Prepared for

US Ecology Nevada, Inc.
Beatty Facility
EPA ID# NVT330010000

Application for Site-Specific Determination of Equivalent Treatment for Organic Contaminated Hazardous Debris under the Land Disposal Restrictions

Beatty Facility
Beatty, Nevada

Prepared by

Geosyntec consultants

engineers | scientists | innovators

Project Number: PNG1090

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PETITIONER CERTIFICATION PER 40 CFR 268.44(c)

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this petition and all attached documents, and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

LIST OF ACRONYMS AND ABBREVIATIONS

BDAT - Best Demonstrated Available Technology
bgs - below ground surface
CFR - Code of Federal Regulations
DET - determination of equivalent treatment
ET - equivalent treatment
EMP - Environmental Monitoring Plan
EVOH - ethylene vinyl alcohol
ft/day - feet per day
ft/year - feet per year
GCL - geosynthetic clay liner
gpad - gallons/acre/day
GWPS - Groundwater Protection Standards
HDPE - high-density polyethylene
LCRS - leachate collection and removal system
LCS - leachate collection system
LDPE - low-density polyethylene
LDR - Land Disposal Restrictions
LDS - Leakage Detection System
MCL - maximum contaminant limit
NDEP - Nevada Division of Environmental Protection
POC - point of compliance
ppm - parts per million
PVC - polyvinyl chloride
RCRA - Resource Conservation and Recovery Act
SSIs - Statistically Significant Increases
SVOC - semi-volatile organic compounds
USEPA - U.S. Environmental Agency
USGS - U.S. Geological Survey
VOCs - volatile organic compounds
WBZ - water bearing zone

1. INTRODUCTION

US Ecology Nevada, Inc is providing this petition to the U.S. Environmental Protection Agency (USEPA/EPA) under 40 Code of Federal Regulations (CFR) §268.42(b) to apply for a determination of equivalent treatment (DET) for **organic contaminated hazardous debris**. This application includes a demonstration that the proposed alternative treatment method can achieve a measure of performance equivalent to that achieved by methods specified in 40 CFR § 268.42(a).

2. DET PETITION APPLICATION

Purpose: Demonstrate a **DET** for **organic contaminated hazardous debris** for treatment and final disposal at the US Ecology Nevada, Inc Facility.

This DET petition is for organic contaminated hazardous debris that contains over 500 parts per million (ppm) of volatile and/or semi-volatile organic compounds (VOCs, SVOCs) and for chemicals that are compatible with polyethylene and/or ethylene vinyl alcohol (EVOH). Once macroencapsulated, the organic contaminated hazardous debris will be placed into a Subtitle C landfill at a location that is demonstrated to be in compliance with federal, state, and local requirements and is as or more protective of human health and the environment than current methods for this waste.

Applicant: US Ecology Nevada, Inc.

Name and Facility Identification Number:

US Ecology Nevada, Inc. (Beatty Facility)

EPA ID# NVT330010000; NDEP Permit # NEVHW0025

The Beatty Facility location is shown in Figure 1.

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Figure 1: Beatty Facility Location

3. BACKGROUND

Hazardous waste must be treated prior to land disposal based on the regulations in 40 CFR Part 268. Hazardous debris subject to treatment can utilize alternative treatment standards in Table 1 of 40 CFR § 268.45. Hazardous debris can be generated from a variety of waste streams with listed and/or characteristic waste codes. The treatment standards must be met for each contaminant subject to treatment contained in the debris. The Beatty Facility uses macroencapsulation, an immobilization technology, for waste that meets the definition of debris.

Currently, US Ecology Nevada, Inc., manages both organic and inorganic contaminated debris using macroencapsulation with high density polyethylene (HDPE). The process includes placement of mixed organic Resource Conservation and Recovery Act (RCRA) hazardous debris onto an HDPE liner within the landfill and wrapping it with HDPE ("wrap-method") to macroencapsulate the waste. This method of macroencapsulation fully encapsulates the debris and reduces contact of the waste with precipitation and landfill leachate and reduces leachability. However, since HDPE may not be resistant to some organic constituents, an alternative method has been developed with chemical-specific compatible materials for encapsulating the organic contaminated hazardous debris. Once macroencapsulated, the debris will be placed into an existing Subtitle C permitted landfill. The process for inorganic contaminated hazardous debris waste will remain unchanged. The current Best Demonstrated Available Technology (BDAT) for organics is incineration, which is not viable for this waste stream based on numerous factors such as impracticability for the waste volumes, overall volumetric waste, suitability of incineration for the materials, capacity of incinerators/infrastructure, and cost. The current waste treatment process is discussed further in Section 8.

4. REGULATORY HISTORY

Organic contaminated hazardous debris is regulated by RCRA of 1976, as amended, and corresponding USEPA hazardous waste regulations, including the Land Disposal Restrictions (LDR).

Treatment standards for hazardous debris are defined in 40 CFR § 268.45. Alternative treatment for hazardous debris includes using an immobilization technology such as macroencapsulation to reduce mobility of toxic substances. Immobilization technologies can include macroencapsulation, microencapsulation, or sealing. The hazardous debris with listed waste that is treated using immobilization must be managed in a subtitle C facility.

4.1 Disposal and Treatment history

The organic contaminated hazardous debris has historically been macroencapsulated by wrapping in an HDPE liner for disposal in a Subtitle C landfill.

5. PROPOSED ACTION FOR DET

US Ecology Nevada, Inc. proposes to macroencapsulate organic-contaminated hazardous debris, with VOCs and SVOCs concentrations greater than 500 ppm, using either polyethylene or EVOH material. Material selection will be based on compatibility with the organic constituents in each waste stream. For organic contaminated hazardous debris where polyethylene is compatible, the current HDPE wrap method will be used. For organic contaminated hazardous debris where polyethylene is not compatible, a bag with an EVOH liner will be used. Once encapsulated, the debris will be placed into the Subtitle C landfill in Beatty, Nevada. The Beatty Facility is located in an arid environment, where relatively small quantities of leachate are intermittently generated in landfill cells.

The proposed process and design are described in more detail in Section 9, and the landfill is described in Section 10. This proposed action for macroencapsulation and landfilling is permanent and secure and provides a high level of protection for human health and the environment.

6. APPLICABLE WASTE CODES

This DET application focuses on organic contaminated hazardous debris that could carry any of the waste codes found in 40 CFR Part 261. For example, waste with organic contaminated hazardous debris may carry one or more listed waste codes (e.g., D, F, K, P, and/or U), and/or have characteristics waste codes (e.g., D001 – D043).

- D001, D002, D003, D004, D005, D006, D007, D008, D009, D010, D011, D012, D013, D014, D015, D016, D017, D018, D019, D020, D021, D022, D023, D024, D025, D026, D027, D028, D029, D030, D031, D032, D033, D034, D035, D036, D037, D038, D039, D040, D041, D042, D043
- F001, F002, F003, F004, F005, F006, F007, F008, F009, F010, F011, F012, F019, F020, F021, F022, F023, F024, F025, F026, F027, F028, F032, F034, F035, F037, F038, F039
- K001, K002, K003, K004, K005, K006, K007, K008, K009, K010, K011, K013, K014, K015, K016, K017, K018, K019, K020, K021, K022, K023, K024, K025, K026, K027, K028, K029, K030, K031, K032, K033, K034, K035, K036, K037, K038, K039, K040, K041, K042, K043, K044, K045, K046, K047, K048, K049, K050, K051, K052, K060, K061, K062, K069, K071, K073, K083, K084, K085, K086, K087, K088, K093, K094, K095, K096, K097, K098, K099, K100, K101, K102, K103, K104, K105, K106, K107, K108, K109, K110, K111, K112, K113, K114, K115, K116, K117, K118, K123, K124, K125, K126, K131, K132, K136, K141, K142, K143, K144, K145, K147, K148, K149, K150, K151, K156, K157, K158, K159, K161, K169, K170, K171, K172, K174, K175, K176, K177, K178, K181
- P001, P002, P003, P004, P005, P006, P007, P008, P009, P010, P011, P012, P013, P014, P015, P016, P017, P018, P020, P021, P022, P023, P024, P026, P027, P028, P029, P030, P031, P033, P034, P036, P037, P038, P039, P040, P041, P042, P043, P044, P045, P046, P047, P048, P049, P050, P051, P054, P056, P057, P058, P059, P060, P062, P063, P064, P065, P066, P067, P068, P069, P070, P071, P072, P073, P074, P075, P076, P077, P078, P081, P082, P084, P085, P087, P088, P089, P092, P093, P094, P095, P096, P097, P098, P099, P101, P102, P103, P104, P105, P106, P108, P109, P110, P111, P112, P113, P114, P115, P116, P118, P119, P120, P121, P122, P123, P127, P128, P185, P188, P189, P190, P191, P192, P194, P196, P197, P198, P199, P201, P202, P203, P204, P205
- U001, U002, U003, U004, U005, U006, U007, U008, U009, U010, U011, U012, U014, U015, U016, U017, U018, U019, U020, U021, U022, U023, U024, U025, U026, U027, U028, U029, U030, U031, U032, U033, U034,

