



TOPEIN® EMULSIONS

**Environmentally safe products for:
Dust Palliatives, Soil Stabilization, Erosion Control,
Prime Coat, Pavement Rejuvenation, Recycling Agent.**

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**Call Paramount Petroleum Bakersfield for the name of a distributor who handles
TOPEIN® Emulsions**

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TOPEIN®S **Organic Acid Dispersions**

1.0 Introduction

TOPEIN®S is a homogeneous “oil in water” non-ionic emulsion of TOPEIN®. This chemically stabilized environmentally friendly specialty emulsion of tree resin has many unique uses. Among the uses of TOPEIN®S are erosion control, prime coat, stockpile cap, soil stabilizer, pavement rejuvenator and as a binder for recycled asphalt pavement (RAP).

TOPEIN® is a resinous natural polymer by-product of the forest industry, more specifically, from the destructive distillation of wood chips. The process begins by adding wood chips to sulfuric acid. The acid breaks down the wood chips into cellulose and Tall Oil Fatty Acid Heads. The fatty acid heads are collected and refined in the same fashion as petroleum. During the refining process, tall oils and resins are separated leaving behind TOPEIN®, a resinous mixture containing adipic acid, polar resin, and saturated and aromatic oils. TOPEIN® is a non-toxic, non-hazardous, and non-carcinogenic material

2.0 Dilution

Dilution Water

TOPEIN®S is designed to be fairly tolerant to dilution with most water encountered. If water to be used is not from a manufacturing plant source, a sample of the water should be obtained for testing. Testing is accomplished by using sample water, mixing it with TOPEIN®S at the desired dilution ratio. Once diluted, allow the mixture to stand a minimum of 24 hours and observe the emulsion. Most dilution problems will be apparent immediately. If the storage time of the diluted emulsion is to be extended, or further doubt exists as to the quality of the water for dilution, follow ASTM D244 procedures for a 5 day stability to test the diluted sample of TOPEIN®S.

Dilution Rates

TOPEIN®C and TOPEIN®S are normally diluted prior to use. Recommended dilution rates (parts water to parts TOPEIN®C, TOPEIN®S) are as follows:

| | <u>Use</u> | <u>Product</u> | <u>Dilution</u> |
|----|----------------------|----------------|-------------------------------|
| a. | erosion control | TOPEIN®S | 3:1 to 4:1 |
| b. | Prime Coat | TOPEIN®S | 3:1 to 4:1 |
| c. | dust palliative | TOPEIN®S | 3:1 to 12:1 |
| d. | soil stabilization | TOPEIN®S | 1:1 to 2:1 |
| e. | pavement rejuvenator | TOPEIN®C | 1:1 * |
| f. | recycling agent | TOPEIN®C | concentrate to .5 parts water |
| | | TOPEIN®S | concentrate to 1 part water |

* may need to be followed with sand application.

See Table 1 attached for application rates calculated per mile of road surface.

3.0 Application

3.1 Erosion Control

TOPEIN®S is diluted per above. The exact dilution rate is determined by considering the conditions of the soil. Small test patches may be applied. Application is best accomplished by use of high power pump spray equipment. Application rates are 0.35 gal/sy of dilute to 1.0 gal/sy of dilute TOPEIN®S. In the case of a heavy treatment, two applications may be required.

3.2 Prime Coat

TOPEIN®S is diluted per above. The exact dilution rate is determined by the R/E per the agency requirements taking into consideration the porosity and compaction of the base course. Application is done by a rate controlled spray system, such as a Bear Cat or Etnyre Spreader. Application is a two step process. The first application should be at 0.25 gallon per square yard. After that treatment has dried so as not to pick up or track (2 to 3 hours depending on ambient temperatures), a second pass at 0.15 gallons per square yard should be applied. Paving can commence usually within hours, again dependent on ambient temperature.

3.3 Dust Palliative TOPEIN®S

TOPEIN®S is diluted per above. The exact dilution rate is determined by considering the condition of the soil, such as soil permeability. Small test patches should be applied. Application is by rate controlled spread trucks (preferred) or with water trucks. Application rates range from 0.20 gal/sy to 0.50 gal/sy. A cure time of 3 or more hours is recommended before reopening the surface to use. Climatic conditions such as humidity may drastically effect cure times. Application should be avoided if rain is expected. Depending on the use, periodic reapplication maybe required continuing the control of dust.

3.4 Soil Stabilization

TOPEIN®S is diluted per above. The exact dilution rate, amount of TOPEIN®S and amount of water to be added to the soil is determined by a mix design (see attached mix design and procedure). Typical application rates, depending on depth of stabilization, will be 0.80 to 1.2 gal/sy of a 1:1 to 2:1 dilute TOPEIN®S. Soil stabilization is accomplished by first adding pre conditioning water (to aid in mixing of the TOPEIN®S and to obtain proper density), applying the diluted TOPEIN®S, mixing the water / TOPEIN®S / soil mixture and compacting the mixture to proper density.

This process may accomplish by using a traveling mixer such as a “BOMAG” or by blade mixing the mixture. In either case, the soil is preconditioned with water per the mix design to obtain optimum moisture. The soil is then scarified or windrowed. Diluted TOPEIN®S can be sprayed over the scarified surface, or to windrows of the road surface material. The BOMAG or motor grader then mixes the soil / water / TOPEIN®S mixture.

3.4.1 Compaction

Compaction is best accomplished by first spreading the soil mixture evening over the road surface. The first pass over the material should be with a sheeps foot roller, then rubber tire rollers and finally a steel wheel. Best performance is by obtaining 95% or more maximum density as specified by the mix design.

3.5 Pavement Rejuvenators

3.5.1 TOPEIN®S

TOPEIN®S is diluted per above. The exact dilution rate is determined by considering the condition of the road surface and small test patch should always be applied. TOPEIN®S must be diluted 1:1 and applied 0.07 gal/sy to 0.15 gal/sy. After application, the dilute TOPEIN®S

must be sanded with 1 to 2 pounds of sand, 100% passing the number 4 (#4) sieve, per square yard before reopening the road surface to traffic.

3.5.2 TOPEIN®C - Emulsified Rejuvenating Agent

TOPEIN®C is a homogenous emulsion of solvent extract petroleum asphaltene resin, or hydrocarbon resin, combined with TOPEIN® and specially selected petroleum asphalt. This chemically stabilized, emulsified rejuvenator has been specifically formulated for extending the life of asphalt pavements, and asphalt pavement surface treatments such as open graded friction courses, chip seals, slurry seals, and micro-surface. The TOPEIN® portion of this unique rejuvenating agent penetrates into the surface of the asphalt pavement adding vital polar compounds and resins to the aged asphalt near the surface. The petroleum asphalt and solvent extract petroleum resin, or hydrocarbon resin, seals and preserves the asphalt pavement, and asphalt pavement surface treatments.

TOPEIN®C is ideally suited as a fog seal maintenance treatment for interstate highways, state highways, county roads, city streets, and airport runways and taxiways. **TOPEIN®C** does not require sanding in most applications, and dries ready for traffic in one to four hours. **TOPEIN®C** should be applied only with ambient temperatures of 50° and rising. **TOPEIN®C** should be applied to asphalt pavements and asphalt surface treatments three to five years of age. **TOPEIN®C** is non-hazardous, non-carcinogenic, and contains no petroleum distillates.

