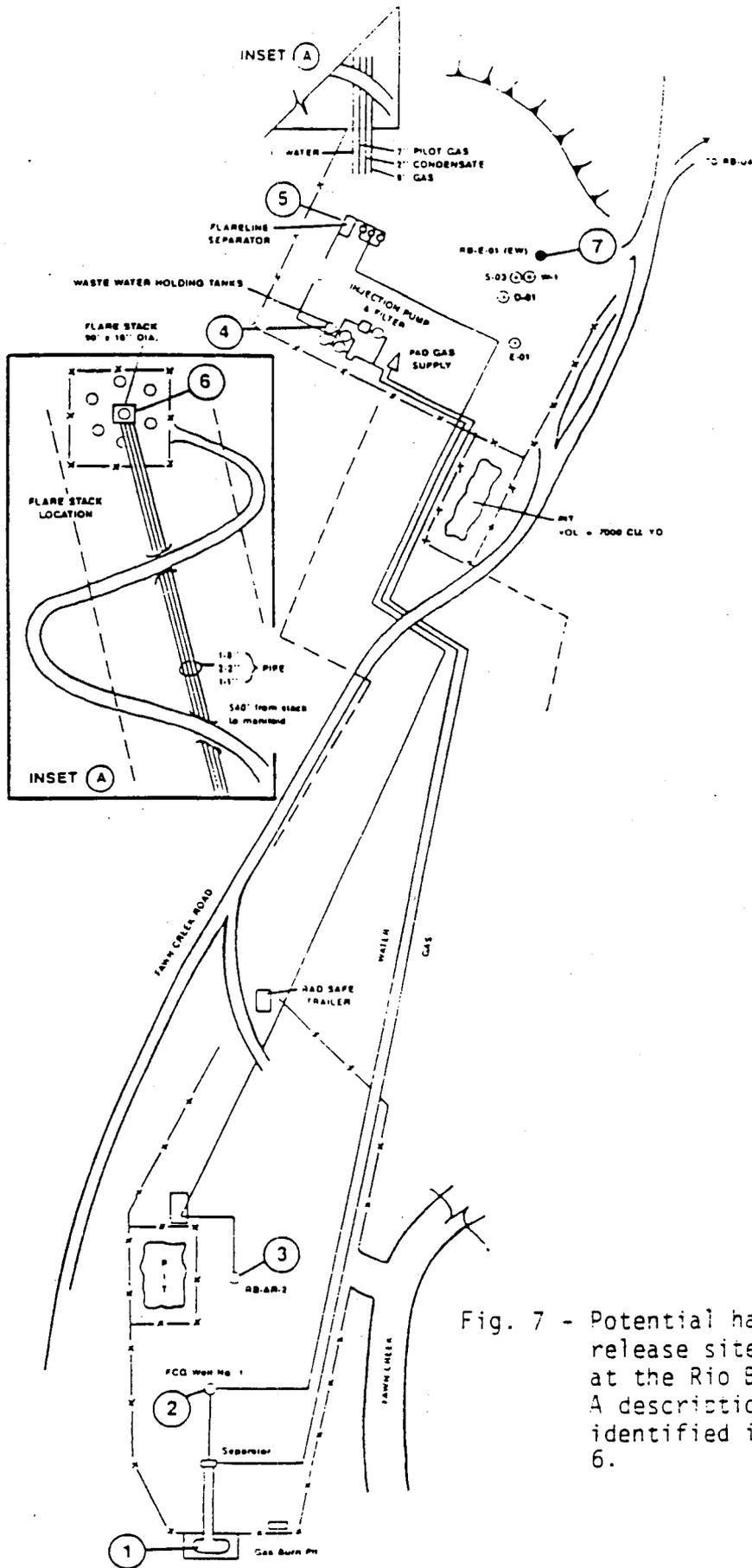


Fig. 7 - Potential hazardous waste release sites investigated at the Rio Blanco Test Site. A description of each site identified is given in Table 6.

The only chemicals detected at the above seven areas were trace quantities of Lindane and Endrin. The sample collected at the FCG Well No. 1 contained 0.02 mg/l of Lindane and 0.02 mg/l Endrin. The sample collected at the Waste Water Tank Area contained 0.03 mg/l of Endrin. These concentrations are less than 0.1 percent of hazardous concentrations listed in 49 CFR 261.24.

#### 6.7 Rulison Test Site

The records search indicated no release of chemical hazardous waste at Rulison. No burial of hazardous material, either radioactive or chemical, was attempted at the Rulison Test Site. A small amount of tritium in waste water and drilling mud (166 mCi H-3) was pumped into the Mesa Verde formation for disposal. Potable aquifers above this depth were previously cemented off during emplacement drilling. Contaminated (radioactive) material and soil resulting from cleanup operations were shipped to Beatty, Nevada for burial at the Nuclear Engineering Company facility. The only radionuclide identified during cleanup operations was tritium.

One accidental spill of radioactive liquid waste (approximately 60 gallons) occurred on September 1, 1976. This liquid was spilled from the separator while being moved to the decontamination pad. The contaminated soil was removed in 55 gallon drums.

Three "operational areas" were sampled; the name and descriptive location of these areas is given in Table 7. The actual location of each site is shown on Figure 8.

There were no hazardous materials detected in any of the samples collected at Rulison Test Site.

#### 6.8 Tatum Dome Test Site

During a site cleanup, conducted in 1972, radioactively contaminated soil, water, and other accumulated fluids were disposed of in the Tatum Salt Dome cavity. The cavity was sealed by plugging all drilling entry holes with cement. All remaining equipment, debris, and other personal property, either contaminated or suspected of contamination, was transported to NTS for disposal.

There was no documented release of non-radioactive hazardous material at the Tatum Dome Test Site.

Radioactive liquid waste generated by the bleed-down plant and during decontamination operations at Project Dribble was temporarily stored in tanks at the bleed-down plant and the decontamination pad. Contaminated liquids were transported from the temporary storage tanks to Test Hole No. 2 (HT-2), by a 2500-gallon tank trailer, where the liquid was pumped into HT-2 to a depth of approximately 2500 feet.

