

DUGWAY PERMIT

MODULE VII

ATTACHMENT 7

**HWMU 36
POST-CLOSURE PLAN**

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1.0 INTRODUCTION

There are three objectives of this post closure plan; 1) Ensure Dugway Proving Ground (Dugway or DPG) complies with the post closure permit issued by the State of Utah in accordance with Title 40 Code of Federal Regulations (CFR) §264.117, with respect to post closure requirements; 2) protection of potable groundwater in the confined aquifer by monitoring horizontal and vertical migration of contamination of groundwater; and 3) inspection and tracking and inspections to ensure industrial site use in accordance with CFR §270.28 and Utah Administrative Code (UAC) R315-3-2.19, the post-closure plan is required to include specific information for a closed facility. As applicable to Hazardous Waste Management Unit (HWMU) 36, the information requirements include:

- General description of the facility;
- Description of security procedures;
- General inspection schedule;
- Preparedness and Prevention Plan;
- Facility location information (including seismic and flood plain considerations);
- Closure Plan or Closure Proposal;
- Certificate of Closure;
- Topographic map, with specific scale;
- Summary of groundwater monitoring data; and
- Identification of uppermost aquifer and interconnected aquifers.

Table 1-1 provides the regulatory citations for the general information requirements and the specific locations in this Post-Closure Plan where the specific information is presented.

Table 1-1: Summary of HWMU 36 Post-Closure Information Requirements Under 40 CFR §270.14, UAC R315-3-2.19, and UAC R315-3.2.5

Regulation Citation	Requirement Description	Location Requirement is Addressed
40 CFR §270.14(b)(1) UAC R315-3.2.5(b)(1)	General Description of the Facility	Section 2.0
40 CFR §270.14(b)(4) UAC R315-3.2.5(b)(4)	Description of Security Procedures	Section 3.0
40 CFR §270.14(b)(5) UAC R315-3.2.5(b)(5)	General Inspection Schedule	Section 7.0, Module VII Table VII-3, and Module VII Form A
40 CFR §270.14(b)(6) UAC R315-3.2.5(b)(6)	Preparedness and Prevention	Section 4.0
40 CFR §§270.14(b)(11)(i-ii, v) UAC R315-3.2.5(b)(11) (i-ii, v)	Facility Location Information Applicable seismic standard	Section 5.0
40 CFR §270.14(b)(11) (iii-v) UAC R315-3.2.5(b)(11) (iii-v)	Facility Location Information 100-year floodplain	Section 6.0
40 CFR §270.14(b)(13) UAC R315-3.2.5(b)(13)	Copy of the Closure Plan	Closure Proposal open for public comment ending on July 5, 1999 with no comments

Table 1-1: Summary of HWMU 36 Post-Closure Information Requirements Under 40 CFR 270.14, UAC R315-3-2.19, and UAC R315-3.2.5 (Continued)

Regulation Citation	Requirement Description	Location Requirement is Addressed
40 CFR §270.14(b)(14) UAC R315-3.2.5(b)(14)	Closure Certification and Notification	Section 9.0 and Appendix A
40 CFR §270.14(b)(16) UAC R315-3.2.5(b)(16)	Post-Closure Cost Estimate	Federal Facilities are exempt from this requirement
40 CFR §270.14(b)(18) UAC R315-3.2.5(b)(18)	Proof of Financial Coverage	Federal Facilities are exempt from this requirement
40 CFR §270.14(b)(19) UAC R315-3.2.5(b)(19) (i)	Topographic Map Map Scale and Date	Figure 2 (1 inch = 1000 feet (ft))
40 CFR §270.14(b)(19) UAC R315-3.2.5(b)(19) (ii)	Topographic Map 100-year floodplain area	Section 6.0; HWMU 36 is not located within a verified 100-year floodplain area
40 CFR §270.14(b)(19) UAC R315-3.2.5(b)(19) (iii)	Topographic Map Surface waters including intermittent streams	Figures 2 and 3; Active waste water treatment discharge ditches and Government Creek
40 CFR §270.14(b)(19) UAC R315-3.2.5(b)(19) (iv)	Topographic Map Surrounding land uses	There are no residential populations in the vicinity of HWMU 36. The closest residential area is English Village (approximately 10 miles away)
40 CFR §270.14(b)(19) UAC R315-3.2.5(b)(19) (v)	Topographic Map A wind rose (i.e., prevailing windspeed and direction)	There are no residential populations in the vicinity of HWMU 36. The closest residential area is English Village (approximately 10 miles away). A wind rose is not deemed necessary for HWMU 36
40 CFR §270.14(b)(19) UAC R315-3.2.5(b)(19) (vi)	Topographic Map Orientation of Map, North Arrow	Figure 2
40 CFR §270.14(b)(19) UAC R315-3.2.5(b)(19) (vii)	Topographic Map Legal boundaries of the hazardous waste management facility.	Legal boundaries have not been established at DPG for former HWMUs
40 CFR §270.14(b)(19) UAC R315-3.2.5(b)(19) (viii)	Topographic Map Access control, fence, gates	Figure 3; Site specific access control was not deemed necessary due to remedial actions taken and DPG security restricting access for the common population
40 CFR §270.14(b)(19) UAC R315-3.2.5(b)(19) (ix)	Topographic Map Injection and withdrawal wells	Figure 2; There are no injection or withdrawal wells in the vicinity of HWMU 36
40 CFR §270.14(b)(19) UAC R315-3.2.5(b)(19) (xi)	Topographic Map Barriers for drainage or flood control	Figures 2 and 3; HWMU 36 features were removed or demolished. Other than the drainage ditches, the HWMU was graded flat