TOPEIN®C may also be used as a cold mix recycling agent. When used as concentrate, pre-wet the recycled asphalt and add from one to four percent by weight **TOPEIN®C**. If the **TOPEIN®C** is diluted prior to use, no additional water is usually necessary, and from three to seven percent by weight is added depending on mix design requirements. Recycle mixes with **TOPEIN®C** typically exhibit higher stabilities than those mixes with other recycling agents, or asphalt emulsions.

3.5.2.1 Application Rates

1:1 dilute **TOPEIN®C** (RTS) application rates are usually 0.05 gallons per square yard to 0.10 gallons per square yard. Rates may vary slightly from above. To determine correct rates, square yard test panels at various rates should be placed on the pavement to be treated at least two weeks prior to actual application. The correct application rate will be apparent from evaluation of the test panels immediately after application, and after two weeks of observation.

3.5.2.2 Sanding

The asphalt pavement surface should be checked prior to application of **TOPEIN®C** to determine if sanding is necessary. **TOPEIN®C** may be applied over pavement surfaces that exhibit adequate skid resistance, without sanding. If the surface of the pavement to be rejuvenated has doubtful skid resistance, sanding should be done as soon as possible after the applied **TOPEIN®C** has turned from brown to black. Blotter sand, 100% passing the number 4 sieve, and 0 to 20% passing the number 200 sieve should be used on streets and highways. The sand should be uniformly applied at 1/2 to 2 pounds per square yard. Sanded pavements, after treatment with **TOPEIN®C**, may be immediately reopened to traffic. Excess sand, if any, should be swept within 48 hours from the pavement surface.

3.6 Recycling Agent

TOPEIN®S or **TOPEIN®C** is diluted per above. The exact dilution rate, amount of **TOPEIN®S** or **TOPEIN®C** and amount of water to be added to the soil is determined by a mix design (see attached mix design and procedure). The RAP is first prescreened to passing 1 inch. Following the same procedures as for stabilization above, the RAP is mixed with water, **TOPEIN®S** or **TOPEIN®C** and compacted. The RAP mixture will have excellent stability. In the case of roads that will experience higher traffic, such as secondary roads, a surface treatment, such as a chip or slurry seal to maintain the wearing surface should be applied.

APPENDIX I

Table 1

GALLONS OF TOPEIN® CONCENTRATE REQUIRED PER MILE

| SPREAD RATE | | WIDTH OF STRIP, 9ft THRU 30 ft, PER ONE MILE LENGTH | | | | | |
|--|---------|---|----------|----------|----------|----------|----------|
| GALS/SY | | GALLONS OF PRODUCT (including dilution) TO BE APPLIED | | | | | |
| | 9.00 | 12.00 | 15.00 | 18.00 | 21.00 | 24.00 | 30.00 |
| 0.5 | 2640.00 | 3520.00 | 4400.00 | 5280.00 | 6160.00 | 7040.00 | 8800.00 |
| 0.75 | 3960.00 | 5280.00 | 6600.00 | 7920.00 | 9240.00 | 10560.00 | 13200.00 |
| 1 | 5280.00 | 7040.00 | 8800.00 | 10560.00 | 12320.00 | 14080.00 | 17600.00 |
| 1.25 | 6600.00 | 8800.00 | 11000.00 | 13200.00 | 15400.00 | 17600.00 | 22000.00 |
| 1.5 | 7920.00 | 10560.00 | 13200.00 | 15840.00 | 18480.00 | 21120.00 | 26400.00 |
| GALLONS OF TOPEIN® TO BE APPLIED AT A 1:1 DILUTION(excluding water) | | | | | | | |
| | 9.00 | 12.00 | 15.00 | 18.00 | 21.00 | 24.00 | 30.00 |
| 0.5 | 1320.00 | 1760.00 | 2200.00 | 2640.00 | 3080.00 | 3520.00 | 4400.00 |
| 0.75 | 1980.00 | 2640.00 | 3300.00 | 3960.00 | 4620.00 | 5280.00 | 6600.00 |
| 1 | 2640.00 | 3520.00 | 4400.00 | 5280.00 | 6160.00 | 7040.00 | 8800.00 |
| 1.25 | 3300.00 | 4400.00 | 5500.00 | 6600.00 | 7700.00 | 8800.00 | 11000.00 |
| 1.5 | 3960.00 | 5280.00 | 6600.00 | 7920.00 | 9240.00 | 10560.00 | 13200.00 |
| GALLONS OF TOPEIN® TO BE APPLIED AT A 1:2 DILUTION(excluding water) | | | | | | | |
| | 9.00 | 12.00 | 15.00 | 18.00 | 21.00 | 24.00 | 30.00 |
| 0.50 | 880.00 | 1173.33 | 1466.67 | 1760.00 | 2053.33 | 2346.67 | 2933.33 |
| 0.75 | 1320.00 | 1760.00 | 2200.00 | 2640.00 | 3080.00 | 3520.00 | 4400.00 |
| 1 | 1760.00 | 2346.67 | 2933.33 | 3520.00 | 4106.67 | 4693.33 | 5866.67 |
| 1.25 | 2200.00 | 2933.33 | 3666.67 | 4400.00 | 5133.33 | 5866.67 | 7333.33 |
| 1.5 | 2640.00 | 3520.00 | 4400.00 | 5280.00 | 6160.00 | 7040.00 | 8800.00 |
| GALLONS OF TOPEIN® TO BE APPLIED AT A 1:5 DILUTION (excluding water) | | | | | | | |
| | 9.00 | 12.00 | 15.00 | 18.00 | 21.00 | 24.00 | 30.00 |
| 0.5 | 440.00 | 586.67 | 733.33 | 880.00 | 1026.67 | 1173.33 | 1466.67 |
| 0.75 | 660.00 | 880.00 | 1100.00 | 1320.00 | 1540.00 | 1760.00 | 2200.00 |
| 1 | 880.00 | 1173.33 | 1466.67 | 1760.00 | 2053.33 | 2346.67 | 2933.33 |
| 1.25 | 1100.00 | 1466.67 | 1833.33 | 2200.00 | 2566.67 | 2933.33 | 3666.67 |
| 1.5 | 1320.00 | 1760.00 | 2200.00 | 2640.00 | 3080.00 | 3520.00 | 4400.00 |

APPENDIX II

Issue Date: 4/08/99

MATERIAL SAFETY DATA SHEET

I. Product Identification

Product Name: TOPEIN®S Emulsions

Chemical Name: Emulsion of blended organic esters, surfactants, and water

CAS Number: Mixture. See Section 3 – Regulatory Information

Chemical Formula: Not applicable (see Section II)

Manufacturer: Paramount Petroleum Bakersfield
1201 China Grade Loop
Bakersfield, CA. 93308
(661) 392-3630