TABLE 7

## OPERATIONAL AREAS INVESTIGATED AT RULISON TEST SITE

| <u>SITE</u>            | <u>SITE NUMBER</u> | <u>SITE LOCATION</u>           | <u>DEPTH OF SOIL SAMPLE</u> |
|------------------------|--------------------|--------------------------------|-----------------------------|
| Re-entry Well (R-EX)   | 1                  | 50' South of R-EX              | Surface                     |
| Implacement Well (R-E) | 2                  | 18' - 305° (magnetic) from R-E | Surface                     |
| Flare Stack            | 3                  | 10' West of Flare stack        | Surface                     |

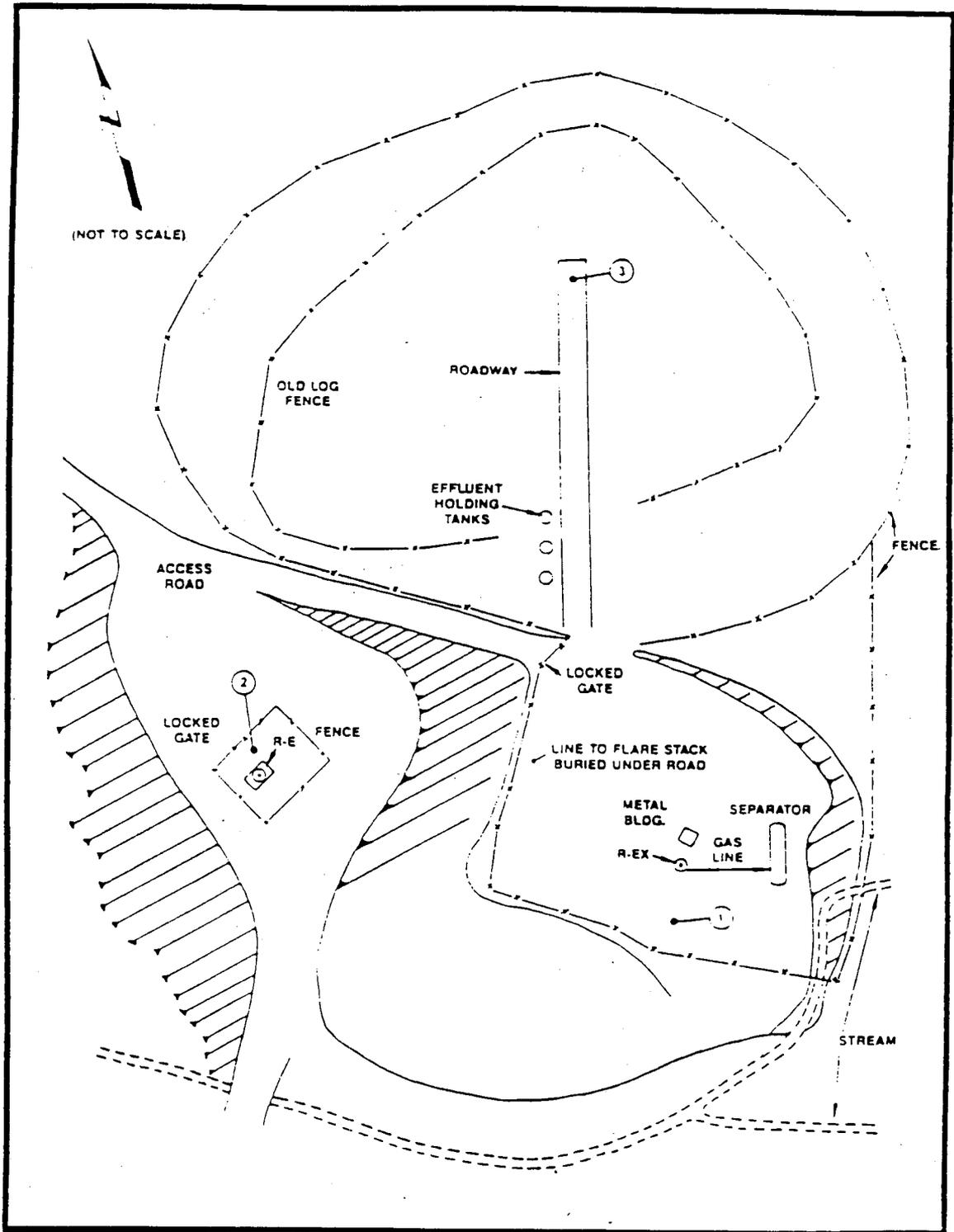


Fig. 8 - Potential hazardous waste release sites investigated at the Rulison Test Site. A description of each site identified is given in Table 7.

During the course of the long-term hydrological monitoring program, anomalous tritium readings were observed in water samples from a pond near the Salmon/Sterling surface ground zero area. An extensive study was performed in 1979 to assess the risk of migration of tritium to groundwater. This study concluded that "No groundwater from Tatum Dome containing tritium will ever move off the site in above background concentrations of tritium (Reference 42)."

The HT-2 area, as well as three other "operational areas," were investigated. The name and descriptive location of these areas is given in Table 8. The actual location of each site is shown on Figure 9.

#### 6.9. Tonopah Test Range

No CERCLA hazardous waste site were identified at the Tonopah Test Range. There were no "operational areas" with the potential for being the site of an undocumented release.

#### 6.10 Amchitka Test Site

The records indicated no release or burial of chemical waste at Amchitka Test Site. The Demobilization and Restoration Plan (reference in Appendix B) states that all chemical wastes were to be removed from the Island.