Table 1-1: Summary of HWMU 36 Post-Closure Information Requirements Under 40 CFR 270.14, UAC R315-3-2.19, and UAC R315-3.2.5 (Continued)

Regulation Citation	Requirement Description	Location Requirement is Addressed
40 CFR §270.14(c) UAC R315-3.2.5(c)(1)	Groundwater Monitoring Information Summary of Groundwater Data	Post-closure groundwater monitoring is required at HWMU 36. Groundwater Management Plan/Ditto GMA (PES, 2004); HWMU 36 Closure Certification Report - Appendix C
40 CFR §270.14(c) UAC R315-3.2.5(c)(2)	Groundwater Monitoring Information Identification of uppermost aquifer	Section 2.6; Post-closure groundwater monitoring is required at HWMU 36. Groundwater Management Plan/Ditto GMA (PES, 2004); HWMU 36 Closure Certification Report - Section 4.3
40 CFR §270.14(c) UAC R315-3.2.5(c)(3)	Groundwater Monitoring Information Delineation of the Waste Management Area	Figure 2; Post-closure groundwater monitoring is required at HWMU 36. Groundwater Management Plan/Ditto GMA (PES, 2004); HWMU 36 Closure Certification Report - Appendix G
40 CFR §270.14(c) UAC R315-3.2.5(c)(4)	Groundwater Monitoring Information Extent of Plume	Section 2.6; Post-closure groundwater monitoring is required at HWMU 36. Groundwater Management Plan/Ditto GMA (PES, 2004); HWMU 36 Closure Report - Section 4.5
40 CFR §270.14(c) UAC R315-3.2.5(c)(5)	Groundwater Monitoring Information Detailed Plans/Engineering Report for Proposed Groundwater Program	Post-closure groundwater monitoring is required at HWMU 36. Groundwater Management Plan/Ditto GMA (PES, 2004)
40 CFR §270.14(c) UAC R315-3.2.5(c)(6)(i)	Groundwater Monitoring Information Proposed List of Parameters	Post-closure groundwater monitoring is required at HWMU 36. Groundwater Management Plan/Ditto GMA (PES, 2004)
40 CFR §270.14(c) UAC R315-3.2.5(c)(6)(ii)	Groundwater Monitoring Information Proposed Groundwater Monitoring System	Post-closure groundwater monitoring is required at HWMU 36, Groundwater Management Plan/Ditto GMA (PES, 2004)
40 CFR §270.14(c) UAC R315-3.2.5(c)(6)(iii)	Groundwater Monitoring Information Background Values	Post-closure groundwater monitoring is required at HWMU 36. Groundwater Management Plan/Ditto GMA (PES, 2004)
40 CFR §270.14(c) UAC R315-3.2.5(c)(6)(iv)	Groundwater Monitoring Information A description of the Proposed Sampling	Post-closure groundwater monitoring is required at HWMU 36. Groundwater Management Plan/Ditto GMA (PES, 2004)

2.0 FACILITY DESCRIPTION

The following provides a general description of HWMU 36, also known as the Imhoff Tank System at Dugway Proving Ground (DPG), as required by UAC R315-3.2.5(b)(1) (Figure 1).