Emergency Contact: Phone: (602) 840-7702
Fax: (602) 840-3697

II. Hazardous Ingredients

| Component | CAS | Approx wt % | ACGIH TLV | OSHA PEL |
|---|-----------|-------------|-----------------------|---------------------|
| TOPEIN® (Sterol esters of C ₁₈ and C ₂₀ organic acids) | 8016-81-7 | 42-48 | None established | None established |
| Nonylphenol Polyethylene Glycol Ether Surfactant | Mixture | Proprietary | None established | None established |
| Hydrochloric acid | 7647-01-0 | <.25 | 7.5 mg/m ³ | 7 mg/m ³ |
| Water | 7732-18-5 | Approx 50 | N/A | N/A |

Hazardous Materials Identification System (HMIS)

| | | |
|--------|--------------|------------|
| Health | Flammability | Reactivity |
| 1 | 0 | 0 |

(Least = 0, Slight = 1, Moderate = 2, High = 3, Extreme = 4)

III. Physical Data

| | |
|-------------------------|--------------------------------|
| Appearance and odor | Beige emulsion with bland odor |
| Molecular weight | Not applicable (mixture) |
| Boiling point | > 212 F |
| Melting point | Not available |
| Vapor pressure (torr) | Not available |
| Vapor density (air = 1) | Not available |
| Water content | Approximately 50% by weight |
| Evaporation rate | Not available |
| pH | 6-8 |
| Sp. Gravity (water = 1) | 1.00 – 1.008 |

Fire and Explosion Data

| | |
|------------------------------------|---|
| Flash point | Not available (> 200 F) |
| Flammable limits | LEL Not determined UEL Not determined |
| Extinguishing media | Dry chemical, foam, carbon dioxide |
| Unusual fire and explosion hazards | None |
| Special fire fighting procedures | Avoid bodily contact. Use self-contained breathing apparatus in enclosed areas. |
| Hazardous combustion | Carbon dioxide and carbon monoxide. |

IV. Reactivity Data

| | |
|---|---------------------------------------|
| Stability | Stable |
| Conditions to avoid | Stable at normal storage conditions |
| Incompatibilities (Materials to avoid) | Strong oxidizing agents; strong bases |
| Hazardous decomposition products | None known |
| Hazardous polymerization | Will not occur |

V. Health Hazard Information

| | |
|-----------------------------|--|
| Exposure from routine use | This product is not hazardous under normal conditions of use. |
| Probable routes of exposure | Skin, eyes, ingestion, inhalation |
| Emergency first aid | GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE <u>Skin</u> : Flush thoroughly with large amounts of water; wash with soap and water. <u>Eyes</u> : Flush thoroughly with water for at least 15 minutes <u>Inhalation</u> : Remove to fresh air. Give artificial respiration if breathing has stopped. <u>Ingestion</u> : Do not induce vomiting. If conscious, dilute by drinking large quantities of water; get medical attention. Never give anything by mouth to an unconscious person. |
| Acute effects | Corrosive material. Can cause irritation to skin, eyes, and mucous membranes. |
| Chronic effects | Repeated or prolonged exposure to liquid, vapor or mist may cause irritation in eyes, nose, mouth and/or throat. |
| Toxicity | No ingredients are listed by IARC, NTP, or OSHA as cancer causing agents. |

VI. Ecological Information

| | |
|-------------|---|
| Ecotoxicity | TOPEIN® (CAS 8016-81-7) |
| | Acute fish toxicity (Zebra) LC50 (96 h) > 400 mg/l |
| | Growth inhibition studies (fresh water algae) EC50 (72 h) > 1000 mg/l |
| | Immobilization studies (Daphnia magna) EC50 (48 h) > 2000 mg/l |
| | Biodegradable |

TOPEIN®S Emulsion

Acute fish toxicity (fathead minnow)

LC50 (96h) > 750 mg/l

VII. Special Protection Information

| | |
|-------------------------------|---|
| Personal Protective Equipment | Eye protection: face shield with chemical safety goggles Protective gloves: rubber Respiratory protection: none required under normal conditions of use Other protective equipment: none |
| Ventilation | No additional ventilation required |
| Handling and Storing | Avoid skin and eye contact. Do not swallow. |

Spill or Leak Procedures

| | |
|---|---|
| Steps to be taken in case of release or spill | Avoid skin contact. Use personal protective equipment as described above. Confine spillage and eliminate releases source if this can be done without risk. Spills of this material may trigger the emergency release reporting requirements. Dispose of all waste in accordance with federal, state, and local regulations. |
|---|---|

Regulatory Information

This product is a mixture. Ingredients of this product are on the TSCA inventory. This mixture contains hydrochloric acid (CAS # 7647-01-0, <1.0%), which is subject to the reporting requirements of section 313 of SARA title III and 40 CFR Part 373. This product or any known constituent are not on California Prop 65 list.

VIII. Comments

The information and data herein are believed to be accurate and have been compiled from sources believed to be reliable. It is offered for your consideration, investigation and verification. Buyer assumes all risk of use, storage and handling of the product in compliance with applicable federal, state and local laws and regulations. PARAMOUNT PETROLEUM BAKERSFIELD MAKES NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, CONCERNING THE ACCURACY OR COMPLETENESS OF THE INFORMATION AND DATA HEREIN. THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE SPECIFICALLY EXCLUDED. Paramount Petroleum Bakersfield will not be liable for claims relating to any party's use or reliance on information and data contained herein regardless of whether it is claimed that the information and data are inaccurate, incomplete or otherwise misleading.

APPENDIX II (A)

MATERIAL SAFETY DATA SHEET

PARAMOUNT PETROLEUM BAKERSFIELD

1201 China Grade Loop Bakersfield, CA 93308 (661) 392-3630

This Material Safety Data Sheet contains environmental, health and toxicology information for your employees. Please make sure this information is given to them. It also contains information to help you meet community right-to-know/emergency response reporting requirements under SARA Title III and other laws. If you resell this product, this MSDS must be given to the buyer, or the information should be incorporated in your MSDS. Discard any previous edition of this MSDS.

A. IDENTIFICATION AND EMERGENCY INFORMATION

PRODUCT NAME

TOPEIN® C
Emulsified Rejuvenating Agent, Type C

PRODUCT CODE

Emulsified Asphalt

PRODUCT CATEGORY

Petroleum Asphalt

PRODUCT APPEARANCE AND ODOR

Dark viscous liquid, Low asphalt odor

EMERGENCY TELEPHONE NUMBERS

1-800-424-8802 National Response Center 1-800-424-9300 Chemtrec

WARNING!

- Heating may release highly toxic and flammable hydrogen sulfide (H₂S) gas.
- Prolonged or repeated breathing of fumes or contact with skin can be harmful.
- Materials present in asphalt have caused cancer in laboratory animals.
- Keep out of reach of children.

B. COMPONENTS AND HAZARD INFORMATION

COMPONENTS

Asphalt
Proprietary ingredients
Soap (Emulsifier)
Water

CAS NO. OF COMPONENTS

8052-42-4
proprietary
61791-55-7

APPROXIMATE CONCENTRATION

50-57%
5-15%
5%
Balance

All components of this product are listed on the U.S. TSCA inventory.
See Section E for Health and Hazard Information.
See Section H for additional Environmental Information.

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM (HMIS)

Health
0

Flammability
1

Reactivity
0

BASIS

Recommended by PARAMOUNT PETROLEUM BAKERSFIELD.