U035, U036, U037, U038, U039, U041, U042, U043, U044, U045, U046, U047, U048, U049, U050, U051, U052, U053, U055, U056, U057, U058, U059, U060, U061, U062, U063, U064, U066, U067, U068, U069, U070, U071, U072, U073, U074, U075, U076, U077, U078, U079, U080, U081, U082, U083, U084, U085, U086, U087, U088, U089, U090, U091, U092, U093, U094, U095, U096, U097, U098, U099, U101, U102, U103, U105, U106, U107, U108, U109, U110, U111, U112, U113, U114, U115, U116, U117, U118, U119, U120, U121, U122, U123, U124, U125, U126, U127, U128, U129, U130, U131, U132, U133, U134, U135, U136, U137, U138, U140, U141, U142, U143, U144, U145, U146, U147, U148, U149, U150, U151, U152, U153, U154, U155, U156, U157, U158, U159, U160, U161, U162, U163, U164, U165, U166, U167, U168, U169, U170, U171, U172, U173, U174, U176, U177, U178, U179, U180, U181, U182, U183, U184, U185, U186, U187, U188, U189, U190, U191, U192, U193, U194, U196, U197, U200, U201, U203, U204, U205, U206, U207, U208, U209, U210, U211, U213, U214, U215, U216, U217, U218, U219, U220, U221, U222, U223, U225, U226, U227, U228, U234, U235, U236, U237, U238, U239, U240, U243, U244, U246, U247, U248, U249, U271, U278, U279, U280, U328, U353, U359, U364, U367, U372, U373, U378, U387, U389, U394, U395, U404, U409, U410, U411

The proposed macroencapsulation process will consider specific wastes and interactions with the materials used to select the encapsulating materials such that it provides treatment for each type of organic material in the mixture.

7. ENGINEERING DISCUSSION - LDR TREATMENT STANDARDS

This section discusses current LDR treatment standards for organic contaminated hazardous debris waste and presents an overview of the waste management options where current LDR treatment standards do not reflect available (modern) treatment methods where encapsulating materials are selected based on the contaminants in the debris.

7.1 Applicable LDR Standards

Current treatment of organic contaminated hazardous debris in the U.S. is based on LDR Treatment Standards for hazardous debris set forth in 40 CFR § 268.45, which states that hazardous debris must be treated prior to disposal. For debris mixtures, the regulations state that treatment standards must be met for each type of debris, meaning each organic constituent must be treated, and if used, immobilization must be the last treatment technology used.

Treatment technologies included in 40 CFR § 268.45, Table 1, include physical, chemical and thermal extraction, biological, chemical, and thermal destruction, and immobilization. This DET application proposes an immobilization technology, macroencapsulation, and demonstrates:

- That the proposed alternative treatment technology, macroencapsulation using polyethylene or EVOH materials and containment within a Subtitle C landfill, provides sufficient treatment to fully encapsulate the debris and reduce exposure to potential leaching media; and
- Compliance with federal, state, and local requirements that are protective of human health and the environment.

7.2 Comparison to BDAT

The existing BDAT for immobilization using macroencapsulation excludes organics and recommends incineration for treatment of debris containing organics. Debris waste streams include items such as steel and/or polyvinyl chloride (PVC) piping and concrete that are not suitable for incineration because volumetrically, the debris consists of large proportions of non-contaminated material, and/or the large size and overall volume of the materials (e.g., lengths of piping, large pieces of concrete). Incineration of these materials would create air emissions and thus be less protective of human health and the environment. Macroencapsulation of debris is the industry standard and eliminating this as an option would stress the already overburdened incineration market.

8. CURRENT WASTE GENERATION AND TREATMENT

This section provides an overview of hazardous debris generation sources, how the debris is characterized, and how it is currently treated and stored.

8.1 Current Waste Generation Sources and Rates

Hazardous debris comes from wide variety of industries that may produce debris that meets the definition of debris in 40 CFR Part § 268.2(g) and (h) including, but not limited to: demolition debris, secondary containments, pavements, piping, solid waste materials, filters, and other industrial types of debris that had a characteristic or listed waste codes associated with the primary site use or remediation. These wastes may carry one or more of the listed or characteristic waste codes provided in Section 6.

The sources of organic contaminated hazardous debris waste could be from but are not limited to the following:

- Spills to the environment (e.g., soil, pavements, catch basin sediments) and materials used to clean up the spills (e.g., filters and media, sorbents, and temporary piping or storage containers);
- Contaminated properties, including site investigation and remediation waste (investigation derived waste) such as soil, sludges, remediation system components (e.g., extracted groundwater piping, concrete, decommissioned well construction materials); and
- Demolition and construction debris (e.g., concrete, piping, wood, bricks).

In 2024, the Facility macroencapsulated approximately 6,025 tons of waste.

8.2 Description of Current Waste Treatment Process

The current waste treatment process for hazardous debris includes encapsulation by wrapping in an HDPE liner in the landfill. The following steps must be completed to ensure that the process reduces the surface exposure to leaching media in the landfill:

- Hazardous debris is wrapped (encapsulated) in 6-mil polyethylene liner;
- Wrapping is performed so that the liner overlaps at least 2 feet to ensure complete coverage. Gaps or openings in the liner material are unacceptable;
- The liner wrapping is secured with duct tape;
- Encapsulated debris is left undisturbed when placed in the trench to maintain the liner coating; and
- Liner/encapsulating wrap is re-inspected after the encapsulation is completed.

The liner acts as the jacket of inert material that reduces exposure to leaching media in the landfill. The tape simply ensures the liner remains in place while the encapsulated debris is covered with waste or daily cover material.

The encapsulating liner must completely cover the debris. Leaching media/liquid moves from the top of the landfill to the bottom. When completed, the encapsulating liner will protect the debris from exposure to leaching media. The encapsulation process is performed directly in the landfill. The following steps must be taken to ensure proper placement in the landfill:

- Prepare a firm and level foundation prior to the deployment of the plastic liner. The foundation waste material should not exhibit visible ruts.

- Heavy equipment should maintain a 4-foot horizontal set-back during placement and compaction of perimeter waste placed around the encapsulated waste.
- Cover waste materials should be placed at a thickness of 4 feet or greater before haul trucks or other heavy equipment are permitted to drive over the encapsulated waste.

Cover material may include other wastes, soil, or clean fill. Debris or waste that could physically damage the encapsulation liner will not be disposed of next to (less than 4 feet) encapsulated debris. Waste and fill material disposed adjacent to the debris must be compatible with the encapsulating liner material.

EPA has determined that this wrapping process is unsuitable for RCRA hazardous debris containing significant concentrations of organic constituents where HDPE may not be resistant. The process potentially fails to meet the standard for compatibility with **each** organic constituent present.

9. PROPOSED WASTE TREATMENT

The proposed waste treatment process described in this petition is an immobilization technology using macroencapsulation of organic contaminated hazardous debris within a chemical resistant material. The encapsulated material will be disposed of in a Subtitle C landfill located in a semi-arid setting where leachate volumes are low.

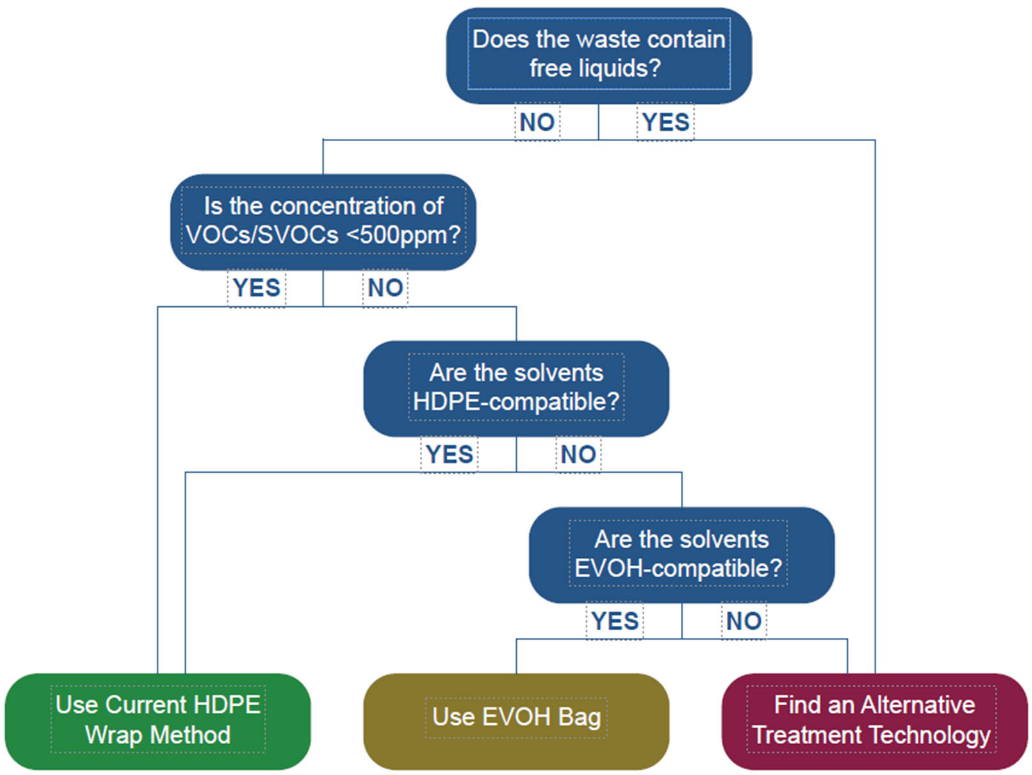
This DET application specifically focuses on the encapsulating materials and presents testing information for compatibility and durability of these materials with organic contaminated hazardous debris. Encapsulation materials, including low-density polyethylene (LDPE) and HDPE, were discussed by EPA in a 2021 memorandum, where the Agency noted *"In general, if **significant** organics are present in the waste or in the disposal environment leachate, plastic encapsulating materials should not be used as the primary basis of meeting the debris treatment standard, **or should be carefully researched. It may be necessary to conduct case-specific testing,** if you cannot find information in the literature on materials that would pertain to specific disposal conditions." (emphasis supplied) (US EPA, RCRA Online 14685 (Nov. 19, 2021)*

