



Permit / Application Information Sheet
Division of Environmental Protection
West Virginia Office of Air Quality

Company:	Integrity Delaware, LLC	Facility:	Bens Run
Region:	2	Plant ID:	095-00025
Engineer:	Kessler, Joe	Application #:	13-3038A
Physical Address:	Industrial Park Road Ben's Run WV 26146	Category:	
County:	Tyler	SIC: [3952] MISCELLANEOUS MANUFACTURING INDUSTRIES - LEAD PENCILS AND ART GOODS NAICS: [325998] All Other Miscellaneous Chemical Product and Preparation Manufacturing	
Other Parties:	PRES - Duncan, Max 361-813-1433 PLT_MGR - Aukerman, Brett 440-347-8462		

Information Needed for Database and AIRS
1. Need valid physical West Virginia address with zip

Regulated Pollutants	
PM10 Particulate Matter < 10 um	4.540 TPY
VOC Volatile Organic Compounds (Reactive organic gases)	0.150 TPY
PM2.5 Particulate Matter < 2.5 um	-0.210 TPY
PT Total Particulate Matter	-4.490 TPY

Summary from this Permit 13-3038A		
Air Programs	Applicable Regulations	
SIP		
Fee Program	Fee	Application Type
9M	\$1,000.00	MODIFICATION

Notes from Database
 Permit Note: Modification of the existing synthetic mud mixing facility (purchased from Steve Simpson & Associates, Inc. and which has been dismantled) to a similar process with new equipment.

Activity Dates	
APPLICATION RECEIVED	11/18/2015
ASSIGNED DATE	11/19/2015
APPLICATION FEE PAID	11/20/2015
APPLICANT PUBLISHED LEGAL AD	11/25/2015
APPLICATION DEEMED COMPLETE	12/17/2015

~~SANITIZED~~
 NOTICE

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Please note, this information sheet is not a substitute for file research and is limited to data entered into the AIRTRAX database.

Company ID: 095-00025
 Company: Integrity Delaware, LLC
 Printed: 02/04/2016
 Engineer: Kessler, Joe

IPR FILE INDEX

Applicant : Integrity Delaware, LLC
Facility : Integrity-Friendly WV Site

Plant ID No.: 095-00025
R13-3038A

Chronological Order - Add Index Pages As Necessary

Date	To	From	Subject	# of pages
11/18/15	WVDEP	ID	Permit Application Submission	
11/19/15	ID	Jennifer Rice	48-Hour Letter	
12/01/15	Joe Kessler	ID	Affidavit of Publication	
12/17/15	ID	Joe Kessler	Completeness Determination	
	File	Joe Kessler	Chemical/Material Supplemental Information	
2/05/16	File	Joe Kessler	DAQ/ID E-mails (w/ revised Attachment N and new MSDS)	
2/08/16	File	Joe Kessler	Draft Permit R13-3038A, Tracking Manifest	
2/09/16	Various	Sandie Adkins	Public Notice Documents	

JRK
2/08/16

AIR QUALITY PERMIT NOTICE

Notice of Intent to Approve

On November 18, 2015, Integrity Delaware, LLC applied to the WV Department of Environmental Protection, Division of Air Quality (DAQ) for a permit to modify a synthetic mud mixing facility located at 162 Industrial Park Road, Friendly, Tyler County, WV at latitude 39.4739 and longitude -81.0981. A preliminary evaluation has determined that all State and Federal air quality requirements will be met by the proposed facility. The DAQ is providing notice to the public of its preliminary determination to issue the permit as R13-3038A.

The following changes in potential emissions will be authorized by this permit action: Particulate Matter less than 2.5 microns, -0.21 tons per year (TPY); Particulate Matter less than 10 microns, -1.76 TPY; Particulate Matter, -4.49 TPY; Volatile Organic Compounds, 0.16 TPY.

Written comments or requests for a public meeting must be received by the DAQ before 5:00 p.m. on **XXXXXX**. A public meeting may be held if the Director of the DAQ determines that significant public interest has been expressed, in writing, or when the Director deems it appropriate.

The purpose of the DAQ's permitting process is to make a preliminary determination if the proposed will meet all State and Federal air quality requirements. The purpose of the public review process is to accept public comments on air quality issues relevant to this determination. Only written comments received at the address noted below within the specified time frame, or comments presented orally at a scheduled public meeting, will be considered prior to final action on the permit. All such comments will become part of the public record.