2.1 HWMU 36 LOCATION AND HISTORY

HWMU 36, also known as the Imhoff Tank System, is located immediately west of the Ditto Technical Center in DPG (Figures 2 and 3). HWMU 36 consisted of a deactivated Imhoff Tank, a sludge drying bed, an influent sump and pumphouse, and two unlined effluent ditches. HWMU 36 was the primary wastewater treatment facility for the Avery, Ditto, and Michaels Army Airfield areas from 1944 to 1990 when it was replaced by a new sewage treatment facility consisting of three sewage lagoons. The new sewage treatment facility is located immediately west of the HWMU 36 sludge drying bed and is still in service.

2.2 PAST OPERATIONS

Facilities that discharged to HWMU 36 included an aircraft hanger, a power plant, a heavy equipment shop, a gas station, a dispensary, laundry facilities, several offices, a cafeteria, and biological, chemical, and photographic laboratories (including the old Ditto Chemical Laboratory). Wastewater generated at the facilities in these areas was carried to HWMU as part of the DPG corrective action program.

Imhoff Tanks are a combination settling tank, skimmer, and sludge digester in one unit that provides primary sewage treatment. These tanks were commonly used prior to the implementation of regulations requiring secondary treatment of sanitary sewage. The Imhoff Tank at HWMU 36 was a reinforced-concrete structure approximately 48 ft long by 27 ft wide, and its top was eight to 10 ft above grade. The Imhoff Tank was replaced by the new sewage lagoons in 1990. When the lagoons began receiving wastewater in late 1990, the piping to the Imhoff Tank was disconnected. The tank was drained and all remaining sludge and wastewater was removed from the Imhoff Tank and shipped to U.S. Pollution Control Industries (USPCI) for disposal.

During its period of operation, accumulated sludge was removed annually from the Imhoff Tank and placed in the sludge-drying bed. Between 1974 and 1979, the dried sludge was containerized and disposed of in a sanitary landfill. During this period, two 55-gallon drums of dried sludge were disposed annually in this manner.

The three sewage lagoons constructed in 1990 adjacent to HWMU 36 are each approximately 140 ft long, 80 ft wide, and 15 ft deep. The sewage lagoons currently operate in series from south to north and discharge effluent to the western unlined drainage ditch at an outfall point about 170 ft north-northwest of the Imhoff Tank. Each of the lagoons has a flexible synthetic liner.

2.3 PREVIOUS INVESTIGATIONS DOCUMENTATION

The detailed results of previous material, soil, and groundwater sampling, and closure information including the risk assessment are available, for HWMU 36, in the DSHW public documents listed below in Table 2-1 (UAC R315-3.2.5(b)(13)).

Table 2-1: DSHW Library Documents Detailing HWMU 36 Investigations

Document Title	Received Date	DSHW Library No.
Foster Wheeler Environmental Corporation (FWEC), 1995. <i>SWMU Closures at Dugway Proving Ground, Interim Report, Volume 4, Appendix F-Results of Data Validation.</i>	10/04/1995	DPG00027
FWEC, 1998. <i>Dugway Proving Ground Closure Plan, Module 3, HWMU 36 Final.</i> May.	6/24/98	DPG00107
IT, 2000. <i>Final Remedial Action Plan, Rev. 0.</i> May.	5/09/2000	DPG00180
IT, 2001. <i>HWMU 36 Final Work Plan & Sampling and Analysis Plan for HWMU 36 Groundwater Investigation, Revision 0.</i> February.	3/01/2001	DPG00208
Shaw Environmental, Inc., 2004. <i>Final Closure Certification Report For HWMU 36 Imhoff Tank System.</i> October.	12/02/2004	DPG00461
Parsons Environmental Science, Inc. (Parsons), 2004. <i>Final Hydrogeological Assessment and Regional Groundwater Monitoring Plan, Volume I, Ditto GMA.</i> Dugway Proving Ground, Utah. October.	11/16/2004	DPG00459