TABLE 8

## OPERATIONAL AREAS SAMPLED AT TATUM DOME TEST SITE

| <u>SITE</u>                                    | <u>SITE NUMBER</u> | <u>SITE LOCATION</u>                 | <u>DEPTH OF SOIL SAMPLE</u> |
|--|--------------------|--------------------------------------|-----------------------------|
| HT-2 Area                                      | 1                  | 18' NE of HT-2                       | Surface                     |
| Mud Pit  | 2                  | 170' South & 50' East of GZ Monument | Composite - 6'-6'8"         |
| E-14 Area (Runoff zone from equipment storage) | 3                  | 120" @ 20° from E-14                 | Surface                     |
| Decon Pad Area                                 | 4                  | 58' @ 135° from Well E-6             | Surface                     |

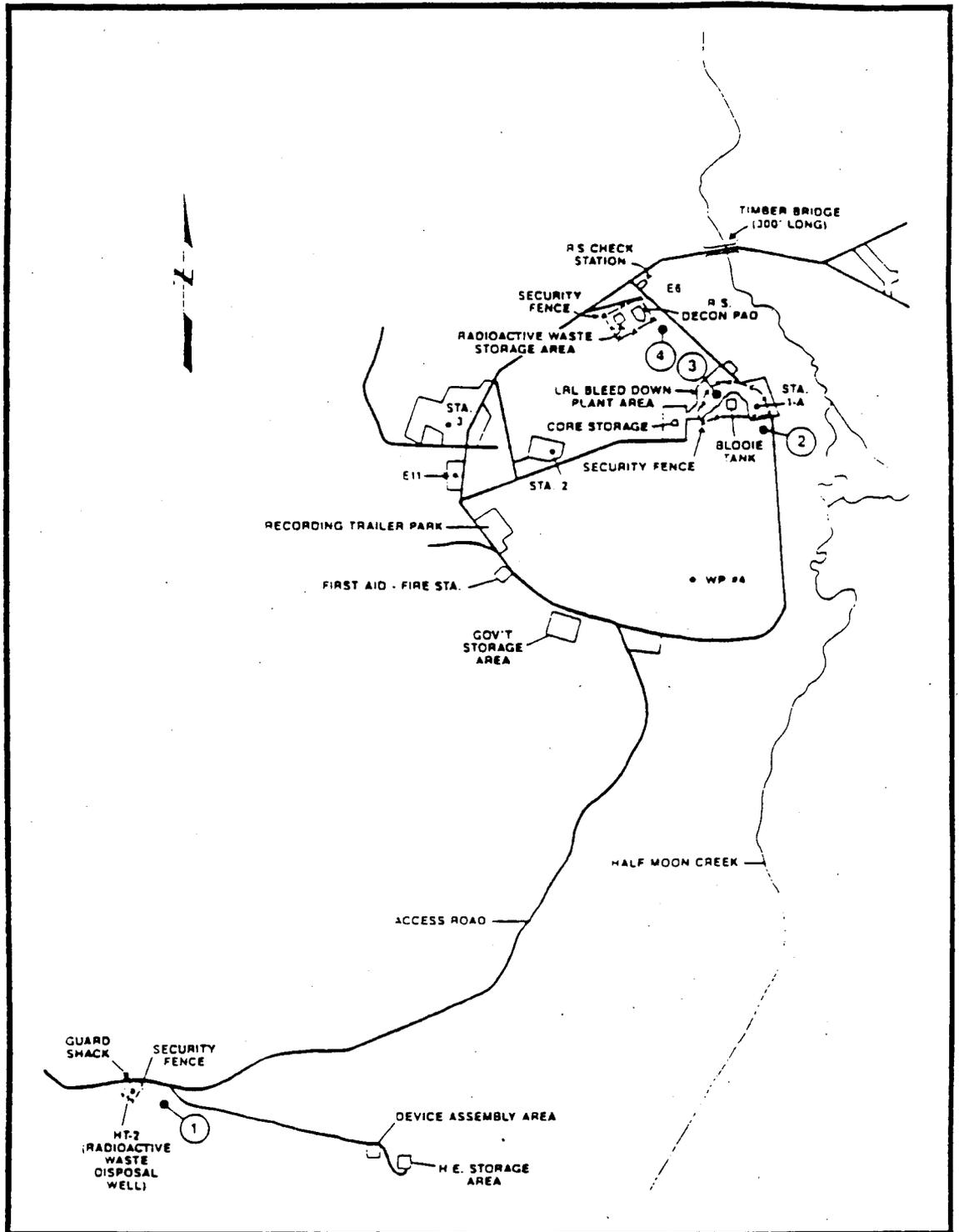


Fig. 9 - Potential hazardous waste release sites investigated at the Tatum Dome Test Site. A description of each site identified is given in Table 8.

No burial of radioactive material was made on Amchitka Island. Radioactive contaminated liquids, generated by the decontamination efforts, were pumped into the Cannikan cavity. Contaminated soils (radioactive) were packaged and transported to NTS for burial.

Nine "operational areas" were sampled. These sites are listed in Table 9. The general location of the sites are shown in Figure 10.

Although not expected, a variety of chemical substances were detected in several of the samples collected at Amchitka. Hydrocarbon films and odors were detected in all of the mud pits sampled. The substances which were found above the detection limit are listed in Table 10. Note that acetone is listed as being present in certain samples. This result is suspect, for two reasons. First, the operations which would have generated the waste streams were performed over 15 years ago. Assuming that acetone was used at this time, which cannot be confirmed, it is unlikely that it would still be present since it is a highly volatile compound. Second, trace concentrations of acetone were detected in the blank which accompanied the samples in question, indicating that the samples may have been contaminated during the analytical process. More sampling would be necessary to determine the inventory of chemicals at these sites.

TABLE 9

## OPERATIONAL AREAS INVESTIGATED AT AMCHITKA TEST SITE

| <u>SITE</u>                | <u>SITE LOCATION</u>                   | <u>DEPTH OF SOIL SAMPLE</u> |
|----------------------------|--|-----------------------------|
| Mitrow GZ                  | 50' North of Ground Zero (GZ)          | Surface                     |
| Longshot GZ                | 45' North of Longshot GZ               | Surface                     |
| Longshot Mud Pit #2        | 100' North of Longshot GZ              | Sediment                    |
| Cannikan GZ                | 79' North of Cannikan GZ               | Surface                     |
| Cannikan Mud Pit           | 300' West of Cannikan GZ               | Sediment                    |
| Cannikan Post-Shot Mud Pit | 100' North of Post-Shot Drillback Hole | Sediment                    |
| Cannikan Decon Area        | 165' at 240° from Cannikan GZ          | Surface                     |
| Drill Site D Mud Pit       | 200' West of Emplacement Hole UA-6     | Sediment                    |