(Least=0, Slight=1, Moderate=2, High=3, Extreme=4)

EXPOSURE LIMIT FOR TOTAL PRODUCT

OSHA Regulation 29 CFR 1910.1000 and the American Conference of Governmental Industrial Hygienist (ACGIH) have adopted a Threshold Limit Value for the hydrogen sulfide (H₂S) of 10 ppm (14 mg/m³) in air as a time-weighted average for an 8-hour workday with a 15 ppm (21 mg/m³), and a maximum peak of 50 ppm (70 mg/m³) for 10 minutes once per day if no other measurable exposure occurs. NIOSH-approved respiratory equipment should be used when permissible concentrations are exceeded.

BASIS

Recommended by PARAMOUNT PETROLEUM BAKERSFIELD

C. PRIMARY ROUTES OF ENTRY AND EMERGENCY AND FIRST AID PROCEDURES

EYE CONTACT

If hot product is splashed into eyes, flush with clear water and contact physician.

SKIN

If skin is contaminated with cool, solid asphalt, the contamination area should be cleaned with waterless skin cleanser followed by soap and water.

If skin is contacted with hot asphalt, thermal burns will result. In this case, the contaminated area should be treated similarly to other thermal burns by cooling the affected area immediately with the coldest available water. It is not usually advisable to immediately remove the asphalt material. Natural separation will occur in 48 - 72 hours. Removal should be attempted only under the direction of a physician. If removal is attempted, mineral oil (not mineral spirits) or mineral oil ointment may be applied to soften the asphalt to facilitate removal. Remove all contaminated clothing.

INHALATION

If overcome by vapor remove from exposure and call a physician immediately. If breathing is irregular or has stopped, start resuscitation, administer oxygen, if available.

INGESTION

If ingested, **DO NOT INDUCE VOMITING; call a physician immediately.**

D. FIRE AND EXPLOSION HAZARD INFORMATION

FLASH POINT (MINIMUM)

450°F (232°C) ASTM D 3143, Tag Open Cup

AUTOIGNITION TEMPERATURE

(Approximate)

Not Available

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) - HAZARD IDENTIFICATION

HEALTH

0

FLAMMABILITY

1

REACTIVITY

0

BASIS

Recommended by the National Fire Protection Association.

(Least=0, Slight=1, Moderate=2, High=3, Extreme=4)

HANDLING PRECAUTIONS

Keep product away from ignition sources, such as heat, sparks, pilot lights, static electricity, static electricity, and open flame.

FLAMMABLE OR EXPLOSIVE LIMITS (APPROXIMATE PERCENT BY VOLUME IN AIR)

Estimated values: Lower Flammable Limit Upper Flammable Limit
Not Available Not Available

HOT ASPHALT FLASH WARNING

Studies have shown that relatively low flash point substance, such as hydrogen sulfide (H₂S) and low-boiling hydrocarbons, may accumulate in the vapor space of hot asphalt tanks and bulk transport compartments. Such vapors may exhibit flammability characteristics of a significantly lower flash product than would be indicated by the open cup flash test. As a precaution, keep ignition sources away from vents and openings, including prevention of accumulation of pyrophoric iron sulfide. Asphalt Institute Publication IS-180 and American Petroleum Institute Publication 852-20230 contain further information and guidance on the safe storage and handling of hot asphalt.

EXTINGUISHING MEDIA AND FIRE FIGHTING PROCEDURES

Foam, water spray (fog), dry chemical, carbon dioxide and vaporizing liquid type extinguishing agents may all be suitable for extinguishing fires involving this type of product, depending on size or potential size of fire and circumstances related to the situation. Plan fire protection and response strategy through consultation with local fire protection authorities or appropriate specialists.

The following procedures for this type of product are based on the recommendations in the National Fire Protection Association's "Fire Protection Guide on Hazardous Materials", Eighth Edition (1984):

Use water spray, dry chemical, foam or carbon dioxide to extinguish the fire. Use water to keep fire-exposed containers cool. If a leak or spill has not ignited, use water spray to disperse the vapors and to provide protection for men attempting to stop a leak. Water spray may be used to flush spills away from exposures. Minimize breathing of gases, vapor, fumes or decomposition products. Use supplied-air breathing equipment for enclosed or confined spaces or as otherwise needed.

DECOMPOSITION PRODUCTS UNDER FIRE CONDITIONS

Fumes, smoke, carbon monoxide, hydrogen sulfide, sulfur oxides, aldehydes and other decomposition products, in the case of incomplete combustion.

"EMPTY" CONTAINER WARNING

"Empty" containers retain residue (liquid and/or vapor) and can be dangerous. **DO NOT PRESSURIZE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION; THEY MAY EXPLODE AND CAUSE INJURY OR DEATH.**

Do not attempt to clean since residue is difficult to remove. "Empty" drums should be completely drained, properly bunged and promptly returned to a drum reconditioner. All other containers should be disposed of in an environmentally safe manner and in accordance with Health Administration regulations, ANSI z49.1, and other governmental and industrial references pertaining to cleaning, repairing, welding or other contemplated operations.

There is water present in this product. Inspect, thoroughly empty and drain all containers before refilling with hot liquid to prevent boilover.

E. HEALTH AND HAZARD INFORMATION

VARIABILITY AMONG INDIVIDUALS

Health studies have shown that many petroleum hydrocarbons and synthetic lubricants pose potential human health risks which may vary from person to person. As a precaution, exposure to liquids, vapors, mists or fumes should be minimized.

EFFECTS OF OVEREXPOSURE (Signs and symptoms of exposure)

High vapor concentrations (greater than approximately 700 ppm, attainable at elevated temperatures well above ambient) are irritating to the eyes and the respiratory tract, and may cause headaches, dizziness, anesthesia, drowsiness, unconsciousness, and other central nervous system effects, including death. CAUTION: Product is normally shipped hot (approximately 100-185°F): protect against burns. See statements below regarding hydrogen sulfide (H₂S).

NATURE OF HAZARD AND TOXICITY INFORMATION

Skin contact with hot product may cause thermal burns. Prolonged or repeated contact with this product at warm or ambient temperatures tends to remove skin oils, possibly leading to irritation and dermatitis; however, based on human experience and available toxicological data, this product is judged to be neither a "corrosive" nor an "irritant" by OSHA criteria.

Eye contact with hot product may cause thermal burns. Contact with this product at warm or ambient temperatures may cause eye irritation but will not damage eye tissue.

CAUTION: Under certain circumstances sulfur compounds in hot product may form hydrogen sulfide (H₂S) gas. Cooling product may continue to emit traces of (H₂S) temporarily from entrapped or dissolved gases. (H₂S) is a colorless, toxic and extremely flammable gas with an odor at low concentrations characteristic of rotten eggs and a sweetish odor at high concentrations. Odor cannot be relied upon as a means of detection because the sense of smell rapidly becomes insensitive to (H₂S), and the (H₂S) odor may be masked by the general odor of hot product. Because (H₂S) may accumulate in tanks and bulk transport compartments, personnel should stand upwind, keep their faces at least two feet from compartment openings, and avoid breathing vapors when opening hatches and dome covers.