Joe Kessler, PE
WV Department of Environmental Protection
Division of Air Quality
601 57th Street, SE
Charleston, WV 25304
Telephone: 304/926-0499, ext. 1219
FAX: 304/926-0478

Entire Document
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Additional information, including copies of the draft permit, application and all other supporting materials relevant to the permit decision may be obtained by contacting the engineer listed above. The draft permit and engineering evaluation can be downloaded at:

www.dep.wv.gov/daq/Pages/NSRPermitsforReview.aspx

Kessler, Joseph R

From: Adkins, Sandra K
Sent: Tuesday, February 09, 2016 10:31 AM
To: 'wentworth.paul@epa.gov'; 'bradley.megan@epa.gov'; baukerman@integrityindustries.com; peward@potesta.com
Cc: Durham, William F; McKeone, Beverly D; McCumbers, Carrie; Hammonds, Stephanie E; Rice, Jennifer L; Kessler, Joseph R; Taylor, Danielle R
Subject: WV Draft Permit R13-3038A for Integrity Delaware, LLC; Friendly
Attachments: 3038A.pdf; Eval3038A.pdf; notice.pdf

Please find attached the Draft Permit R13-3038A, Engineering Evaluation, and Public Notice for Integrity Delaware, LLC's Integrity-Friendly WV Site located in Tyler County.

The notice will be published in the *Tyler Star News* on Wednesday, February 17, 2016, and the thirty day public comment period will end on Friday, March 18, 2016.

Should you have any questions or comments, please contact the permit writer, Joe Kessler, at 304 926-0499 x1219.

Kessler, Joseph R

From: Adkins, Sandra K
Sent: Tuesday, February 09, 2016 10:31 AM
To: Wheeler, Cathy L
Cc: Kessler, Joseph R
Subject: DAQ Public Notice

Please see below the Public Notice for Draft Permit R13-3038A for Integrity Delaware, LLC's Integrity-Friendly WV Site located in Tyler County.

The notice will be published in *The Tyler Star News* on Wednesday, February 17, 2016, and the thirty day public comment period will end on Friday, March 18, 2016.

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Additional information, including copies of the draft permit, application and all other supporting materials relevant to the permit decision may be obtained by contacting the engineer listed above. The draft permit and engineering evaluation can be downloaded at:



west virginia department of environmental protection

Division of Air Quality
601 57th Street, SE
Charleston, WV 25304
Phone: (304) 926-0475 • Fax: (304) 926-0479

Earl Ray Tomblin, Governor
Randy C. Huffman, Cabinet Secretary
www.dep.wv.gov

ENGINEERING EVALUATION / FACT SHEET

BACKGROUND INFORMATION

Application No.:	R13-3038A
Plant ID No.:	095-00025
Applicant:	Integrity Delaware, LLC
Facility Name:	Integrity-Friendly WV Site
Location:	Friendly, Tyler County
SIC/NAICS Code:	3952/325998
Application Type:	Modification
Received Date:	November 18, 2015
Engineer Assigned:	Joe Kessler
Fee Amount:	\$1,000
Date Received:	November 19, 2015
Complete Date:	December 17, 2015
Due Date:	March 16, 2016
Applicant's Ad Date:	November 25, 2015
Newspaper:	<i>Tyler Star News</i>
UTM's:	Easting: 491.561 km Northing: 4,369.371 km Zone: 17
Latitude/Longitude:	39.4739/-81.0981
Description:	Modification of the existing synthetic mud mixing facility (purchased from Steve Simpson & Associates, Inc. and which has been dismantled) to a similar process with new equipment.

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On April 15, 2013 Permit Number R13-3038 was issued to Steve Simpson & Associates, Inc. (SSA) for the construction of a synthetic mud mixing facility. Since that time, Integrity Delaware, LLC (Integrity) has leased the site from SSA, transferred the permit into their name, and removed the existing equipment. They are now proposing to install a new permanent mud mixing facility using a process similar to the previous SSA process.

DESCRIPTION OF PROCESS

Integrity is proposing to construct a new permanent 500,000 gallons/year mud mixing facility in place of the previous SSA facility. The facility will operate similar to, but not identical to, the SSA process. The most significant difference is the use of petroleum (diesel and other oils) as the

primary constituency of the produced synthetic drilling mud. Synthetic drilling mud is used in the process of natural gas drilling to protect and isolate wells from water penetration and decay.

Liquid additives (brine water and base oils) are delivered to the site by tank truck and delivery truck for other additives (which include dry bagged products and liquids in totes, drums, or pails). Delivered diesel and synthetic base oil are stored in 21,000 gallon vertical storage tanks (TK17-19 and TK28-30). Integrity is proposing to make two mud mixtures: (1) synthetic oil based mud and (2) diesel based mud (each has a specific use in the industry). The difference between the two mud types is the base oil used in the mix (either diesel or a proprietary petroleum based liquid base). The remaining ingredients are the same but the amount of the ingredients used may differ depending on the specific order. The other ingredients are calcium chloride (liquid and powder), various Bentone products, water, barite, gel, lime, and various other products. MSDS/SDS sheets are provided in Attachment H of the permit application for these chemicals.