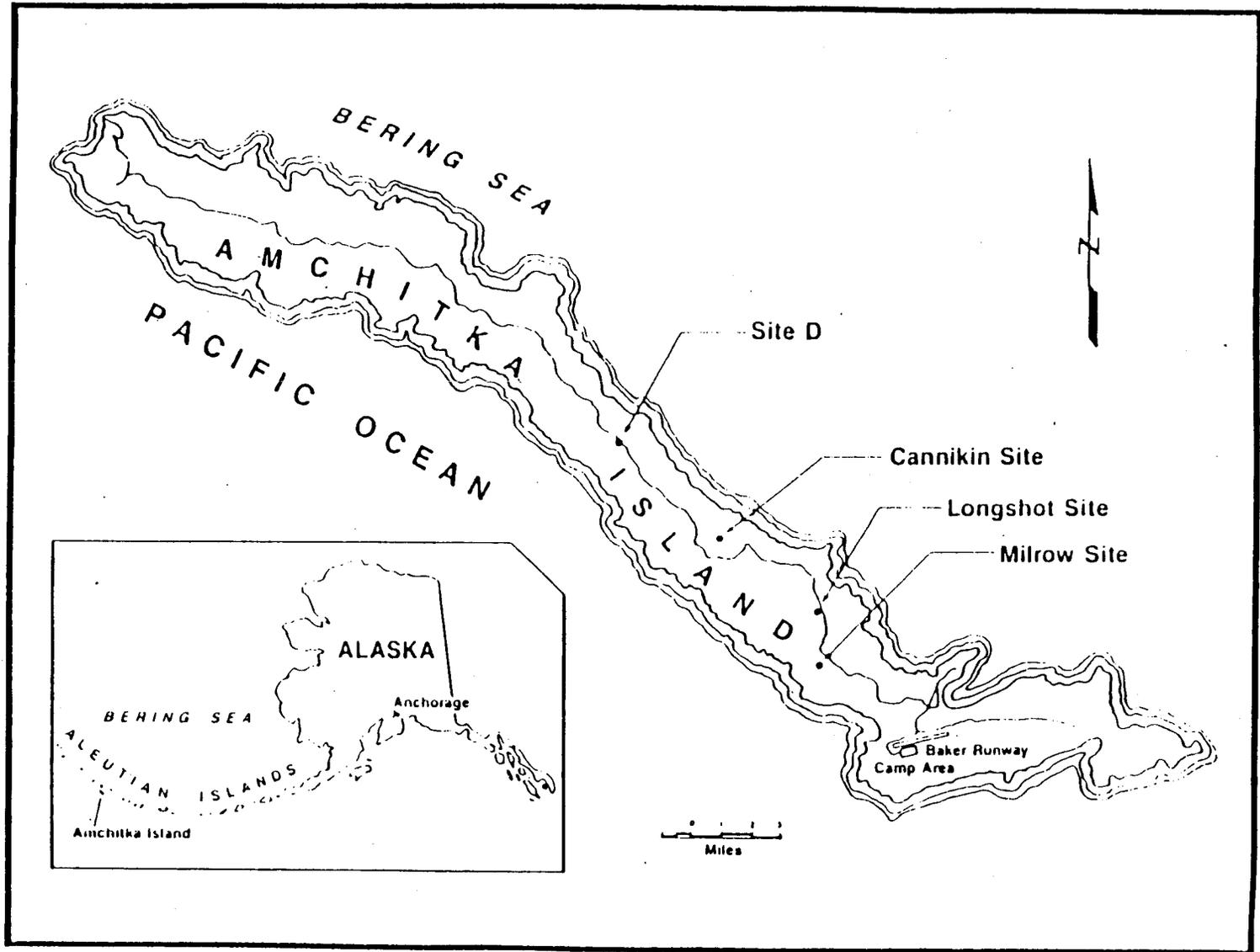


Fig. 10 - Potential hazardous waste release sites investigated at the Amchitka Test Site. A description of each site identified is given in Table 9.

TABLE 10

NON-RADIOACTIVE HAZARDOUS SUBSTANCES DETECTED  
AT THE AMCHITKA TEST SITE

| SITE                                 | SUBSTANCE               | EP TOXICITY        |                      | HALOCARBON          |                     |
|--------------------------------------|-------------------------|--------------------|----------------------|---------------------|---------------------|
|                                      |                         | DETECTED<br>(mg/l) | HAZARDOUS<br>(mg/l)* | DETECTED<br>(µg/kg) | HAZARDOUS<br>(kg)** |
| Milrow GZ                            | Methylene Chloride      | ----               | ----                 | 53                  | 1000                |
| Longshot GZ                          | Barium                  | 0.20               | 100.00               | ----                | ----                |
|                                      | Dichlorodifluoromethane | ----               | ----                 | 15                  | 1000                |
|                                      | Acetone                 | ----               | ----                 | 1600                | 1000                |
| Longshot Mud Pit #2                  | Arsenic                 | 0.03               | 5.00                 | ----                | ----                |
|                                      | Methylene Chloride      | ----               | ----                 | 27                  | 1000                |
|                                      | Acetone                 | ----               | ----                 | 140                 | 1000                |
|                                      | Xylene                  | ----               | ----                 | 240                 | 1000                |
|                                      | Benzene                 | ----               | ----                 | 302                 | 1000                |
| Cannikan GZ                          | Barium                  | 0.20               | 100.00               | ----                | ----                |
|                                      | 2-Butanone              | ----               | ----                 | 53                  | 1000                |
|                                      | 1-Butanol               | ----               | ----                 | 260                 | 1000                |
|                                      | Acetone                 | ----               | ----                 | 1500                | 1000                |
| Cannikan Post-Shot<br>Drillback Area | 1,4-Dioxane             | ----               | ----                 | 23                  | 1000                |

\* Hazardous concentrations as listed in 49 CFR 261.24.

\*\* Hazardous quantity as listed in 49 CFR 261.33.

## 7.0 SUMMARY AND CONCLUSIONS

For the ten installations investigated, chemicals were used during decontamination and cleaning operations as well as small laboratory operations, resulting in liquid mixed wastes. Solvents, degreasers, detergents, acids, etc., were used in conjunction with these operations. The control and containment of the mixed wastes generated during these operations was based on the concentration of radioactivity. At sites other than NTS, contaminated liquid wastes were injected downhole or solidified and shipped to a low-level radioactive waste facility. The NTS mixed-wastes were released to various leachfields within the site boundaries.