2.4 CLOSURE ACTIVITIES

DPG has completed closure actions for HWMU 36, and the site meets the risk-based closure criteria for future commercial/industrial site use, as specified in UAC R315-101. The remedial activities performed at HWMU 36 are described in detail in the Final Closure Certification Report (Shaw, 2004). The remedial investigation completed at HWMU 36 included soil and groundwater sampling. The investigation included confirmation soil samples, cone penetrometer testing (CPT)/direct push groundwater sampling at 16 primary locations, and four additional step-out locations, and monitoring of the 11 existing monitoring wells. Remedial activities completed included: 1) decontaminating and backfilling the existing pumphouse foundation and influent sump, 2) demolishing the Imhoff Tank roof and walls to below grade and backfilling to grade using pea gravel and clean fill, 3) excavating and removing influent/effluent and the sludge draw off piping, 4) excavating, removing, and backfilling the sludge drying bed, and contaminated soil, and 5) characterizing and disposing of all generated wastes including excavated soils, piping, sludge, decontamination liquids, and spent personal protective equipment (PPE). No waste is present at HWMU 36. The sample results were evaluated in the human health and ecological risk assessments as discussed below.

2.5 HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT

Human health and ecological risk assessments were conducted and indicated that the remaining residual contamination at HWMU 36 does not pose an unacceptable risk to industrial users as defined in UAC R315-101. The industrial cancer risk is less than 1E-04 and the Hazard Index is less than 1. Ecological risks are expected to be minimal. Since no waste is present at HWMU 36, there is not any potential for escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products to the ground, surface waters, or to the atmosphere. The existing sewage treatment lagoons will continue to operate at HWMU 36.

The human and ecological risk assessments are presented in the Final Closure Certification Report (Shaw, 2004). Residual contamination in soil is not considered a source of ongoing groundwater contamination.

2.6 SURFACE WATER AND GROUNDWATER

The principle surface water features in the vicinity of HWMU 36 are the two unlined drainage ditches that historically conveyed effluent from the Imhoff Tank first to the north-northwest and then to the west, with the eastern ditch combined with Government Creek, before it was discharged into the desert. Effluent was discharged into at least one of these ditches on a continuous basis.

The most important natural surface water feature near HWMU 36 is Government Creek. The U.S. Geological Survey (USGS) Topographic Map for the area, Camels Back Ridge NW, Utah, dated 1993, shows Government Creek and one effluent drainage ditch running parallel and flowing west for approximately 15,000 ft from the Imhoff Tank area.

Groundwater in the upper water bearing zone is non potable. The vertical and horizontal extent of volatile organic compound (VOC) groundwater contamination at HWMU 36 was defined based on groundwater investigations, and as a result, two plumes were identified in the upper water bearing zone, a trichloroethene (TCE) plume with a maximum concentration at 036MW02 of 1,770 micrograms per liter ($\mu\text{g/L}$) and a second previously unidentified chlorobenzene plume with a maximum concentration of 5, 280 $\mu\text{g/L}$ at CPT-13A. Long term monitoring is required as described in the Ditto GMA.

2.7 CLOSURE NOTIFICATIONS

The Certification of Closure (Appendix A) was received by the Division of Solid and Hazardous Waste (DSHW) on December 2, 2004, and verified by the Executive Secretary of the Utah Solid and Hazardous Waste Control Board on December 27, 2004.

Federal facilities are exempt from submitting notifications to the local zoning authority as required by 40 CFR §§264.116 and 264.119, which are incorporated by reference in UAC R315-8-7.

3.0 SECURITY REQUIREMENTS

HWMU 36 is located within a federal, military installation (Dugway Proving Ground). As such, the installation is restricted for the common population. Access to HWMU 36 is strictly monitored by DPG Base Security (Range Control).

4.0 PREPAREDNESS AND PREVENTION MEASURES

All wastes have been removed from HWMU 38. The DPG Emergency Response and Contingency Plan (Part B Permit), where applicable to this site (Module VII.M.), shall be used to announce and respond to emergency conditions. At a minimum, the site inspector should have a radio or phone and a First Aid kit available during inspections.

5.0 SEISMIC STANDARD

HWMU 36 is not located within 200 ft of any active faults. Although Utah is tectonically active, most of the earthquake activity occurs about 55 miles to the east along the Wasatch Range Foothills.