9.1 Proposed Waste Evaluation and Acceptance Criteria

Organic contaminated hazardous debris is typically shipped to the landfills in roll-off boxes/bins or 55 -gallon drums. The hazardous debris could contain one or more organic constituents as defined in 40 CFR Part 268. It is anticipated that chemical concentrations will be *de minimis* or present at very low concentrations, because the primary waste components by volume are mixed debris that were either used at hazardous cleanup sites or came into contact with listed hazardous waste (e.g., groundwater remediation piping). The Agency stated that a total concentration of toxic organics less than 500 ppm would not pose a hazard to human health or the environment.[1] Waste containing greater than 500 ppm organics will be managed under a process outlined in this DET.

A decision tree has been developed to determine if the organic contaminated hazardous debris is compatible and can be macroencapsulated using the proposed method. The decision tree is summarized in Figure 2.

Figure 2: Proposed Macroencapsulation Decision Steps



9.2 <u>Compatibility</u>

The VOC/SVOC chemicals above the 500-ppm threshold in the organic debris will be evaluated to determine compatibility with the macroencapsulating material type. Chemicals evaluated for compatibility with polyethylene and EVOH are summarized in Table 1. If the debris contains organic chemicals that are compatible with polyethylene,

[1] *See* 57 Fed. Reg. 37194, 37227 (Aug. 18, 1992) *"When the total concentration of toxic organic compounds in the waste is less than 500 ppm, the Agency believes that any emissions of organic compounds attributable to those organic compounds will not pose a hazard to human health and the environment."*

the facility will continue the current waste treatment process described in Section 8. If the organic chemicals are compatible with EVOH, then the EVOH bag process described below will be used.

Compatibility testing was completed by the supplier using *ASTM D543 Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagent*s. ASTM D543 outlines the procedures to evaluate the resistance of plastics to various chemical reagents by exposing test samples to specific chemicals for a set duration and then assessing any changes in physical or mechanical properties like color, weight, dimensions, or mechanical strength. The industry standard practice includes the following.

- **Test method:** Immersing plastic specimens in a selected chemical reagent at a controlled temperature for a specified time (reagent and times determined based on use/application).
- **Evaluation parameters:** After exposure, the samples are examined for changes like discoloration, swelling, cracking, loss of strength, or other visual signs of degradation.
- **Application:** This method is commonly used to assess the suitability of plastics for applications where they might come into contact with specific chemicals.

The testing was conducted at two temperature ranges and used chemicals that were directly tested for compatibility. The supplier reported results of the compatibility testing using a qualitative assessment. Little to no effects such as, slight corrosion or discoloration were considered compatible, and moderate to significant effects such as cracking or deterioration were considered not compatible. In addition, compatibility was based on known behavior by the chemical structures, such that some chemicals were used as indicator chemicals.

9.2.1 Chemical Groups

These constituents have been evaluated by chemical groups or families to determine compatibility with the EVOH and polyethylene material proposed for encapsulation in this DET application. Compatibilities of greater than 80% are considered appropriate for use of the material. Compatibility of these chemical families with the material type is shown in Figures 3 and 4.

Figure 3: Macroencapsulation - EVOH Chemical Compatibility

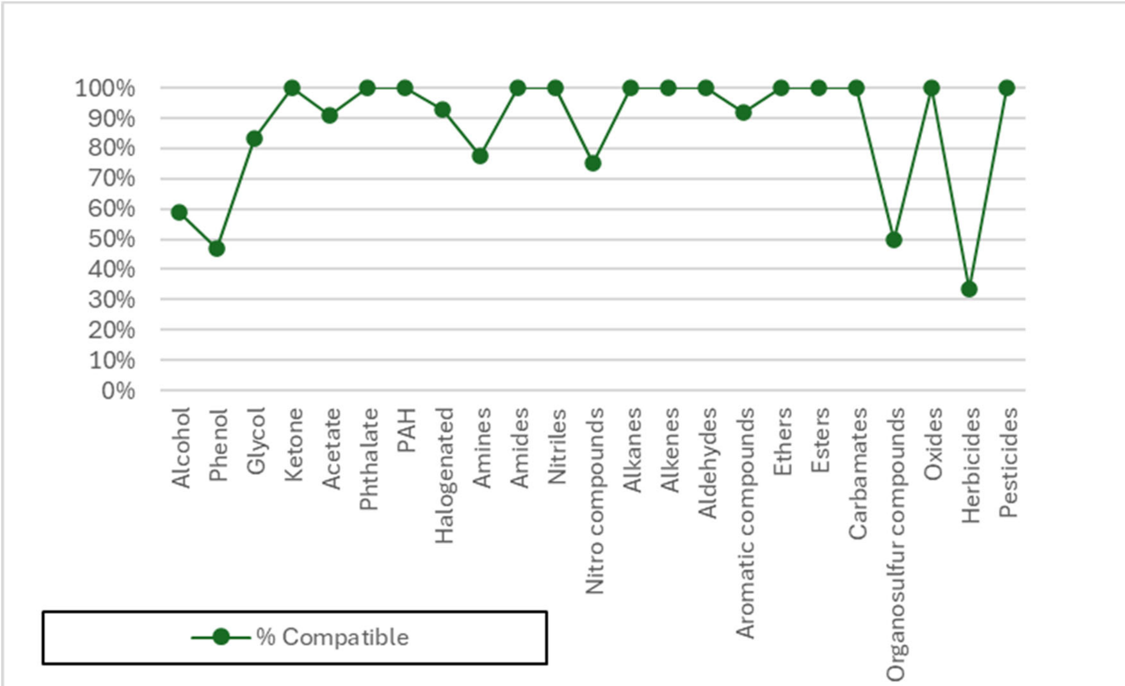
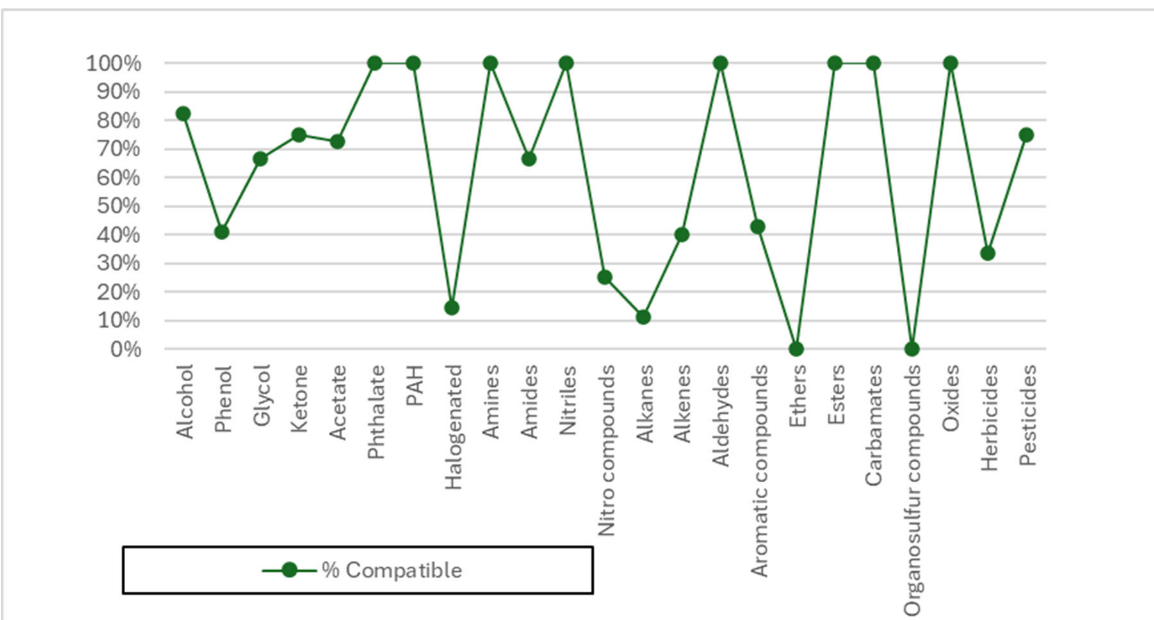


Figure 4: Macroencapsulation - Polyethylene Chemical Compatibility



9.2.2 Mixtures

For debris that contains a mixture of chemicals that are either not compatible with the EVOH or polyethylene materials or if the compatibility is unknown, they will be treated by a method other than macroencapsulation.