Prolonged breathing of 50 to 100 ppm, of (H₂S) may produce eye and respiratory tract irritation, headache, nervousness and nausea and only a few breaths of high concentrations (e.g. 700 to 1000 ppm) may lead to unconsciousness and could be fatal. NIOSH-approved respiratory equipment should be used when permissible concentrations are exceeded. The OSHA 8-hour Time Weighted Average-Permissible Exposure Limit (TWA-PEL) is 10 ppm with a 15 minute Short Term Exposure Limit (TWA-STEL) of 15 ppm.

DERMAL TOXICITY

The systemic toxicity of this substance has not been determined. However, it should be practically non-toxic to internal organs if it gets on the skin. This hazard is based on data from similar materials.

F. PHYSICAL DATA

The following data are approximate or typical values and should not be used for precise design purposes.

BOILING RANGE

IBP 650 - 1000+°F (ASTM D 2887)

VAPOR PRESSURE

Less than 0.1 mm Hg @ 20°C

SPECIFIC GRAVITY (H₂O = 1) (Typical)

0.98 @ 60°F (15.6°C)

VAPOR DENSITY (Air = 1)

Greater than 5

pH

2 - 7

POUR, CONGEALING OR MELTING POINT

Not Available

EVAPORATION RATE @ 1 atm and 25°C (77°F) (n-BUTYL ACETATE = 1)
Negligible

SOLUBILITY IN WATER @ 1 atm and 77°F (25°C)
Negligible - less than 0.1%

VISCOSITY @ 275°F and 30 mm Hg (typical)
475 min

PERCENT VOLATILE BY VOLUME
Not Available

G. REACTIVITY

This product is stable. Hazardous polymerization will not occur. Avoid contact with strong oxidants such as liquid chlorine, concentrated oxygen, sodium hypochlorite, calcium hypochlorite, etc. Hot product in contact with water can cause foaming or sudden evolution of steam which could cause pressure build-up and possibly rupture a tank or vessel.

Hydrogen sulfide (H₂S) from the product can react with the iron in an asphalt storage tank to form ferrous sulfide which is pyrophoric.

H. ENVIRONMENTAL INFORMATION

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Shut off and eliminate all ignition sources. Keep people away. Form a dike or berm to contain product. Recover free liquid. Minimize skin contact. Ventilate confined spaces. Hot product may solidify when cooled. Keep product out of sewers and watercourses by diking or impounding. Advise authorities if product has entered any sewer or water courses. Assure conformity with applicable governmental regulation. Continue to observe precautions for volatile, combustible vapors from absorbed material.

THE FOLLOWING INFORMATION MAY BE USEFUL IN COMPLYING WITH VARIOUS STATE AND FEDERAL LAWS AND REGULATIONS UNDER VARIOUS ENVIRONMENTAL STATUTES:

REPORTABLE QUANTITY (RQ), EPA REGULATION 40 CFR 302 (CERCLA Section 102)

No RQ for product or any constituent greater than 1% or 0.1% (carcinogen).

THRESHOLD PLANNING QUANTITY (TPQ), EPA REGULATION 40 CFR 355 (SARA Section 301-304)

No TPQ for product or any constituent greater than 1% or 0.1% (carcinogen).

TOXIC CHEMICAL RELEASE REPORTING, EPA REGULATION 40 CFR 372 (SARA Section 313)

No toxic chemical is present greater than 1% or 0.1% (carcinogen).

HAZARDOUS CHEMICAL REPORTING, EPA REGULATION 40 CRF 370 (SARA Section 311-312)

| | | | | | |
|--|----------------|----------------|----------------|-----------------|-----------------|
| EPA HAZARD CLASSIFICATION CODE: | Acute | Chronic | Fire | Pressure | Reactive |
| Hazard: | Hazard: | Hazard: | Hazard: | Hazard: | Hazard: |
| xxx | xxx | xxx | | | |

I. PROTECTION AND PRECAUTIONS

VENTILATION

Provide ventilation sufficient to prevent exceeding recommended exposure limit or buildup of explosive concentrations of vapor in air.

RESPIRATORY PROTECTION

Use supplied-air respiratory in confined or enclosed spaces, if needed, or when H₂S exceeds permissible limits.

PROTECTIVE GLOVES

Protect against hot liquid. Use chemical-resistant gloves to avoid skin contact.

EYE PROTECTION

Use splash goggles or face shield when eye contact may occur.

OTHER PROTECTIVE EQUIPMENT

Use chemical-resistant apron or other impervious clothing, if needed, to protect against hot liquid and to avoid skin contact.

WORK PRACTICES/ENGINEERING CONTROLS

No smoking, flame or other ignition sources.

Keep containers closed when not in use. Do not store near heat, sparks, flame or strong oxidants. Ventilation must be sufficient to prevent exceeding recommended exposure limit or buildup of explosive concentrations of vapor in air.

In order to prevent fire or explosion hazards, use appropriate equipment.

Information on electrical equipment appropriate for use with this product may be found in the latest edition of the National Electrical Code (NFPA-70). This document is available from the National Fire Protection Association, Batterymarch Park, Quincy, Massachusetts 02269.

PERSONAL HYGIENE

Minimize breathing vapor, mist or fumes. Avoid prolonged or repeated contact with skin. Remove contaminated clothing; launder or dry-clean before re-use. Remove contaminated shoes and thoroughly clean before re-use; discard if oil-soaked. Cleanse skin thoroughly after contact, before breaks and meals, and at end of work period. Product is readily removed from skin by waterless hand cleaners followed by washing thoroughly with soap and water.

ADDITIONAL HEALTH DATA COMMENT:

There is concern about the carcinogenicity of chemical compounds found in asphalts. The International Agency for Research on Cancer (IARC) reviewed the carcinogenic potential of asphalts in 1985 and again in 1987. At that time, they concluded there was inadequate evidence to decide that asphalts were carcinogenic to humans. Overall, findings from health monitoring studies of asphalt workers are not conclusive. However, asphalt fume condensates and certain chemical components of asphalt fume have been shown to cause cancer in mice when repeatedly applied to the skin and allowed to remain on the skin for a prolonged period of time. In addition, asphalt fume condensates have been shown to be weakly positive in Ames mutagenicity tests. Skin contact and breathing of fumes, mists and vapors should be reduced to a minimum.

J. TRANSPORTATION AND OSHA RELATED LABEL INFORMATION

TRANSPORTATION INCIDENT INFORMATION

For further information relative to spills resulting from transportation incidents, refer to latest Department of Transportation Emergency Response Guidebook for Hazardous Materials Incidents, DOT Publication P 5800.5.

DOT IDENTIFICATION NUMBER:

Elevated Temperature Material, N.O.S. 9 NA 9259 III Liquid

LABEL REQUIREMENTS:

Class 9

PACKAGING GROUP:

III (CFR 49 Hazardous Materials Table 172.IV)

OSHA REQUIRED LABEL INFORMATION

In compliance with hazard and right-to-know requirements, the following OSHA Hazard Warnings should be found on a label, bill of lading or invoice accompanying this shipment.

DANGER!