A geologic map completed in a 1988 study by the U.S Geological Survey (Barnhard and Dodge, 1988), was used to determine the distribution, relative age, and amount and extent of surface rupture on Quaternary fault scarps, in the area of HWMU 36.

The USGS study (Barnhard and Dodge, 1988) concluded that morphologic and geologic data collected along the fault scarps in the area indicate that all were formed during the later Pleistocene era and there is not any clear evidence of Holocene surface rupture. Several faults inferred on geophysical evidence are located at Dugway; however, there is no evidence of displacement during Holocene time.

6.0 FLOODPLAIN STANDARD

HWMU 36 is not located within a 100-year verified floodplain. The National Flood Insurance Rate Map, identifying the boundary of the 100-year flood, does not include DPG. There are no permanent streams or other surface water bodies on DPG.

Surface water from precipitation flows through well-established drainage channels into the flat plain and evaporates. Like other arid regions, DPG is subject to flash flooding following high-precipitation events. Flash floods have occurred only four times in the history of the installation, in 1944, 1952, 1973, and 1983. The major area affected during flash floods has been the Government Creek drainage channel, which has overflowed and caused minor inundation of roads at the Ditto Technical Center.

7.0 POST-CLOSURE OPERATIONS AND INSPECTIONS

7.1 INTRODUCTION

HWMU 36 has been closed under a continued industrial use scenario, which prohibits residential use in the areas formerly occupied by the site. To ensure that the area is not reused or developed for residential purposes, annual site inspections and a biennial post-closure report shall be required. The new sewage treatment facility will continue to be used at HWMU 36 and will be managed so that it does not contribute to soil or groundwater contamination.

7.2 GROUNDWATER MONITORING

Post-Closure management of the HWMU 36 groundwater monitoring shall be in accordance with the Ditto Groundwater Management Area (GMA) Plan (PES, 2004), as referenced in permit condition VII.Q.

7.3 ANNUAL INSPECTIONS

General site inspections of the former HWMU 36 site shall be conducted annually before November 1st, to ensure that the former site remains under industrial use and to verify the Dugway Dig Permit process as described in Module VII.I has been followed. The annual post-closure site inspection checklist for industrial use sites included as Form A in Module VII should be used. Completed inspection forms shall be filed with the DPG Environmental Office.

The site shall be visually inspected to ensure the following conditions are maintained at the site:

- There is no evidence of land use other than for industrial purposes within the former site boundary; and
- Inspect for evidence of soil disturbance.

Table 7-1 summarizes the Post-Closure Inspection Schedule for HWMU 36, and lists the items to be inspected and potential problems. Inspection personnel shall note any problems found and shall inform appropriate DPG representatives.

Table 7-1: HWMU 36 Post-Closure Inspection Schedule

Inspection/Monitoring Item	Method of Documentation	Frequency of Inspection
Land Use	General Site Inspection Checklist (Form A, Module VII)	Annual Inspection conducted before November 1 st .

7.4 INSPECTION FOLLOW-UP

Copies of completed site inspection checklists (Form A in Module VII) shall be forwarded to the DPG Environmental Office. The Point-of-Contact for the DPG Environmental Office is as follows:

Environmental Programs Compliance Representative
 Dugway Proving Ground Environmental Program Office
 Dugway Proving Ground, UT 84022
 Telephone: (435) 831-3560

The DPG Environmental Office shall notify the appropriate personnel to implement corrective action as needed.

DPG shall initiate corrective action as soon as practical after identifying the problem. If the corrective action requires substantial effort, a technical plan shall be prepared to summarize the problem, the potential impacts, the proposed plan for action, and the time frame in which corrective action shall be implemented as required under this Permit. This plan shall be approved by the Executive Secretary and shall be submitted within 30 days of DPG’s decision to implement corrective action.

8.0 SUBMITTALS/REPORTING

Based on the evaluation presented in the Final Closure Certification Report for HWMU 36, post-closure monitoring, including groundwater monitoring IAW the Ditto Groundwater Management Plan (PES, 2003), is required for HWMU 36. Groundwater results will be reported through the requirements of the Ditto Groundwater Management Plan, not within the biennial report for HWMU 36.