9.3 Durability

Landfill facilities across the Unites States, including US Ecology Nevada, have operational experience using polyethylene liners and macroencapsulation bags like those proposed in this DET. Polyethylene is a thermoplastic polymer that is the most widely used plastic in the world. Polyethylene plastic (e.g., HDPE) has long been successfully used as landfill liners and for macroencapsulation of hazardous waste (Chattopadhyay and Condit, 2002).[2] The proposed liner material, EVOH, is a thermoplastic copolymer that is typically used in packaging. The proposed macroencapsulation bags require testing per the U.S. Department of Transportation guidelines in 49 CFR, including drop and stack testing. Additional durability testing details are provided in Appendix A.

9.4 Encapsulation Process

If organic contaminated hazardous debris does not contain liquids and if VOCs/SVOCs are less than 500 ppm or compatible with PE, the debris will be encapsulated using the current waste treatment process described in Section 8. If VOCs/SVOCs are greater than 500 ppm and compatible with EVOH, then they will be encapsulated in a proprietary double-lined and sealed bag. The bag material will be constructed with an EVOH outer material with a felt liner to reduce punctures. The bag will close with a polyethylene zipper. A schematic of a typical EVOH macroencapsulation bag is provided in Appendix A. When EVOH-compatible bags are used, in most cases, the hazardous debris will be packaged in the EVOH bags by the generator prior to receipt at the Beatty Facility. When preloaded EVOH macroencapsulation bags arrive at the facility, they will be weighed and visually inspected for integrity to ensure the contents or transportation equipment has not damaged/punctured/torn the bag and that it is still sealed per manufacturer instructions. Should an issue with the bag/load be identified (i.e., the bag is punctured, is not properly closed/sealed, etc.), the load will be rejected, repackaged, or resealed prior to acceptance by the facility. Upon confirmation that the bag/load condition is acceptable and not compromised, it will be approved and routed for landfill disposal. Bag offloading in the landfill will be monitored to ensure it is unloaded with the proper equipment and that the

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[2] 2002 Chattopadhyay and Condit provides list of advantages and limitations for polyethylene for the encapsulation of hazardous waste and notes that *"HDPE is used in landfill liners, extensive studies have been performed to document the chemical resistance and long-term durability of HDPE."*

bag is not damaged . The landfill operator will prepare a disposal area for the bag that is free from items that could compromise the integrity of the bag and place it in a position that the bag can be covered with debris-free material to prevent damage.

The immobilization technology described in this DET includes an encapsulation methodology; therefore, there is no reduction in contamination after treatment, only a reduction in leachability in contamination. This reduction in leachability protects human health and the environment.

9.4.1 Process Variability

The EVOH and polyethylene materials are obtained from a verified supplier, and material quality is within manufacturers' specifications as referenced in the 2021 EPA memorandum US EPA, RCRA Online 14685 (Nov. 19, 2021). Testing of these materials is completed by the supplier.

9.5 Geochemistry and Physical Material Treatment

The oxidation of the EVOH and polyethylene materials is not anticipated based on performance of these materials, as landfill liners and antioxidants are added to the materials to resist weathering and degradation. The macroencapsulation process further reduces the leachability of the waste itself mitigating potential reactions (e.g., chemical redox reactions). Once the macroencapsulated material is placed into the landfill, it will be isolated from the ambient environment by soil cover and thus further protected from thermal mechanisms of degradation and weathering.

9.6 Health Risks

Potential health risks for personnel involved in the proposed process could result from handling the hazardous debris. Engineering controls and personal protective equipment are used to further minimize potential exposures. Potential air/inhalation hazards and direct contact/dermal exposure to waste is mitigated by encapsulation. In the unlikely event of a spill or break of the encapsulated materials where direct contact could occur, mechanized equipment and operators wearing personal protective equipment will be used to clean up/pick up spills.

Significant weathering of the EVOH or polyethylene materials would increase the potential for exposure; however, this scenario is unlikely, as the encapsulated debris will be covered with soil within the engineered landfill within the same day. Potential health risks via exposure pathways listed above will be further mitigated and reduced during operations by placing clean soil around and over the encapsulated debris.

9.7 Stormwater

Stormwater flow will be very limited at the landfill location due to: 1) the arid climate: the recent (2014-20234) 10-year average annual precipitation is 3.95 inches,[3] based on a site meteorological station; 2) the undisturbed unsaturated desert landscape around the landfill location, which absorbs a significant amount of rainfall and limits the potential for stormwater run-on; and 3) the adjacent flat terrain, which provides little natural potential for stormwater run-on by gravity flow.

Based on the existing landfills at the facility, it is expected that precipitation will be fully absorbed by and then evaporated from the cover soil of the liner system and the soil material placed around the encapsulated debris. However, there may be times that some precipitation may flow into and be recovered from the leachate collection system. The recovered water will then be reused for dust control on the active landfill. This is only expected to occur following unusually large storm events and after normal storm events where precipitation falls on the landfill liner or during the early stages of landfill operation when there is insufficient cover material to absorb all the precipitation.

9.8 Leachate

As described above, for the very little precipitation that occurs in the arid environment, most of the precipitation will evaporate and will not flow to the leachate collection. The water that does reach the leachate collection system is expected to infiltrate. Treatment and encapsulation of the waste significantly limits the potential for the treated waste to encounter precipitation.

10. PROPOSED FINAL DISPOSAL FACILITY – BEATTY, NEVADA

10.1 Landfill Design

The Beatty, Nevada, facility is an active Subtitle C landfill operating under a RCRA Hazardous Waste Management Permit administered by the Nevada Division of Environmental Protection (NDEP).

Management of leachate includes monitoring the levels in the sumps, pumping leachate to keep depths below the permitted levels, testing leachate for concentrations of chemicals, testing leachate for quarterly permit parameters, disposing of leachate, and reporting leachate management metrics to the permitting agencies.

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[3] Average total precipitation varies from 4.16 to 4.24 depending on the time range selected. *See:* https://www.wrcc.dri.edu/

Low volumes of leachate are generated at the Beatty, Nevada, facility due to the low average annual precipitation and high evaporation of the region. The volume of leachate generated in the western U.S. is significantly less than leachate generation rates in the more temperate regions. In a USEPA study of the performance of modern double-lined landfills in the United States, leachate collection and removal system (LCRS) flow rates from active hazardous waste landfills in the western United States included in the study ranged from approximately 0.1 to 410 gallons/acre/day (gpad) and averaged 100 gpad.

The average LCRS generation rates for the active landfills at the Beatty, Nevada, facility during 2022 and 2023 monitoring periods (US Ecology 2022, 2023a, 2023b, 2024), ranged from approximately 6 to 31 gpad (Table 2) and fell within the middle of the range from the EPA study. Average leakage detection system (LDS) flow rates were very low, less than 0.1 gpad for the Trench 13 phase, and were within the range of values of 0 to 0.1 gpad reported in the EPA study for landfills with geomembrane/geosynthetic clay liner (GCL) primary liners. The relative hydraulic performance of the top liner for Trench 13 was calculated using the “apparent liner hydraulic efficiency” parameter, E_a, introduced by Bonaparte et al. (1996), and defined as:

$$E_a\,(\%) = (1 - \text{LDS Flow Rate}/\text{LCS Flow Rate}) \times 100$$

The higher the value of E_a, the smaller the flow rate from an LDS compared to the flow rate from a leachate collection system (LCS). The calculated apparent efficiency of the primary liner for Trench 13 ranged from 99.0 to 100%. Based on the data presented in the EPA study, the efficiency of geomembrane/GCL composite primary liners is expected to be 99.0% or higher. This efficiency is high and indicative of exceptionally good leachate containment capability.

For the Beatty Facility, average semi-annual leachate generation rates by trench are summarized in Table 2. For Trench 12, LCRS and LDS flow rates are combined; for Trench 13, LCRS and LDS flow rates are presented separately. Leachate levels are checked weekly in the LCRS and LDS sumps of active disposal Trenches 12 and 13. Both LCRS and LDS sumps are checked in the event the facility receives more than ¼ inch of rainfall in a 24-hour period. Leachate is pumped and removed in accordance with action levels established in the Permit. Records are maintained for each pumping event and indicate leachate levels before and after pumping, the volume pumped, and the on-site dispensation of the leachate. Disposal of leachate consists of applying it for dust control from the cell of landfill from which it came (Trenches 12 and 13).

10.2 <u>Landfill Monitoring</u>

The Betty Facility is currently monitored for protection of groundwater from potential landfill releases by a network of 34 monitoring wells: 29 wells in the upper aquifer and 5 wells in the lower aquifer. Four of the wells are considered background wells, and 24 wells are downgradient point of compliance (POC) wells. Potential releases from active cells are also monitored via a network of leachate sumps, one per each landfill cell, for a total of seven sumps. The sump at each cell has a pair of access pipes, the upper one for the LCRS and the lower one for the LDS. The wells and sumps are sampled quarterly.