COMBUSTIBLE

MAY FORM HYDROGEN SULFIDE (H₂S) WHEN HEATED

INHALATION OF (H₂S) MAY BE FATAL

MAY CAUSE SKIN CANCER

Note: Product label will contain additional non-OSHA related information.

The information and recommendations contained herein are, to the best of PARAMOUNT PETROLEUM BAKERSFIELDs' knowledge and belief, accurate and reliable as of the date issued. PARAMOUNT PETROLEUM BAKERSFIELD does not warrant or guarantee their accuracy or reliability, and PARAMOUNT PETROLEUM BAKERSFIELD shall not be liable for any loss or damage arising out of the use thereof.

The information and recommendations are offered for the user's consideration and examination, and it is the user's responsibility to satisfy itself that they are suitable and complete for its particular use. If buyer repackages this product, legal counsel should be consulted to insure that proper health, safety and other necessary information is included on the container.

The Environmental Information included under Section H hereof as well as the Hazardous Materials Identification System (HMIS)

and National Fire Protection Association (NFPS) ratings have been included in order to provide additional health and hazard classification information. The ratings recommended are based upon the criteria supplied by the developers of these rating systems.

FOR OTHER PRODUCT INFORMATION CONTACT:
MSDS Coordinator
PARAMOUNT PETROLEUM BAKERSFIELD
1201 China Grade Loop
Bakersfield, CA 93308
Phone (661) 392-3630
Fax (661) 399-1054

APPENDIX III

DUST PALLIATIVE/STABILIZER
SPECIFICATIONS

A. TYPE OF MATERIAL

TOPEIN® Emulsion: TOPEIN® S

TOPEIN®S Emulsion characterized by the following:

Emulsion

| | |
|-------------------------------------|-------------------------|
| Specific Gravity, 25°C | 0.99-1.01 |
| TOPEIN® Solids Content, % | 42-48 per type use |
| pH | 6.0-8.0 |
| Odor Intensity | Slight |
| Emulsion Solubility in water | Dilutable |
| Brookfield Viscosity, 25°C,cps | Max. 100 |
| Solubility of Cured TOPEIN® Residue | Not Soluble in DI water |

Recovered TOPEIN®Residue

| | |
|----------------------|---------|
| Acid Value, mg KOH/g | 40-55 |
| Fatty Acid, % | 34-50 |
| Rosin Acid, % | 15-25 |
| Unsaponifiables, % | 30-36 |
| Ash, % | Max 0.5 |

B. TEST REPORTS AND CERTIFICATIONS:

Proof of conformance of materials to the criteria defined shall be provided at the pre-construction conference in the form of test reports and certifications. Test reports and certifications shall be bound together with a cover sheet titled Test Reports and Certifications, name and address of chemical palliative vendor, and chemical palliative type and trade name.

Contractor shall provide a copy of the current Material Safety Data Sheet (MSDS) for the product(s). The MSDS must include all chemical compounds present in concentrations greater than 0.1% for each product.

Failure to provide adequate proof of conformance to the criteria shall be considered grounds for rejection. Contractor shall provide any new or updated written or verbal information regarding product use to the Engineer as it is made available.

Contractor shall provide a certificate of compliance with each lot purchased. The certifications shall state as a minimum that the product complies with the specifications. Hazardous Material Identification System (HMIS) and/or National Fire Protection Association (NFPA) ratings labels shall be exhibited on all containers.

APENDIX III(A)

TOPEIN®C

ROAD REJUVENATOR/RAP BINDER

SPECIFICATIONS

TOPEIN®C shall be a water based dispersion of a homogeneous mixture of tall oil pitch, asphaltene resin and petroleum asphalt. **TOPEIN®C** shall not contain added gas oil, lube oil or lube oil extract. **TOPEIN®C**, when applied properly during normal summer conditions, shall cure and allow controlled traffic without tracking. **TOPEIN®C**, under normal conditions, shall not require sanding. The supplier shall supply with each load of **TOPEIN®C** a Certificate of Compliance certifying that the R/S meets the following specification.

Tests on Concentrated Dispersion:

| <u>Test Description</u> | <u>Test Method</u> | <u>Limits</u> | |
|---|--------------------|---------------|------------|
| | | <u>Min</u> | <u>Max</u> |
| Viscosity at 25 C (77 F), SSF | AASHTO T-59 | 16 | 80 |
| Sieve, % | AASHTO T-59 | | 0.01 |
| 5 Day Settlement, % | AASHTO T-59 | | 5.0 |
| Particle charge | AASHTO T-59 | Positive | |
| pH (used if particle charge test is inconclusive) | AASHTO T-59 | 2.0 | 7.0 |
| Residue, % | AASHTO T-59 | 51 | |

Tests on Recovered Residue:

| | | | |
|---------------------------------|----------------|------|------|
| Viscosity at 135 C (275 F), cSt | ASTM D4402 | 475 | 1500 |
| Flash point, COC, C | AASHTO T-48 | 232 | |
| Solubility in TCE | AASHTO T-44 | 97.5 | |
| Specific Gravity (1- Water) | AASHTO T-228 | 0.98 | |
| Asphaltenes, % | ASTM D2007 mod | 20 | 40 |
| Polar Compounds, % | ASTM D2007 mod | 30 | |
| Aromatics, % | ASTM D2007 mod | 15 | |
| Saturates, % | ASTM D2007 mod | | 10 |

Tests on TOPEIN®C ready to shoot, 1:1 dilute:

| | | | |
|-------------------|-------------|------|--|
| Residue, % (1:1) | AASHTO T-59 | 26 | |
| Pumping Stability | Note 1 | pass | |

Note 1: Pumping stability is tested by pumping 475 ml of dilute emulsion, at 25 C (77 F), through a 1/4 inch gear pump operating at 1750 rpm for 10 minutes without significant coagulation or separation of bitumen and water.

APPENDIX IV

Storage and Handling

TOPEIN® Emulsion should be stored similar to standard bituminous emulsions. Storage tanks should be vertical, and equipped with low temperature heat, less than 100°C (212 F), and with moderate mechanical agitation (horizontal tanks are adequate for short periods of time). Tank recirculation for agitation may also be employed when necessary. Circulation on a regular basis is preferred on all storage tanks holding **TOPEIN® Emulsion**. Positive displacement, low shear gear pumps should be used to pump concentrate or dilute **TOPEIN® Emulsion**. **TOPEIN® Emulsion** should be stored at temperatures of 48°C (120°F) to 71°C (160°F). **TOPEIN® Emulsion** must not be allowed to freeze, and should be kept warm and circulated whenever outside temperatures drop below 4°C (40°F). **TOPEIN® Emulsions** are capable of being easily and rapidly applied at temperatures of 48° C (120°F) to 71°C (160°F), with conventional oil spreading equipment. **TOPEIN® Emulsions** cures ready for traffic in four hours or less. Longer cure times may occur depending on temperature and humidity. **TOPEIN® Emulsions** should only be applied in ambient temperatures 50°F+ and rising, and pavement temperatures of 60°F and rising.

Clean-up

TOPEIN® Emulsion may be removed from equipment with standard petroleum solvents and degreasers. One cleaner that has been found to work very well and is safe to work with is Neugenic 4176 by Rochester Midland Corp (602-264-4868, Phoenix number, but located all over). Hand cleaners should be used to remove **TOPEIN® Emulsion** from skin.