Using radioactivity as a control criteria appears to have adequately contained the mixed waste streams and prevented significant releases to the environment. However, potentially hazardous substances were detected at two installations, the CNTS and the Amchitka Test Site. Samples collected at the CNTS Central Mud Pit contained hazardous concentrations of chromium and trace concentrations of 2-butanone. Samples collected at Amchitka Test Site contained trace contaminations of several compounds including, methylene chloride, acetone, xylene, benzene, 2-butanone, 1-butanol, 1-4 dioxone, and barium. The source of the heavy metals and chemical compounds detected at these two sites is unknown. No potentially hazardous chemical substances were identified at the other eight installations.

One installation, the Nevada Test Site, was found to contain hazardous quantities of radioactive material. This material was released to a variety of leachfields and burial sites within the NTS boundaries. At the remaining eight nuclear testing installations, extensive decontamination and decommissioning operations were conducted after their missions were complete. These efforts were well documented and were successful in the removal of soil and equipment which exceeded the cleanup criteria. The contaminated material was disposed of by downhole injection or shipped to a low-level waste facility. At certain installations slightly contaminated soil below cleanup criteria was consolidated and covered with several feet of fill dirt.

A part of the decommissioning effort was the design and implementation of long-term groundwater monitoring programs, which are to remain operational indefinitely. There is also an extensive groundwater monitoring program at the NTS.

Hazard ranking calculations were performed for the three installations where hazardous material was detected, i.e., NTS, Amchitka, and CNTS. Using conservative values for the "Waste Quantity" factor, the resulting mHRS scores were all less than one, indicating a very small risk of the hazardous material migrating and posing a risk to health, safety or the environment.

Using the criteria described in DOE Order 5480.14, comprehensive environmental surveys, Phase II, are not justified at any of the DOE/NV installations investigated as there seems to be no significant potential

for environmental impact at these sites. However, more work may be justified at the Central Nevada Test Site and Amchitka Test Site on the grounds that the findings were unexpected and undocumented. It may be prudent to have a better understanding of type and quantity of material present at these two installations before the DOE/NV CERCLA effort is concluded.

APPENDIX A  
INSTALLATION DESCRIPTIONS

1. NEVADA TEST SITE

The major programs conducted at the NTS have been nuclear weapons development, proof-testing and weapons safety and effects, testing peaceful uses of nuclear explosives (Plowshare Program), reactor engine development for nuclear rocket and ramjet applications (Projects Rover and Pluto), high-energy nuclear physics research, seismic studies (Vela Uniform), and studies of high-level waste storage. Project Pluto was discontinued in 1964; Project Rover was terminated in January 1973; Plowshare tests were terminated in 1970; Vela Uniform studies ceased in 1973. All nuclear weapons tests since 1962 have been conducted underground.

2. SHOAL TEST SITE

Project Shoal (10/26/63) was a 12kt nuclear test detection - research experiment in granite conducted 1200 feet underground in a self-sealing tunnel. It was part of the Vela-Uniform Program sponsored jointly by the Department of Defense and the Atomic Energy Commission. The objective was to detonate a nuclear device in an active seismic area. The site is located 28 miles southwest of Fallon, Nevada in the Sand Springs Mountain Range. Decommissioning was completed in 1970.

3. CENTRAL NEVADA TEST SITE

Project Faultless (1/19/68) was a large yield seismic calibration experiment detonated in a drill hole in Railroad Valley, Nevada approximately 200 air miles NNW of Las Vegas, Nevada and approximately 75 miles NE of Tonopah, Nevada. Demobilization and restoration was completed in 1974.

4. GASBUGGY TEST SITE

Project GASBUGGY (12/10/67) was a Plowshare Program joint government - industry gas stimulation experiment in the San Juan Basin of northeastern New Mexico, approximately 55 air miles east of Farmington, New Mexico. The experiment involved the detonation of a 29kt contained nuclear explosive at a depth of 4240 feet, in the Lewis Shale formation. The primary purpose of the GASBUGGY experiment was to determine if nuclear stimulation would release gas that could not be economically produced by conventional means. Decommissioning of the site was completed in 1979.

5. GNOME TEST SITE

Project Gnome (12/10/61) was a multipurpose 3kt nuclear experiment in salt conducted 1200 feet underground at the end of a 1116 foot long button hook tunnel. It was the first event of the Plowshare Program. The tunnel was constructed about 25 miles southeast of Carlsbad in the Salado salt formation of the Delaware Basin, Eddy County, New Mexico. The cavity was post event drilled into and re-entered through mineback operations.

6. RIO BLANCO TEST SITE

Project Rio Blanco was part of the Plowshare Program and was a joint government - industry gas reservoir stimulation experiment using three 33kt nuclear explosives detonated simultaneously in a single well bore, at depths of 5840, 6230, and 6690 feet. The detonation occurred on 5/17/73 in Rio Blanco County, Colorado. The site is located 52 air miles NE of Grand Junction and 37 miles NW of Rifle, Colorado. The site demobilization and restoration was completed in 1978.

7. RULISON TEST SITE

Project Rulison (9/10/69) was part of the Plowshare Program and was a joint government - industry gas stimulation experiment in the gas-bearing Mesa Verde Formation of the Rulison Field of west central Colorado. The site is located on the north of Battlement Mesa, 40 miles northeast of Grand Junction, Colorado, and 12 miles southwest of Rifle, Colorado. The experiment involved the detonation of a 40kt device at a depth of 8426 feet. Site demobilization was completed in 1977.

8. TATUM DOME TEST SITE

The Tatum Dome Test Site was the location of Projects Dribble and Miracle Play of the Vela Uniform Program. The site is located approximately 110 miles northwest of New Orleans, Louisiana, and 22 miles southwest of Hattisburg, Mississippi. The Salmon Event was a 5.3kt nuclear device detonated at a depth of 2700 feet on 10/22/64 to evaluate the decoupling

principle and wave propagation in the southeast United States. The second test of Project Dribble was the Sterling Event which was a 380 ton device detonated at a depth of 2715 feet on 12/3/66. The objective of this experiment was to determine the extent of decoupling in a salt cavity and the accuracy of existing decoupling calculations.