The existing RCRA Permit for the facility requires quarterly sampling at the upper aquifer wells to assess potential releases from the existing landfill cells. Analytical data are compared to Groundwater Protection Standards (GWPS) established in the approved Permit. The GWPS values are in (Section 10 (Groundwater Detection Monitoring) of the RCRA Permit, in Tables 10.3A through D. The Environmental Monitoring Plan (EMP) also contains the details of the required quarterly monitoring. The monitoring program allows Statistically Significant Increases (SSIs) to be identified when two consecutive concentrations of regulated analytes greater than the applicable GWPS are detected (i.e., a 1 of 2 sampling protocol is utilized). Such exceedances are evaluated to determine if they represent releases from the landfill cells or are attributable to some other source or cause, such as background chemistry or analytical variation or error.

Chemical concentrations monitored in groundwater are routinely compared to the GWPS values to determine if an SSI has occurred. Additionally, the potable water supply is subject to compliance with the groundwater protection standards and federal EPA maximum contaminant limit (MCL) for VOCs in drinking water (chemical specific; see Table 3-2 in US Ecology, 2023). The results of the quarterly sampling are documented in semi-annual reports (due September 30 and March 30 of each year) and submitted to both the NDEP and EPA.

Existing air monitoring at the landfill includes the constituents included in this DET, so additional air monitoring is not necessary as part of this DET petition.

10.3 Site Characteristics – Nevada Facility

This section describes the geography, climate, and general setting of the Beatty Facility.

10.3.1 Topography

The landfill is located on a slight rise in desert terrain formed by an alluvial fan surrounded by relatively flat topography. The flat desert terrain extends for long distances to bordering mountain ranges, except on the east about three miles where the terrain rises gently to the Bare Mountain range.

10.3.2 Surface Water

Surface water resources near the facility consist of ephemeral riverbeds and washes, which flow only during rare heavy rain events. The Amargosa River channel is the closest surface water body, which is approximately 1.5 miles to the west. The Amargosa River channel is dry in the vicinity of the facility, except during rare heavy rain events.

10.3.3 Climate

Nevada's main climatic features are bright sunshine with high solar radiation, low annual precipitation, and large daily temperature ranges. The average percentage of sunshine in southern Nevada is more than 80 percent. The high solar radiation, low humidity, and windy days in this region account for an average annual evaporation of approximately 66 inches (central Nevada Research Station; Western Regional Climate Center, 2025). The monthly daily average temperature ranges from 41.2°F in December to 80.8°F in July. On average, there are 26 days of 100°F+ highs, 97 days of 90°F +, and 38 days where the high remains at or below 50°F; the average window for freezing temperatures is November 2 to April 6.

The Beatty region of Nevada is one of the driest locations in Nevada and, consequently, in the United States. On average, only 13.28 days a year have 0.1 inches of rain or more. The average number of days with rain for the State of Nevada is 22.11. The U.S. average is over 66. The Community Environmental Monitoring Program (CEMP[4]) maintains a weather station near Beatty, Nevada. Since 2014 (10-year average), Beatty has averaged 3.96 inches of rain per year (Figures 5a and 5b). The climate is Mediterranean, with most of the precipitation occurring in the winter months.

[4] https://cemp.dri.edu/cemp/

Figure 5a: Total Annual Precipitation 2008-2024

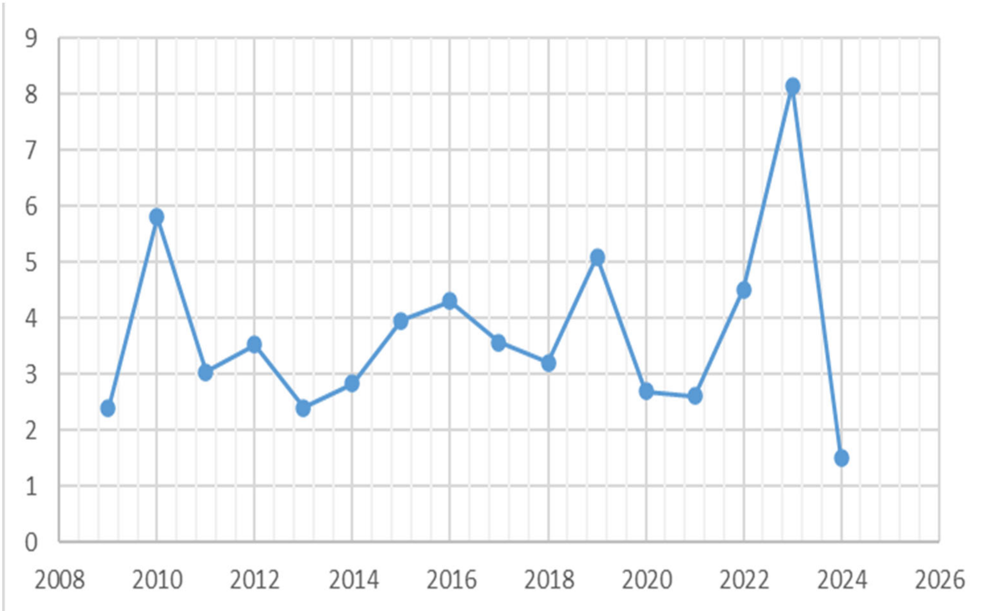
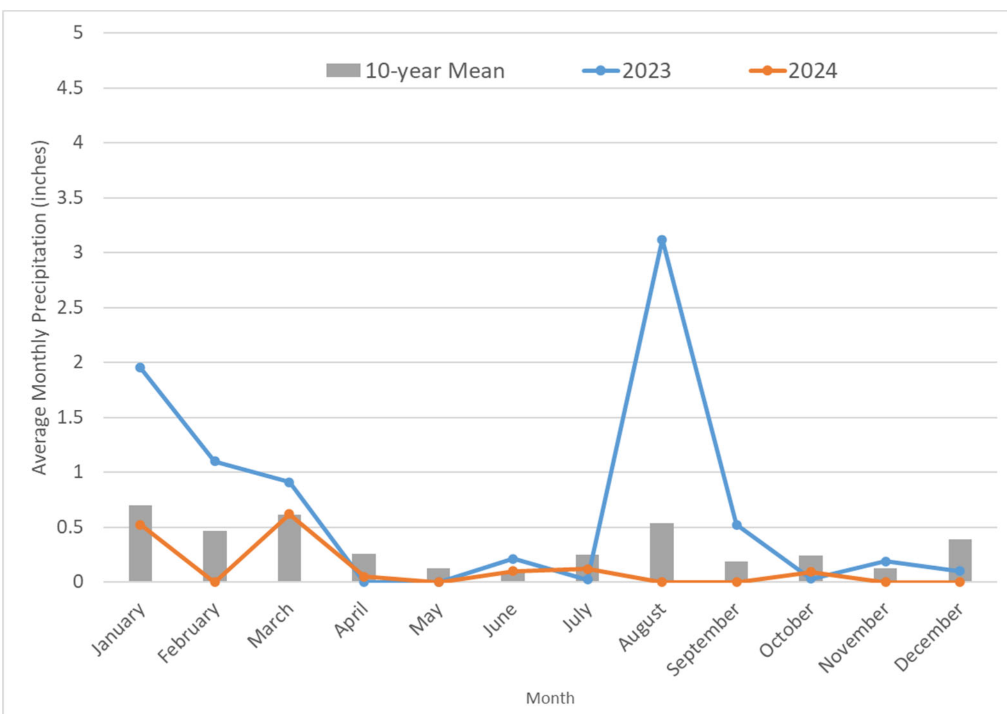


Figure 5b: Annual Precipitation 2023-2024 and 10-year Monthly Mean Precipitation



10.3.4 Geology

Details on the nature of the unconsolidated strata beneath the Facility have been determined from the various borings and well installations that have been completed at the facility since 1961. Extensive hydrogeologic investigations have been conducted to determine the soil properties and hydrologic characteristics. Stratigraphic information derived from the site characterization and monitoring well installation programs describe a sequence of sedimentary deposits consistent with alluvial fan and playa depositional processes.

Deposits from the ground surface to a depth of approximately 300 feet are alluvial sediments consisting of gravelly sands with poorly sorted gravel or discontinuous sand interbeds. The gravelly sand extends approximately 300 feet below ground surface (bgs) beneath the Site and extends up to 350 feet bgs at the southwestern area of the Site.

Indurated playa deposits consisting of silt, clay, and sand underlie the gravelly sands and are approximately 50 to 150 feet in thickness, or 350 to 400 feet bgs up to 450 to 500 feet bgs. These fine-grained sediments are typical of playa deposits that may change composition quickly with depth. The upper surface of the silt-clay unit appears to be relatively flat beneath the northern half of the Site and deepens to the southwest (like the gravelly sands). Beneath the silt-clay playa deposit is an older, deeper unit consisting of gravels, cobbles, and boulders that represent a higher energy, fluvial environment.

Although the Carrara Fault has been mapped near the Site, and U.S. Geological Survey (USGS) has not recorded any activity along this fault in the last 10,000 years. The nearest major fault zones are the Death Valley Fault Zone and the Las Vegas Fault Zone, 20 miles and 100 miles from the Site, respectively. Published data list no record of any historic earthquake epicenter in the area around Beatty for the period (since 1800) that records have been kept. A resistivity study was conducted at the Site in 2018 to better understand the Carrara Fault, and the results identified low-resistivity sediments and preferential groundwater flow to the southeast along secondary fractures. More discussion regarding the study is provided in the First Half 2019 Environmental Monitoring Report (US Ecology 2019).