Caution

Keep **TOPEIN® Emulsions** out of the reach of Children. Avoid contact with eyes. Do not take internally. Read the MSDS prior to use.

APPENDIX V

**NATIONAL POLLUTION DISCHARGE ELIMINATION SYSTEM
(NPDES)**

TOPEIN®S Test Results Compared to NPDES Benchmark Values

| <u>Parameter Value</u> | <u>Benchmark Level</u> | <u>Result</u> |
|-------------------------------|-------------------------------|----------------------|
| Biochemical Oxygen Demand | 30 mg/l | 7 mg/l |
| Chemical Oxygen Demand | 120 mg/l | 7 mg/l |
| Total Suspended Solids | 100 mg/l | N.D. |
| Oil and Grease | 15 mg/l | N.D. |
| Nitrate + Nitrate Nitrogen | 0.68 mg/l | <0.05 mg/l |
| Total Phosphorus | 2.0 mg/l | <0.2 mg/l |
| PH | 6.0-9.0 mg/l | 7.73 |
| Acrylonitrile | 7.55 mg/l | N.D. |
| Aluminum | 0.75 mg/l | <0.05 mg/l |
| Ammonia | 19 mg/l | 0.08 mg/l |
| Antimony | 0.636 mg/l | <0.002 mg/l |
| Arsenic | 0.16854 mg/l | <0.002 mg/l |
| Benzene | 0.01 mg/l | N.D. |
| Beryllium | 0.13 mg/l | <0.002 mg/l |
| Butylbenzyl Phthalate | 3 mg/l | N.D. |
| Cadmium | 0.0159 mg/l | <0.002 mg/l |
| Chloride | 860 mg/l | 12 mg/l |
| Copper | 0.0636 mg/l | <0.022 mg/l |
| Dimethyl Phthalate | 1.0 mg/l | N.D. |
| Ethylbenzene | 3.1 mg/l | N.D. |
| Fluoranthene | 0.042 mg/l | N.D. |
| Flouride | 1.8 mg/l | <0.1 mg/l |
| Iron | 1.0 mg/l | <0.05 mg/l |
| Lead | 0.0816 mg/l | <0.05 mg/l |
| Manganese | 1.0 mg/l | 0.33 mg/l |
| Mercury | 10.0024 mg/l | 0.0005 mg/l |
| Nickel | 1.417 mg/l | 0.016 mg/l |
| PCB-1016 | 0.000127 mg/l | N.D. |
| PCB-1221 | 0.10 mg/l | N.D. |
| PCB-1232 | 0.000318 mg/l | N.D. |
| PCB-1242 | 0.00020 mg/l | N.D. |
| PCB1248 | 0.002544 mg/l | N.D. |
| PCB1254 | 0.10 mg/l | N.D. |
| PCB-1260 | 0.000477 mg/l | N.D. |
| Phenols | 1.0 mg/l | N.D. |
| Pyrene | 0.01 mg/l | N.D. |
| Selenium | 0.2385 mg/l | <0.002 mg/l |
| Silver | 0.0318 mg/l | <0.002 mg/l |
| Toluene | 10.0 mg/l | N.D. |
| Trichloroethylene | 0.0027 mg/l | N.D. |
| Zinc | 0.065 mg/l | <0.01 mg/l |

N.D.= Not detected

APPENDIX VI

**Hazardous Waste Aquatic Toxicity Screening Test Results for
One Soil Sample (verbal)**

Prepared For:
Michael P. Doyle
Paramount Petroleum Bakersfield
P.O. Box 5655
Bakersfield, CA 93388

BES Sample #16584

Prepared By:
Block Environmental Services, Inc.
2451 Estand Way
Pleasant Hill, CA 94523-3911
(925) 682-7200

December 15, 1998

Carol Promessi
Analyst

Josh Gravenmier
Laboratory Manager

1. INTRODUCTION

The California Department of Substances Control has adopted regulations (R-45-78) which define criteria for the identification of hazardous wastes. These criteria are codified in Chapter 11, Article 3 of Title 22 of the California Code of Regulations. Toxicity to aquatic life, specifically fish, is one of the criteria used to gauge the hazardous potential of a waste. An acute 96-hour bioassay is used to determine the LC50 as defined in Section 66261.24(a)(6) of these regulations. This 96-hour LC50 value serves as the numerical indicator of the toxicity of a waste to aquatic life. The sample is deemed hazardous if the LC50 is less than 500 mg/L.

This report describes the procedures used and the results obtained for the hazardous waste aquatic toxicity screening test(s) performed by Block Environmental Services (BES) for Paramount Petroleum Bakersfield (verbal).

BES is an Environmental Laboratory Accreditation Program certified laboratory (#1812).

2. MATERIALS AND METHODS

2.1 TEST ORGANISMS

- Fathead Minnow, *Pimephales promelas*, obtained from a commercial supplier.

2.2 TEST PROCEDURES

A detailed procedure for this test is outlined in laboratory standard operating procedures (SOPs) kept at the BES laboratory. These SOPs are based upon the following references:

- California's Title 22 Code, Section #66261.24(a)(6); *Static Acute Bioassay Procedures for Hazardous Waste Samples*, Polisini and Miller, 1988, California Department of Fish and Game
- *Guidelines for Performing Static Acute Toxicity Fish Bioassays in Municipal and Industrial Wastewaters*, Kopperdahl, 1976, California Department of Fish and Game
- *Standard Methods for the Examination of Water and Wastewater*, 19th Edition, American Public Health Association, 1995.

2.3 DATA ANALYSIS

All toxicity testing results will be analyzed using an appropriate statistical method to determine a LC50 and the corresponding 95% confidence limits.

3. RESULTS

| 3.1 Sample Identification | 3.2 BES Sample # | 3.3 Sample Collection Date | 3.4 Date Received | 3.5 Testing Period |
|---------------------------|------------------|----------------------------|-------------------|---------------------|
| TOPEIN®S Treated Soil | 16584 | NA | 11/2/98 | 11/11/98 - 11/15/98 |

3.6 *P. promelas* TEST RESULTS

| Test Concentration | Sample 96 Hour Percent Survival |
|--------------------|---------------------------------|
| | 16584 |
| Control | 100 |
| 250 mg/L | 100 |
| 500 mg/L | 100 |
| 750 mg/L | 100 |

3.7 STATISTICAL ANALYSIS

| Statistical Endpoint | Sample 96 Hour Statistics |
|----------------------------|---------------------------|
| | 16584 |
| LC50 (mg/L) | >750 |
| 95% Upper Confidence Limit | NA |
| 95% Lower Confidence Limit | NA |

NA = Not Available

3.8 NOTES

The photocopied data sheet(s) and chain-of-custody for testing are attached. If you have any questions concerning this report please contact the BES laboratory, (925) 682 - 7200.