The Miracle Play Series consisted of two gas explosions which were conducted in the cavity on 2/2/69 and 4/19/70. The objectives of these experiments were to determine the decoupling effect of explosions in an open cavity. Decontamination and decommissioning was completed in 1972.

#### 9. AMCHITKA TEST SITE

Three nuclear events were conducted on Amchitka Island in the Alaska Aleutian Island chain. The Longshot Event was a Department of Defense Nuclear Test Detection experiment conducted as part of the Vela Uniform Program on 10/29/65. The experiment utilized a device yielding approximately 80kt.

The Milrow experiment was a weapons related seismic calibration test of approximately one megaton on 10/2/69. The third nuclear detonation was the Cannikin event which was a test of a warhead for the Spartan Missile on 11/6/71, yielding approximately 5mt. The site was demobilized in 1973.

APPENDIX B

REFERENCES

NEVADA TEST SITE

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APPENDIX C

TARGET SUBSTANCES (NON-RADIOACTIVE)

|                          |                           |                           |
|--------------------------|---------------------------|---------------------------|
| Acetone                  | Arsenic (As) EP TOX       | Barium (Ba) EP TOX        |
| Cadmium (Cd) EP TOX      | Chromium (Cr) EP TOX      | Lead (Pb) EP TOX          |
| Mercury (Hg) EP TOX      | Selenium (Se) EP TOX      | Silver (Ag) EP TOX        |
| Lindane                  | Endrin                    | Methoxychlor              |
| Toxaphene                | 2,4-D                     | 2,4,5-TP Silvex           |
| Bromodichloromethane     | Bromoform                 | Bromomethane              |
| Carbon Tetrachloride     | Chlorobenzene             | Chloroethane              |
| 2-Chloroethylvinyl ether | Chloroform                | Chloromethane             |
| Dibromochloromethane     | 1,2-Dichlorobenzene       | 1,3-Dichlorobenzene       |
| 1,4-Dichlorobenzene      | Dichlorodifluoromethane   | 1,1-Dichloroethane        |
| 1,2-Dichloroethane       | 1,1-Dichloroethene        | trans-1,2-Dichloroethene  |
| 1,2-Dichloropropane      | cis-1,3-Dichloropropene   | trans-1,3-Dichloropropene |
| Methylene Chloride       | 1,1,2,2-Tetrachloroethane | Tetrachloroethene         |
| 1,1,1-Trichloroethane    | 1,1,2-Trichloroethane     | Trichloroethene           |
| Trichlorofluoromethane   | Vinyl Chloride            |                           |

## APPENDIX D

## GAMMA SPECTROSCOPY RESULTS FOR SAMPLES COLLECTED AT NTS

|          | SITE NAME                     | SAMPLE NO. | NUCLIDE         | CONCENTRATION $(\mu\text{Ci/g})$<br>+/- 2 $\sigma$ (%) |                |
|----------|-------------------------------|------------|-----------------|--|----------------|
| 06-05-01 | CP-2 Leachfield               | L50771     | Cs-137          | 1.07E-06 +/- 12  |                |
|          |                               | L50773     | Cs-137          | 7.49E-07 +/- 13  |                |
|          |                               | L50774     | Cs-137          | 6.79E-07 +/- 13  |                |
|          |                               | L50775     | Cs-137          | 4.24E-07 +/- 17  |                |
|          |                               | L50777     | Cs-137          | 3.47E-07 +/- 29  |                |
| 11-08-01 | Contaminated Waste Dump #1    | L50944     | Cs-137          | 5.42E-07 +/- 24  |                |
|          |                               | L50945     | Cs-137          | 6.44E-07 +/- 20  |                |
|          |                               | L50948     | Cs-137          | 4.28E-07 +/- 27  |                |
| 11-08-02 | Contaminated Waste Dump #2    | L50950     | Am-241          | 2.82E-04 +/- 8   |                |
|          |                               | L50951     | Am-241          | 5.63E-04 +/- 8   |                |
|          |                               | L50952     | Cs-137          | 5.58E-07 +/- 22  |                |
|          |                               |            | Am-241          | 1.54E-04 +/- 9   |                |
|          |                               |            | Cs-137          | 1.28E-06 +/- 15  |                |
|          |                               | L50953     | Am-241          | 4.77E-04 +/- 8   |                |
|          |                               | Cs-137     | 5.58E-07 +/- 18 |  |                |
| 25-02-01 | R-MAD Contaminated Waste Dump | L50721     | Cs-137          | 1.51E-06 +/- 11  |                |
| 25-07-01 | R-MAD Leachfield              | L50717     | Cs-137          | 4.93E-03 +/- 8   |                |
|          |                               | L50718     | Cs-137          | 1.62E-06 +/- 11  |                |
| 25-07-02 |                               |            | L50719          | Cs-137   | 2.17E-02 +/- 8 |
|          |                               |            | Co-60           | 6.32E-04 +/- 8   |                |
|          |                               |            | L50689          | Cs-137   | 9.41E-06 +/- 9 |
|          |                               |            | L50714          | Cs-137   | 1.19E-04 +/- 8 |
|          |                               |            | Co-60           | 7.40E-07 +/- 21  |                |
| 25-05-01 | Test Cell-A Leachfield        | L50734     | Cs-137          | 1.71E-07 +/- 43  |                |
|          |                               |            | Co-57           | 2.07E-07 +/- 30  |                |
| 25-05-02 | Test Cell-C Leachfield        | L50701     | Cs-137          | 7.91E-02 +/- 8   |                |
|          |                               | L50702     | Cs-137          | 8.16E-05 +/- 8   |                |
|          |                               |            | Sb-125          | 4.22E-06 +/- 23  |                |
|          |                               | L50741     | Cs-137          | 7.35E-01 +/- 8   |                |
|          |                               | L50745     | Cs-137          | 1.72E-05 +/- 9   |                |
|          |                               |            | Eu-155          | 2.27E-06 +/- 16  |                |
|          |                               |            | Sb-125          | 2.48E-06 +/- 15  |                |
|          |                               | L50749     | Cs-137          | 1.07E-02 +/- 8   |                |
|          |                               |            |                 |  |                |
|          | R-MAD Contaminated Waste Dump | L50922     | Cs-137          | 3.95E-04 +/- 8   |                |
|          |                               |            | Co-60           | 7.24E-06 +/- 8   |                |
|          |                               | L50925     | Cs-137          | 2.03E-07 +/- 37  |                |
| 26-05-07 | Tory Reactor Leachfield       | L50767     | Cs-137          | 2.22E-04 +/- 8   |                |