10.3.5 Hydrogeology

Two saturated, water bearing zones have been encountered beneath the Site, at approximately 300 and 600 feet bgs. Drilling investigations indicate that the upper saturated zone occurs near the contact of the silt-clay playa deposits with the overlying gravelly sands. Beneath this, a confined aquifer occurs in a sandy gravel formation underlying the silt-clay deposits. This sandy gravel generally becomes coarser as it extends to depths exceeding 650 feet below ground level.

The surface drainage area of the Amargosa Desert covers about 2,600 square miles and is part of two regional groundwater systems. These two groundwater systems converge in the Amargosa Desert and likely continue to the south into Death Valley. Groundwater flow directions in the Amargosa Desert are generally to the southeast and southwest. The closest public drinking water supply well is located in Beatty, approximately 11 miles to the north of the Site. Aside from the well that supplies process water to the Facility, the nearest private water well is located approximately 10.5 miles north of the Facility at the Vanderbilt Mine.

Saturation begins near the top of a 50- to 150-foot-thick sequence of partially cemented to well-indurated clays, silts, and sand. The depth to saturation from the ground surface ranges from near 285 feet on the north side of the site to greater than 360 feet at the southwest corner of the facility. The interbedding of clays and cemented silts and sands at these depths serves to separate the upper saturated zone from the confined gravel aquifer beneath into discrete hydrogeologic units.

The gravel aquifer is encountered beneath the fine-grained deposits at a depth of 380 feet or more. It consists of sandy gravel with some cobbles and boulders and is greater than 250 feet thick at the southern boundary of the site. The piezometric level measured in this aquifer occurs near 315 feet bgs, indicating a confined condition, based on wells and borings drilled into this unit. The groundwater gradient in both the upper saturated zone and confined gravel aquifer is southward, following the trend of the Amargosa Valley. This gradient is consistent with regional data.

Numerous studies conducted by US Ecology Nevada, Inc. estimate hydraulic conductivities and transmissivities for this Facility. The estimated Upper water bearing zone (WBZ) hydraulic conductivity for the Facility is 57.3 feet per day (ft/day), with an estimated effective porosity of 0.35. The hydraulic conductivity for the Lower WBZ is estimated to be 2.4 ft/day, also with an effective porosity of 0.35 (US Ecology 2019). Based on these estimates, the US Ecology Nevada, Inc. report states that the horizontal flow velocities in the Upper WBZ range from 1,800 to 2,500 feet per year (ft/year) and in the Lower WBZ, range from 0.11 to 0.12 ft/day. The measured hydraulic conductivities are consistent with sample lithologies and are considered representative of the upper and lower saturated zones.

The potential for contaminant transport by water flow through the vadose zone is minimal under the conditions observed at the facility. An environmental pathways analysis performed for the Beatty Facility used physical property data of site sediments and assumed a conservative recharge rate of 0.04 inches per year. Calculated travel times for vadose zone water from trenches to the upper saturated zone ranged from 13,000 to 24,000 years.

Pumping test data from earlier studies indicate that the confined gravel aquifer has a transmissivity ranging from about 1,900 to 3,000 gallons per day per foot. A groundwater flow velocity of about 30 to 50 ft/year is considered typical of the confined aquifer. The heterogeneity of the sediments in the confined aquifer suggests somewhat smaller or larger velocities may be possible on a local scale.

10.4 Site Conditions Summary

The Beatty, Nevada, facility is ideally suited for disposal of hazardous debris based on the arid site setting, with low average annual rainfall and high evaporation, relatively flat topography, deep groundwater, and low population. The macroencapsulated debris will be placed into the existing landfill facility, which produce only small quantities of leachate, and the hydraulic performance of the containment systems for the active landfills is very high (>99%). In addition, groundwater monitoring wells and monitoring protocols are already in place.

11. PROPOSED WASTE TREATMENT PROCESS COMPARED TO BDAT CRITERIA

Polyethylene materials are widely used as liquid and chemical barriers in many applications, including for containment of hazardous waste. The EVOH and polyethylene materials are both expected to have very good chemically resistance and durability under the anticipated service conditions (i.e., buried in a landfill at an arid site).

11.1 Long-Term Effectiveness of Treatment

The long-term effectiveness of treatment considered the potential effects of pH and temperatures on macroencapsulate debris and the site-specific disposal conditions that are expected to exist at the Beatty Facility.

- pH – soil pH ranges from 8.3 to 9.4 SU (Standard Units) (Table 3). This range of pH is fairly neutral and not anticipated to degrade the EVOH or polyethylene materials. Similarly, rainwater that encounters and reacts with this soil is unlikely to create highly acidic or highly basic conditions (e.g., less than 2 SU or greater than 12 SU) that would degrade the EVOH or polyethylene materials.
- Temperatures - Temperatures in the landfill are expected to be relatively constant below shallow depths that are affected by surface temperature. Unlike municipal landfills, they do not have putrescent waste that generates heat as it degrades. Freeze/thaw cycles are also not anticipated to degrade the EVOH or polyethylene materials, since the materials will be buried up to 20 feet bgs, only a limited amount of precipitation will migrate deep into the landfill, and groundwater is deep (>300 feet bgs).

11.2 Discussion of Demonstrated Available Technology

Does not propose greater total risk to human health and environment. The macroencapsulated hazardous debris will not create dust or volatilization, and in fact, reduces the potential for these risk pathways by encapsulation and burial within the landfill. The leachability of the material is similarly restricted based on its containment within inert materials, low potential for reactions with soil or groundwater in the landfill, and the arid environment. Future potential risk is also mitigated by encapsulation and burial in the landfill.

Commercially available. The EVOH and polyethylene materials have been commercially available for decades in a variety of industries. Macroencapsulation is also not a new technology and has been used in similar technology/applications since the beginning of RCRA to eliminate leachability of toxins into the environment. The innovative application in this DET is the use of the EVOH and polyethylene as materials for macroencapsulation of organic contaminated hazardous debris.

Substantial treatment and best technology: Compatibility of the EVOH and polyethylene materials has been tested by the supplier for a variety of organic constituents. The material testing was conducted with higher concentrations or organic constituents, which provides a conservative high-end estimate of compatibility with the solid organic contaminated hazardous debris that will have much lower concentrations (Figure 3).

Containment and stabilization: The immobilization technology, macroencapsulation, is a known method for containing debris. Use of the EVOH bags with the felt liners and polyethylene material for wrapping the debris reduces the ability for the debris to come into contact with other landfill materials, leachate, and precipitation. These materials have been shown to have long-term effectiveness.

Economic factors: Economic factors were not considered in the selection of this technology.

12. LONG-TERM MONITORING

The landfill monitoring requirements will be conducted in accordance with the RCRA Hazardous Waste Management Permit. Monitoring will include the existing groundwater monitoring system and LCRS/LDS sumps with quarterly data collection and reporting events.

13. CONCLUSIONS/RECOMMENDATIONS

This DET application requests use of polyethylene and EVOH for macroencapsulation of organic contaminated hazardous debris. Polyethylenes have long been used in landfill applications for liners and have shown long-term durability and effectiveness. Early decisions for disallowing use of polyethylene for organic contaminated hazardous debris encapsulation did not have the benefit of relying on empirical evidence from polyethylene landfill liners over the subsequent decades.

Results from testing of EVOH and polyethylene with common chemicals (solvents) found in organic contaminated hazardous debris are presented herein and demonstrate that many of the organic chemicals are compatible with, or do not readily degrade, the EVOH or polyethylene materials tested. These compatibility results have been grouped by chemical group or family, and testing was conducted using higher concentrations than anticipated to be present in the organic contaminated hazardous debris.

Volumetrically, the organic contaminated hazardous debris is predominantly composed of solid materials such as PVC piping, concrete, steel, and other solid wastes that have come into contact or were from sites with hazardous organic chemicals. These hazardous organic chemicals are typically present in low or *de minimis* concentrations within the debris. A 500-ppm threshold is proposed.

These factors can be used in a multipart decision tree tailored for specific hazardous debris waste streams. Organic contaminated hazardous debris that contains liquids or organic solvents such as VOCs or SVOCs that are not compatible with polyethylene or EVOH will be considered for alternative treatment (e.g., incineration). Following those factors, chemical compatibility is considered for selection of the material to be used for macroencapsulation.

The proposed treatment that is the basis of this DET application described herein provides a high level of protection for human health and the environment. The arid climate produces very limited precipitation and generation of leachate. There is a very low chance for introduction of other chemistries from organic material in the soil or rainwater, or other landfill waste. The Beatty Nevada site is an existing Subtitle C permitted facility. The landfill is lined, has a dedicated monitoring system of groundwater monitoring wells, and data reporting procedures are already in place.

14. REFERENCES

Chattopadhyay and Condit, 2002. Advances in Encapsulation Technologies for the Management of Mercury-Contaminated Hazardous Wastes.

Data Collection Program. Community Environmental Monitoring Program (CEMP). Retrieved December 2024 from https://cemp.dri.edu/cemp/. .