8.1 NON-COMPLIANCE REPORTING

The conditions at HWMU 36 are such that the impact to human health and the environment is very unlikely. No wastes remain at the site. Hazardous wastes are no longer managed or maintained at the site. Sewage treatment facility activities at the former HWMU will be managed under a separate permit. Nonetheless, if there is any type of non-compliance with any condition of this Permit, notifications shall be submitted per Permit Conditions VII.C.5.

8.2 BIENNIAL POST-CLOSURE REPORT

In accordance with UAC R315-3-3.1(1)(9), a Biennial Post-Closure Report shall be prepared for all DPG closed HWMUs and SWMUs undergoing post-closure care. Post Closure Reports shall be submitted to

DSHW no later than March 1st, of the following year, that the report is due. The first Post-Closure reporting year is 2007 for HWMU 36. The report shall be submitted no later than March 1st of 2008. Specifically for HWMU 36, the Biennial Post-Closure Report shall include, at a minimum, the following:

- General site description and conditions;
- Inspection records.

8.3 REQUIRED SUBMITTALS

Table 8-1 summarizes the requirements for the Biennial Post-Closure Report for HWMU 36 and reporting for any non-compliance.

Table 8-1: Summary Table of Required Submittals

Required Submittals	Frequency and Submittal Date
<u>Biennial Post-Closure Report</u>	Post-Closure Reports shall be submitted to the Division of Solid and Hazardous Waste no later than March 1 st , of the following year that the report is due. Reporting years are odd numbered years beginning with March 2007, for the duration of the Post-Closure Monitoring Period.
<u>Non-Compliance Reporting</u> <ol style="list-style-type: none"> 1. Anticipated Non-Compliance (Module VII.C.5.). 2. 24-hour Notification for information concerning the non-compliance, which may endanger public drinking water supplies or human health or the environment (Module VII.C.5.). 3. Five-day written notification for information concerning the non-compliance, which may endanger public drinking water supplies or human health or the environment. The Executive Secretary may waive the 5-day notice, in favor of a 15-day notice (Module VII.C.5.). 4. Written notification for information concerning the non-compliance, which does not endanger human health or the environment (Module VII.C.5.). 	<ol style="list-style-type: none"> 1. 30 days advance notice of any change which may result in noncompliance 2. Orally within 24 hours of discovery 3. Within 5 days of discovery 4. Submitted with the Biennial Post Closure Report are submitted.

9.0 POST-CLOSURE CERTIFICATION

No later than 60 days after post-closure activities are completed and approved by the Executive Secretary, DPG representatives shall submit a certification to the Board, signed by DPG and an independent professional engineer registered in the State of Utah, stating why post-closure care is no longer needed.

10.0 REFERENCES

Barnhard, T.P. and R.L. Dodge, 1988. *Map of Fault Scarps Formed on Unconsolidated Sediments, Tooele 1° x 2° quadrangle, Northwestern Utah*, United States Geological Survey.

Ebasco Services Incorporated (Ebasco), 1993. *Final Nature and Extent Investigation Plan No. 4 – SWMU 36*. April.

Parsons Environmental Science, Inc. (Parsons), 2004. *Final Hydrogeological Assessment and Regional Groundwater Monitoring Plan, Volume I, Ditto GMA*. Dugway Proving Ground, Utah. October.

Shaw Environmental, Inc. (Shaw) 2004. *Final Closure Certification Report, for HWMU 36, Imhoff Tank System, Dugway Proving Ground, Utah*. October.

DUGWAY PERMIT

MODULE VII

ATTACHMENT 7

APPENDIX A

HWMU 36

CERTIFICATE OF CLOSURE

CERTIFICATION OF CLOSURE

The Closure Report for Hazardous Waste Management Unit (HWMU) 36 at Dugway Proving Ground, Utah has been prepared by Shaw Environmental in accordance with the closure requirements specified under the Utah Administrative Code (UAC) 315-7-14 and 40 Code of Federal Regulations 265, Subpart G. The requirements of UAC 315-101 form the basis for the risk-based criteria in the closure of HWMU 36.

In accordance with 40 CFR 265.115, the signature and seal certify that a licensed professional has reviewed the Closure Report in accordance with the above referenced regulatory requirements.

Respectfully submitted,

Scott Reed
Directorate of Environmental Programs
Dugway Proving Ground



Adam S. Ng, Ph.D., P.E.
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