APPENDIX E

HAZARD RANKING SYSTEM REPORTS AND WORK SHEETS

mHRS GROUND WATER ROUTE WORK SHEET

DOE/NV Las Vegas, Nevada  
 Site: Nevada Test Site

04/02/86  
 Site Index: 6

| Rating Factor   | Assigned Value | Multiplier | Score   | Max. Score | Ref. (Section) |
|---|----------------|------------|---------|------------|----------------|
| 1. Observed Release   | 0              | 1          | 0       | 45         | 3.1            |
| If observed release is given a score of 45, proceed to line 4.<br>If observed release is given a score of 0, proceed to line 2. |                |            |         |            |                |
| 2. Route Characteristics  |                |            |         |            | 3.2            |
| Depth to Aquifer of Concern   | 0              | 2          | 0       | 6          |                |
| Net Precipitation   | 0              | 1          | 0       | 3          |                |
| Permeability of the Unsaturated Zone  | 1              | 1          | 1       | 3          |                |
| Physical State  | 0              | 1          | 0       | 3          |                |
| Total Route Characteristics Score   |                |            | 1       | 15         |                |
| 3. Containment  | 1              | 1          | 1       | 3          | 3.3            |
| 4. Waste Characteristics  |                |            |         |            | 3.4            |
| Chemical  |                |            |         |            |                |
| a. Toxicity/Persistence   | 0              | 1          | 0       | 18         |                |
| Hazardous Waste Quantity  | 0              | 1          | 0       | 8          |                |
| Radioactive   |                |            |         |            |                |
| b.1 Maximum Observed  | 0              | 1          | 0       | 26         |                |
| b.2 Maximum Potential   | 26             | 1          | 26      | 26         |                |
| Total Waste Characteristics Score 4.a<br>(Largest of 4.a, b.1, b.2) 4.b   |                |            | 0<br>26 | 26         |                |
| 5. Targets  |                |            |         |            | 3.5            |
| Ground Water Use  | 1              | 3          | 3       | 9          |                |
| Distance to Nearest Well/<br>Population Served  | 0              | 1          | 0       | 40         |                |
| Total Targets Score   |                |            | 3       | 59         |                |
| 6. If line 1=45 (1x4x5) Chemical  |                |            | 0       |            |                |
| If line 1=0 (2x3x4x5) Radioactive   |                |            | 78      | 57330      |                |
| 7. Line 6/57330 * 100   | Sc(gw) =       | 0.00       | Sr(gw)  | 0.14       |                |

mHRS HAZARDOUS RANKING SYSTEM FACILITY REPORT

Facility name: NEVADA TEST SITE  
DOE/NV LAS VEGAS, NV

Location: 60 MILES NORTHWEST OF LAS VEGAS, NV

EPA Region: Person(s) in charge of facility: DOE/NV

Reviewer: DAVID N. FAUVER

Date: 04/02/86

Facility Description

Type of facility: NUCLEAR TESTING SITE

Types of hazardous wastes: RADIOACTIVE

Contamination route of concern: GROUNDWATER

Additional descriptive comments:

Waste storage types: LANDFILLS

The following worksheets are included for this facility: GROUND WATER

Scores: Sm = 0.08 (Sgw = 0.14 Ssw = 0.00 Sa = 0.00)  
Sfe = 0.00  
Sdc = 0.00

mHRS GROUND WATER ROUTE WORK SHEET

Vegas, Nevada  
 1 Test Site

04/02/86  
 Site Index: 4

| <u>Rating Factor</u> | <u>Assigned Value</u> | <u>Multi-plier</u> | <u>Score</u> | <u>Max. Score</u> | <u>Ref. (Section)</u> |
|----------------------|-----------------------|--------------------|--------------|-------------------|-----------------------|
| 1 Release            | 0                     | 1                  | 0            | 45                | 3.1                   |

oved release is given a score of 45, proceed to line 4.  
 rved release is given a score of 0, proceed to line 2.

| <u>Rating Factor</u>       | <u>Assigned Value</u> | <u>Multi-plier</u> | <u>Score</u> | <u>Max. Score</u> | <u>Ref. (Section)</u> |
|----------------------------|-----------------------|--------------------|--------------|-------------------|-----------------------|
| Characteristics            |                       |                    |              |                   | 3.2                   |
| No Aquifer of Concern      | 0                     | 2                  | 0            | 6                 |                       |
| precipitation              | 0                     | 1                  | 0            | 3                 |                       |
| ability of the Unsaturated | 2                     | 1                  | 2            | 3                 |                       |
| al State                   | 3                     | 1                  | 3            | 3                 |                       |
| oute Characteristics Score |                       |                    | 5            | 15                |                       |

|    |   |   |   |   |     |
|----|---|---|---|---|-----|
| it | 1 | 1 | 1 | 3 | 3.3 |
|----|---|---|---|---|-----|

| <u>Rating Factor</u>          | <u>Assigned Value</u> | <u>Multi-plier</u> | <u>Score</u> | <u>Max. Score</u> | <u>Ref. (Section)</u> |
|-------------------------------|-----------------------|--------------------|--------------|-------------------|-----------------------|
| Characteristics               |                       |                    |              |                   | 3.4                   |
| ical                          |                       |                    |              |                   |                       |
| oxicity/Persistence           | 18                    | 1                  | 18           | 18                |                       |
| azardous Waste Quantity       | 6                     | 1                  | 6            | 8                 |                       |
| active                        |                       |                    |              |                   |                       |
| Maximum Observed              | 0                     | 1                  | 0            | 26                |                       |
| aximum Potential              | 0                     | 1                  | 0            | 26                |                       |
| ite Characteristics Score 4.a |                       |                    | 24           | 26                |                       |
| est of 4.a, b.1, b.2) 4.b     |                       |                    | 0            |                   |                       |

| <u>Rating Factor</u> | <u>Assigned Value</u> | <u>Multi-plier</u> | <u>Score</u> | <u>Max. Score</u> | <u>Ref. (Section)</u> |
|----------------------|-----------------------|--------------------|--------------|-------------------|-----------------------|
| Water Use            | 1                     | 3                  | 3            | 9                 | 3.5                   |
| ce to Nearest Well/  | 0                     | 1                  | 0            | 40                |                       |
| lation Served        |                       |                    |              |                   |                       |
| argets Score         |                       |                    | 3            | 59                |                       |