US EPA, 2021. Coversheet: Explanation of Citation and/or Terminology Changes in this Policy Document (Dated November 19, 2021), Treatment Standards for Mercury-Containing Debris, from Robert Springer, Director Office of Solid Waste.

US Ecology, 2019. US Ecology Nevada, Inc., Beatty, Nevada, Permit Number NEVHW0025, EPA ID #NVT 330 010 000. Environmental Monitoring Report First Half 2019, September 23, 2019, Revision 1- October 31, 2019.

US Ecology, 2022. US Ecology Nevada, Inc., Beatty, Nevada, Permit Number NEVHW0025, EPA ID #NVT 330 010 000. Environmental Monitoring Report First Half 2022, September 23.

US Ecology, 2023a. US Ecology Nevada, Inc., Beatty, Nevada, Permit Number NEVHW0025, EPA ID #NVT 330 010 000. Environmental Monitoring Report Second Half 2022, March 24.

US Ecology, 2023b. US Ecology Nevada, Inc., Beatty, Nevada, Permit Number NEVHW0025, EPA ID #NVT 330 010 000. Environmental Monitoring Report First Half 2023, September 29.

US Ecology, 2024. US Ecology Nevada, Inc., Beatty, Nevada, Permit Number NEVHW0025, EPA ID #NVT 330 010 000. Environmental Monitoring Report Second Half 2023, March 20.

Western Regional Climate Center, 2025. https://wrcc.dri.edu/ Accessed March 2025.

TABLE

Table 1
Summary of Chemicals and EVOH and PE Compatibility
Organic Debris DET

Chemical Name	EVOH	PE
1,1,1,2-Tetrachloroethane	+	-
1,1,1-Trichloroethane	+	
1,1,2,2-Tetrachloroethane	+	-
1,1,2-Trichloro-1,2,2-Trifluoroethane [Freon 113]	+	
1,1,2-Trichloroethane	+	
1,1-Dichloroethane	+	-
1,1-Dichloroethylene	+	-
1,2,4-Trimethylbenzene	+	-
1,2-Diaminoethane	+	+
1,2-Dichlorobenzene	+	-
1,2-Dichloroethane	+	-
1,3-Dichlorobenzene	+	-
1,3-Dichloropropylene	+	-
1,3-Dimethaneamine Benzene	-	+
1,4-Dichlorobenzene	+	-
1,4-Dioxane	+	-
1-Methoxy-2-Propanol	-	+
1-Methylnaphthalene	+	+
2,2,4-Trimethylpentane	+	+
2,4,4-Trimethyl-1-Pentene	+	+
2,4,6-Tribromophenol	-	-
2,4-D		
2,4-Dimethylphenol	-	-
2,4-Dinitrotoluene	+	-
2,4-Pentanedione	+	+
2,6-Dimethyl-4-Heptanone	+	+
2-Butoxyethanol	+	+
2-Butoxyethyl Acetate	+	+
2-Ethoxyethanol	+	+
2-Heptanone	+	+
2-Mercaptoethanol	-	-
2-Methylnaphthalene	+	+
2-Nitrophenol	-	-
2-Nitropropane	+	-
2-Pentanone	+	+

Table 1
Summary of Chemicals and EVOH and PE Compatibility
Organic Debris DET

Chemical Name	EVOH	PE
3,3'-Diaminobenzidine	+	+
3-Iodo-2-Propynyl Butylcarbamate	+	+
4,4'-Isopropylidenediphenol	-	+
4,4'-Methylenedianiline	+	+
4-Isopropyltoluene	+	-
4-Methyl-2-Pentanone	+	+
4-Nitrophenol	-	-
4-Nonylphenol, Branched	-	-
Acenaphthene	+	+
Acetic Anhydride	-	+
Acetone		+
Acetonitrile	+	+
Acrylamide	+	+
Amyl Acetate	+	+
Aniline	-	+
Anthracene	+	+
Benz(A)Anthracene	+	+
Benzene	+	-
Benzo(a)Pyrene	+	+
Benzo(b)Fluoranthene	+	+
Bis(2-Ethylhexyl) Phthalate	+	+
Bromodichloromethane	+	-
Bromomethane	+	-
Butane	+	-
Butanol	+	-
Butyl Acetate	+	-
Carbaryl	+	+
Carbon Disulfide	+	-
Carbon Tetrachloride	+	-
Chlordane	+	+
Chlorhexidine	+	+
Chlorinated Paraffin	+	-
Chloroform	+	-
Chloromethane	+	-
Chrysene	+	+

Table 1
Summary of Chemicals and EVOH and PE Compatibility
Organic Debris DET

Chemical Name	EVOH	PE
Cis-1,2-Dichloroethene	+	-
Cresols	+	-
Cresylic Acid	+	+
Cyclohexane	+	-
Cyclohexanone	+	-
Cyclophosphamide	+	+
Decabromodiphenyl Oxide	+	-
Dibenzo(a,h)Anthracene	+	+
Dichlorobenzene	+	
Dichlorodifluoromethane	+	-
Dichlorofluoromethane	+	-
Dichloromethane	+	-
Diethyl Ether	+	-
Diethyl Phthalate	+	+
Diethylenetriamine	+	+
Diglycidyl Ether	+	-
Diisopropyl Ether	+	-
Dimethyl Formamide	+	-
Dimethyl Phthalate	+	+
Dimethyl Sulfoxide	-	-
Dimethyl-4-Heptanone, 4,6-	+	+
Di-N-Butyl Phthalate	+	+
Dipropylene Glycol Monomethyl Ether	+	-
Endosulfan	+	+
Endosulfan Sulfate	+	+
Endrin	+	+
Epichlorohydrin	+	-
Epoxy Resin	+	+
Ethane, 1,1,2-Trichloro-1,2,2,-Trifluoro-	+	-
Ethanol	+	+
Ethidium Bromide	+	+
Ethyl Acetate	+	+
Ethyl Acrylate	+	+
Ethyl Benzene	+	-
Ethyl Silicate	+	+

Table 1
Summary of Chemicals and EVOH and PE Compatibility
Organic Debris DET

Chemical Name	EVOH	PE
Ethyl-3-Ethoxypropionate	+	+
Ethylene Diamine	+	+
Ethylene Glycol	+	+
Ethylene Glycol Monophenyl Ether	+	+
Ethylene Oxide	+	+
Fluorene	+	+
Fluorotrichloromethane	+	-
Formaldehyde	+	+
Furfuryl Alcohol	-	+
Gamma - Bhc	+	-
Heptachlor	+	-
Heptane	+	-
Hexachlorobenzene	+	-
Hexachlorobutadiene	+	-
Hexachloroethane	+	-
Hexane	+	-
Hexanoic Acid, 2-Ethyl-, Compd. with 2,4,6-Tris((Dimethylamino)Methyl)Phenol (1:X)	+	+
Indeno(1,2,3-cd)Pyrene	+	+
Isobutanol	+	+
Isobutyl Alcohol	-	+
Isopropanol	-	+
Isopropylbenzene	+	+
Methanol	-	+
Methoxychlor	+	+
Methyl Acetate	+	-
Methyl Chloride	+	-
Methyl Ethyl Ketone	+	-
Methyl Ethyl Ketone Peroxide	+	+
Methyl Isobutyl Ketone	+	-
Naphthalene	+	+
N-Butyl Acetate	+	-
N-Butyl Alcohol	-	+
n-Butylbenzene	+	-
n-Hexane	+	-
Nitrobenzene	+	-

Table 1
Summary of Chemicals and EVOH and PE Compatibility
Organic Debris DET

Chemical Name	EVOH	PE
Nonylphenol	+	+
N-Propylbenzene	+	-
Octane	+	-
o-Dichlorobenzene	+	
Pentane	+	-
Phenanthrene	+	+
Phenol	-	+
P-Nitrophenol	-	+
Propylene Glycol Monomethyl Ether Acetate	+	+
Pyrene	+	+
Pyridine	+	+
Sec-Butylbenzene	+	+
Silvex (2,4,5-TP)	+	-
Styrene	+	-
Terphenyls	+	+
Tert-Butyl Acetate	+	+
Tert-Butyl Alcohol	+	+
Tetrabromobisphenol A	+	-
Tetrachloroethene	+	-
Tetrahydrofuran	+	-
Tetramethylethylenediamine, N,N,N,N- (as Ethylenediamine)	+	+
Tetrasodium Ethylenediaminetetraacetate	+	+
Toluene	+	-
Toxaphene	+	-
Trichloroacetic Acid	-	-
Trichloroethane	-	-
Trichloroethene	+	-
Trichlorofluoromethane [Freon 11]	+	-
Triethanolamine	+	+
Triethylenetetramine	+	+
Trifluoromethyl-3-Ethoxyperfluorohexane, 2-	+	+
Trimethylbenzene	+	+
Vinyl Chloride	+	-
Vinylidene Chloride	+	-

Table 1
Summary of Chemicals and EVOH and PE Compatibility
Organic Debris DET

Chemical Name	EVOH	PE
Xylenes - Mixed Isomers (Sum of O-, M-, and P-Xylene Concentrations)	+	
Ziram	+	+