APPENDIX VII

**Evaluation Results from the
Soil Erosion Research Laboratory
San Diego State University**

**For Alon Asphalt Bakersfield's
TOPEIN®S Product**

Prepared For

*Alon Asphalt Bakersfield
Bakersfield, CA
Tel: 661-392-3630*

SDSU/SERL Technical Report No. 02-2006

September 1, 2006

The San Diego State University, Soil Erosion Research Laboratory evaluated the TOPEIN®S erosion control protection product supplied by Alon Asphalt Bakersfield. Four experiments were performed for the No Treatment, NT, case, and three experiments were performed for the TOPEIN®S, TS, product. Tables 1-5 and Figures 3-13 summarize the results from the experiments. Appendix A contains photographs that illustrate the No Treatment and product treatment results on SERL's tilting erosion bed. The no treatment experiments resulted in a mean peak runoff rate of 13 lpm ranging from 11 to 17 lpm; mean runoff volume was 535 liters ranging from 390 to 780 liters; mean peak sediment concentration was 385,000 mg/l ranging from 337,000 to 437,000 mg/l; and mean sediment export was 172 kg ranging from 120 to 310. The TOPEIN®S treatment experiments resulted in a mean peak runoff rate of 15 lpm ranging from 12 to 17 for the 50 and 100% application rates, respectively; mean total runoff volume was 770 liters, ranging from 650 to 850 liters for the 50 and 100% application rates; mean peak sediment concentration was 87,000 mg/l, ranging from 198,000 down to 2,000 for the 50 and 100% application rates; and mean sediment export was 30 kg, ranging from 80 down to <1 kg for the 50 and 100% application rates.

Given the inherent variability of large scale rainfall-runoff-erosion experiments, the comparison of no treatment and treatment results is performed by assessing the initial soil conditions (eg., bulk density, moisture) and paring the individual no treatment-treatment cases based on similarity. The initial soil conditions of all experiments were classified into three categories: dry, average and wet, based primarily on moisture. No Treatment, NT, run 1 was classified as dry (i.e., initial experiment, ~ 11% soil moisture by volume); NT runs 2 and 3 were average (~15 and 18%, respectively); and NT run 4 was wet (~20%). TOPEIN®S, TS, run 1 was classified as average (~19%), and TS runs 2 and 3 were wet (~21 and 20%, respectively). These classifications are also consistent with the sequence of experiments. When experiments are performed back-to-back with only a few days between runs, soil moisture tends to increase. A second factor that supports this assessment is that the TOPEIN®S product provided additional moisture to the soil during application. The measured moisture content was done prior to the application of the product. Thus, the TOPEIN®S treatment experiments tended have higher moisture contents relative to the no treatment experiments. Table 3 summarizes the categorizing

of initial experimental conditions and the paring of no treatment-treatment experiments for performance assessment.

The TOPEIN®S product increased total runoff volume by approximately 130, 20, and 70 liters (25, 3, and 9 %) for 50, 75, and 100% application rates, and decreased total sediment export by approximately 60, 300, and 310 kg (44, 96 and 99 %) for 50, 75, and 100% application rates as compared to no treatment simulations. While only one experiment was performed at each application rate, the consistent, logical trend in product performance and treatment effectiveness supports the overall findings. The product achieved 96% treatment efficiency at the 75% application rate and 99.9% at the 100% application rate. However, it is recommended that the existing 100% application rate remain unchanged. The laboratory setting provided "ideal" application conditions on a relatively flat soil surface, and the erosion bed was raised after product application. The variability of field conditions will likely reduce these reported performance values.

Table 3: Selected No Treatment (NT) – Treatment (TS) experiment pairings for determining product performance.

| Comparison Experiments | Runoff (liters) | Sediment (kg) | Peak Runoff (lpm) | Peak Sediment Conc. (mg/l) | Initial Soil Moisture (%) |
|------------------------|-----------------|---------------|-------------------|----------------------------|---------------------------|
| NT-3 | 520 | 140 | 11.4 | 368,000 | 17 |
| TS-1 | 650 | 79 | 12.3 | 198,000 | 18 |
| NT-4 | 780 | 309 | 16.9 | 437,000 | 20 |
| TS-2 | 803 | 12.2 | 16.2 | 59,000 | 21 |
| NT-4 | 780 | 309 | 16.9 | 437,000 | 20 |
| TS-3 | 848 | 0.4 | 16.5 | 2,000 | 20 |

Table 4: Absolute change in total runoff volume, sediment export, peak runoff rate, and peak sediment concentration for TOPEIN®S (TS) product experiments, where change values are determined by subtracting the NT result from TS result for the Table 3 pairings (positive values indicate that the product resulted in an increase; negative values indicate that the product resulted in a decrease).

| TOPEIN®S Experiments | Δ Runoff (liters) | Δ Sediment (kg) | Δ Peak Runoff (lpm) | Δ Peak Sediment Conc. (mg/l) |
|----------------------|--------------------------|------------------------|----------------------------|-------------------------------------|
| TS-1 | 130 | -61 | 1.0 | -170,000 |
| TS-2 | 23 | -297 | -0.6 | -378,000 |
| TS-3 | 68 | -309 | -0.4 | -435,000 |

Table 5: Percent change in total runoff volume, sediment export, peak runoff rate, and peak sediment concentration for TOPEIN®S (TS) product experiments, where percent change are determined by subtracting the NT result from TS result for the Table 3 pairings and dividing by the NT result (positive values indicate that the product resulted in an increase; negative values indicate that the product resulted in a decrease).

| TOPEIN®S Experiments | Δ Runoff (%) | Δ Sediment (%) | Δ Peak Runoff (%) | Δ Peak Sediment Conc. (%) |
|----------------------|---------------------|-----------------------|--------------------------|----------------------------------|
| TS-1 | 25.1 | -43.8 | 8.5 | -46.2 |
| TS-2 | 3.0 | -96.0 | -3.8 | -86.5 |
| TS-3 | 8.8 | -99.9 | -2.2 | -99.5 |

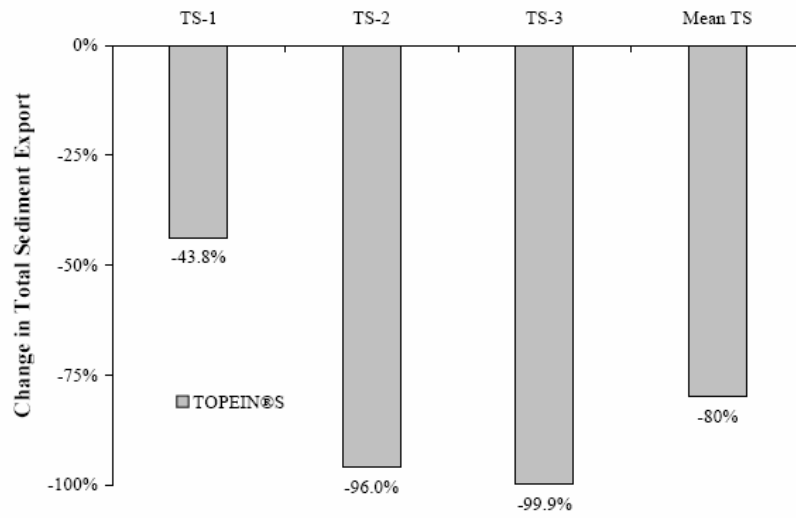


Figure 13: Reduction in total sediment export using the TOPEIN®S product; negative values indicate that the TOPEIN®S product decreased sediment export.