1=45 (1x4x5) Chemical 360  
 1=0 (2x3x4x5) Radioactive 0 57330

57330 \* 100 Sc(gw) = 0.63 Sr(gw) 0.00

mHRS HAZARDOUS RANKING SYSTEM FACILITY REPORT

Facility Name: CENTRAL NEVADA TEST SITE  
DOE/NV LAS VEGAS, NV

Location: 50 MILES NORTHEAST OF TONOPAH, NV

Person(s) in charge of facility: DOE/NV

Name: DAVID N. FAUVER

Date: 12/86

Description

Facility: DEMOBILIZED NUCLEAR TESTING SITE

Hazardous wastes: CHEMICAL

Medium of concern: GROUNDWATER

Descriptive comments:

Facility types: SURFACE IMPOUNDMENTS

Groundwater worksheets are included for this facility: GROUND WATER

U<sub>1</sub> = 0.36 (S<sub>gw</sub> = 0.63 S<sub>sw</sub> = 0.00 S<sub>a</sub> = 0.00)  
U<sub>2</sub> = 0.00  
U<sub>3</sub> = 0.00

mHRS GROUND WATER ROUTE WORK SHEET

Vegas, Nevada  
 Pitka Test Site

04/02/86  
 Site Index: 5

| <u>Rating Factor</u> | <u>Assigned<br/>value</u> | <u>Multi-<br/>plier</u> | <u>Score</u> | <u>Max.<br/>Score</u> | <u>Ref.<br/>(Section)</u> |
|----------------------|---------------------------|-------------------------|--------------|-----------------------|---------------------------|
| erved Release        | 0                         | 1                       | 0            | 45                    | 3.1                       |

erved release is given a score of 45, proceed to line 4.  
 erved release is given a score of 0, proceed to line 2.

| <u>Rating Factor</u>                   | <u>Assigned<br/>value</u> | <u>Multi-<br/>plier</u> | <u>Score</u> | <u>Max.<br/>Score</u> | <u>Ref.<br/>(Section)</u> |
|--|---------------------------|-------------------------|--------------|-----------------------|---------------------------|
| Characteristics                        |                           |                         |              |                       | 3.2                       |
| h to Aquifer of Concern                | 0                         | 2                       | 0            | 6                     |                           |
| recipitation                           | 3                         | 1                       | 3            | 3                     |                           |
| availability of the Unsaturated<br>one | 2                         | 1                       | 2            | 3                     |                           |
| cal State                              | 3                         | 1                       | 3            | 3                     |                           |
| Route Characteristics Score            |                           |                         | 8            | 15                    |                           |

|     |   |   |   |   |     |
|-----|---|---|---|---|-----|
| ent | 1 | 1 | 1 | 3 | 3.3 |
|-----|---|---|---|---|-----|

| <u>Rating Factor</u>           | <u>Assigned<br/>value</u> | <u>Multi-<br/>plier</u> | <u>Score</u> | <u>Max.<br/>Score</u> | <u>Ref.<br/>(Section)</u> |
|--------------------------------|---------------------------|-------------------------|--------------|-----------------------|---------------------------|
| Characteristics                |                           |                         |              |                       | 3.4                       |
| ical                           |                           |                         |              |                       |                           |
| Toxicity/Persistence           | 18                        | 1                       | 18           | 18                    |                           |
| azardous Waste Quantity        | 6                         | 1                       | 6            | 8                     |                           |
| active                         |                           |                         |              |                       |                           |
| Maximum Observed               | 0                         | 1                       | 0            | 26                    |                           |
| Maximum Potential              | 0                         | 1                       | 0            | 26                    |                           |
| aste Characteristics Score 4.a |                           |                         | 24           | 26                    |                           |
| gest of 4.a, b.1, b.2) 4.b     |                           |                         | 0            |                       |                           |

| <u>Rating Factor</u>                   | <u>Assigned<br/>value</u> | <u>Multi-<br/>plier</u> | <u>Score</u> | <u>Max.<br/>Score</u> | <u>Ref.<br/>(Section)</u> |
|--|---------------------------|-------------------------|--------------|-----------------------|---------------------------|
| s                                      |                           |                         |              |                       | 3.5                       |
| ind Water Use                          | 1                         | 3                       | 3            | 9                     |                           |
| nce to Nearest Well/<br>ulation Served | 0                         | 1                       | 0            | 40                    |                           |
| Targets Score                          |                           |                         | 3            | 59                    |                           |

|                 |             |     |       |
|-----------------|-------------|-----|-------|
| e 1=45 (1x4x5)  | Chemical    | 576 |       |
| e 1=0 (2x3x4x5) | Radioactive | 0   | 57330 |

5/57330 \* 100      Sc(gw) =      1.00      Sr(gw)      0.00

mHRS HAZARDOUS RANKING SYSTEM FACILITY REPORT

Facility Name: AMCHITKA TEST SITE  
DOE/NV LAS VEGAS, NV

Location: AMCHITKA ISLAND, ALASKA

Person(s) in charge of facility: DOE/NV

Name: DAVID N. FAUVER

Date: 12/86

Description

Facility: DEMOBILIZED NUCLEAR TESTING SITE

Hazardous wastes: CHEMICAL

Medium of concern: GROUNDWATER

Descriptive comments:

Impoundment types: SURFACE IMPOUNDMENTS

Monitoring worksheets are included for this facility: GROUND WATER

$n = 0.58$  ( $S_{gw} = 1.00$   $S_{sw} = 0.00$   $S_a = 0.00$ )  
 $f = 0.00$   
 $a_1 = 0.00$

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