Notes:
EVOH = ethylene vinyl alcohol
PE = polyethylene
Y = yes
+ = compatible
- = incombatible
Blank cells indicate no information available

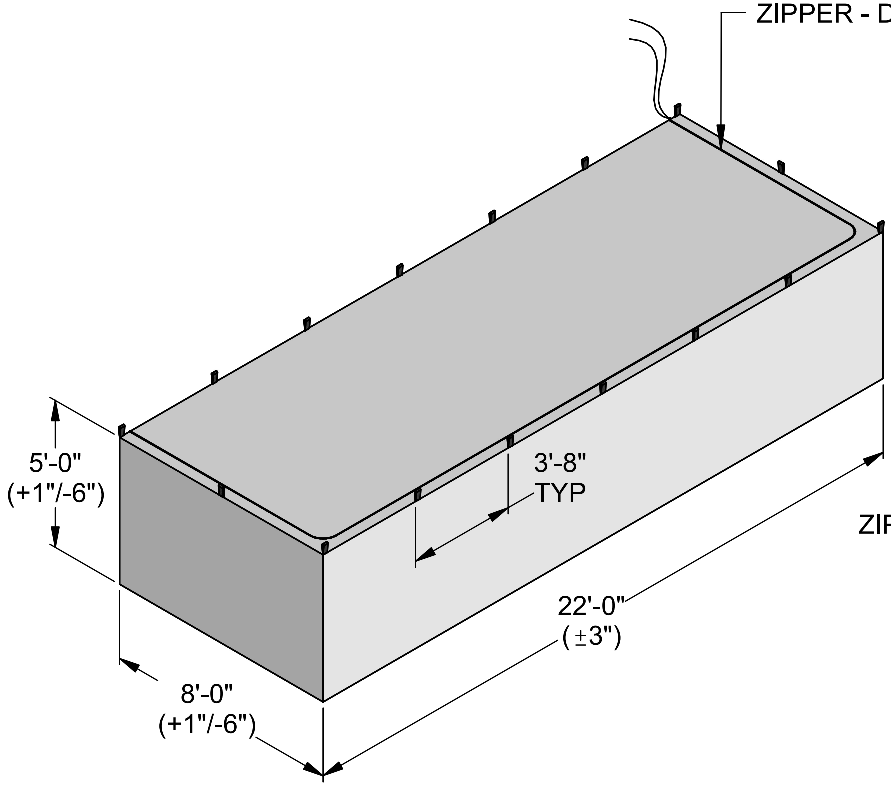
APPENDIX A

Supplier Specifications

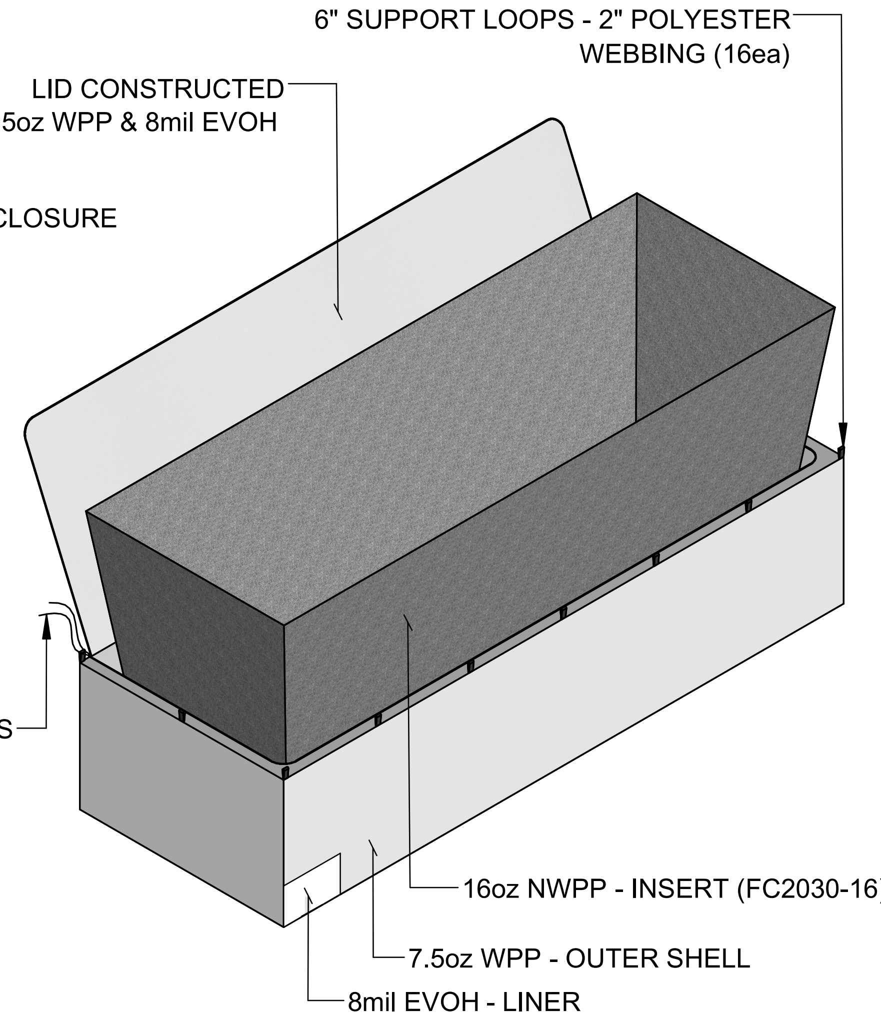
VP2285-7.58GF16ZT(SP)

MTL'S:

- 7.5oz WPP - OUTER SHELL
- 8mil EVOH - LINER
- 16oz NWPP INSERT - (FC2030-16)
- ZIPPER - DUAL PULL CLOSURE
- 2" POLYESTER WEBBING - SUPPORT LOOPS
- 1/2" NYLON WEBBING - ZIPPER PULLS
- 6000 DENIER THREAD - SEAMS
- T135 THREAD - ZIPPER



OPEN VIEW



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Customer Approval

Signature ____________________ Date ______________

Contact Information

Name ____________________ Phone # ______________

Proprietary And Confidential

Customer Name:	US ECOLOGY		
PacTec Item Code:	VP2285-7.58GF16ZT(SP)		
Estimated Tare Weight:	132 lb	Drawn By:	ALR
Date Drawn:	March 25, 2025		
Revision #:	0.0	Internal Design Approval:	N/A
Scale: NONE	Sheet Size: A4	Sheet: 1 OF 1	

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March 25, 2025

To Whom It May Concern,

PacTec has been a quality manufacturer of specialty flexible packaging for the environmental, industrial, military, and nuclear industries for over 35 years in the USA and abroad. Our packagings include Type IP-1, IP-2, IP-3 (7A Type A) as well as UN PGII (Y) as described in US DOT 49CFR. We hold over 20 US and foreign patents and have won numerous awards in both the USA and UK for our innovative products. PacTec is ISO 9001:2015 certified and also follows NQA-1 guidelines. We are routinely audited by ISO governing bodies as well as many customers, including the US Department of Energy (DOE).

PacTec's nuclear packagings require testing per the USDOT 49CFR guidelines. This testing includes drop and stack. For the drop test, a bag that is 8'x5.5'x5,5' is filled with 24,000 lb and dropped from a height of 24" at an angle so that the center of gravity is directly above the bottom corner of the bag. For the stack test, the requirements are that a weight of 5X the rated weight capacity of the bag is stacked on top of the bag for a time period of 24hr. In this case, the stack weight was 120,000 lb. We have performed numerous tests of this nature utilizing not only the exact same materials of construction of your bag in question, but also on bags with the same identical outer layer used in your bag, but with thinner/lighter materials making up the inner layers. Our most common DOT approved bag is constructed of 7.5oz ctd wpp outer, 6mil PE middle, 12oz nwpp inner. Your bag consists of 7.5oz ctd wpp outer, 8mil PE middle, and 16oz nwpp inner.

In addition to the drop and stack tests mentioned above, over the years PacTec has conducted dozens of other tests both internally and utilizing outside entities to continually improve our product designs. These include but are not limited to, routine conditions of transport, vibration, puncture, water spray, tear, topple, righting, abrasion, and others. Also, we routinely send our raw materials off for independent testing to confirm manufacturers specs such as tensile strength, tear strength, elongation, puncture, mass, and thickness. Below is a brief description of the most common tests:

Tensile – a strip of the material is placed between two clamps and pulled in opposing directions. The force required to rupture the material is recorded. The test is performed in both directions of the material.
Tensile elongation – this is the amount the material stretches in each direction prior to failure in the tensile test.
Tongue Tear – a 3" tear is cut into the top of a rectangular piece of material, creating two "tongues". The two tongues are then placed in clamps and pulled in opposite directions. The force required to tear the material is recorded.

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Trap Tear – a 3" cut is placed in the side of a trapezoid shaped piece of material. The top and bottom of the material is placed in clamps and pulled in opposite directions. The force required to tear the material is recorded.
Puncture – a piece of material is placed on a flat surface with a hole, and a small diameter rod (50mm) is forced through the material at the hole location. The force required to puncture the material is recorded.

If you need any further information, please do not hesitate to ask.

Regards,

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