The pulling of the liquid materials into the plant, batch mixing, and pumping off into storage tanks is accomplished using centrifugal pumps with a pump rate of approximately 2,000 gallons per minute (gpm). This pumping rate allows for proper mixing of the materials. Barite (a dry additive) is unloaded from trucks pneumatically (approximately at 50 TPH) to silos and also blown pneumatically to the mixers. When the 100 ton barite silos (BRS1 and BRS2) are being filled (TP2A and TP2B), they vent to the mixers which have dust socks (passive dust filters) on them for control of particulate. Also, when barite is blown to the mixers (TP3A and TP3B), the transfer is also controlled by the same dust socks.

Smaller quantity dry materials (other than barite) are fed manually through a hopper from bags. The circulating material in the mixer pulls the material into the fluid. This is a batch process and when an order is received, the mud is mixed in two 14,700 gallon mixing tanks (MT1 and MT2) and stored in the hold tanks (TK1-16 and TK22-27). Trucks will then be loaded with the material by the 2,000 gpm pumps (TRUCK) and product removed from the site. Some mud may be returned and loaded back into the product storage tanks. The overall mud production is anticipated to be a maximum of 500,000 gallons per year.

SITE INSPECTION

On February 27, 2013 the writer conducted an inspection of the (at that time) proposed location of the SSA facility. At the time of the inspection, site preparation activities were underway that included making repairs to an existing building on the site and setting up of an office trailer. Other observations from that inspection included:

- The state of WV was preparing to create a new access road to the proposed facility off of WV State Route 2;
- The facility was located in the Bens Run Industrial Park adjacent to an existing Aleris recycling facility; and
- The location was in an industrial location with no occupied residences visible from the site. The nearest occupied residences was located approximately 0.65 miles south of the facility in Bens Run.

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Due to the nature of the proposed modification, an additional site inspection by the writer was deemed as not necessary. On September 18, 2014, a site inspection of the SSA facility was conducted by Mr. James Robertson of the DAQ Compliance/Enforcement (C/E) Section. This inspection found the facility be "Status 41 - Not in Operation."

AIR EMISSIONS AND CALCULATION METHODOLOGIES

Material Handling and Unpaved Roads

Particulate matter emissions from material handling and unpaved haulroads were based on the following AP-42 Sections:

Table 1: Sources of Emission Factors for Particulate Matter

Emission Source	Emission Factor(s)	Emission Factor Source	Comments
Manual Dry Additive Loading	0.2431 lb-PM/ton-additive, 0.1150 lb-PM ₁₀ /ton-additive, 0.0174 lb- PM _{2.5} /ton-additive	AP-42 Section 13.2.4. (11/06)	(TP1) Uncontrolled. Maximum hourly/annual throughput based expected maximum usage rates.
Pneumatic Barite Transfer	0.73 lb-PM/ton-additive, 0.73 lb-PM ₁₀ /ton-additive, 0.73 lb- PM _{2.5} /ton-additive	AP-42 Section 11.12. (6/06)	(TP2A, TP2B, TP3A, TP3B) Uncontrolled. Based on loading of dry cement, but appropriate for barite.
Unpaved Haulroads	7.88 lb-PM/VMT, 2.33 lb-PM ₁₀ /VMT, 0.23 lb- PM _{2.5} /VMT	AP-42 Section 13.2.2 (11/06)	Uncontrolled. Based on mean vehicle weights (40 tons), percent silt in road surface (10%), and number of precipitation days (157).

As noted above, the pneumatic transfer of barite into the silos and the mixers will be controlled by a passive dust filter on the mixers. Integrity has used a minimum filter capture efficiency of 95% in the calculations.

Storage Tanks and Truck Loading

While any VOC emissions from the diesel, synthetic base oil, and product storage tanks are expected to be very small based on the vapor pressures of the materials, Integrity calculated potential uncontrolled working/breathing emissions from these storage tanks using the TANKS 4.09d program as provided under AP-42, Section 7. Diesel (as the material with the highest vapor pressure) was used as a surrogate for all other liquids in the storage tanks. Only one TANKS model was run for a 21,000 gallon tank and emissions from other tanks were scaled down using a ration based on tank size. Uncontrolled emissions from truck loading was also calculated using results from the TANKS 4.09d program.

Emissions Summary

The new post-modification (dismantling of the old SSA equipment and installation of the new Integrity equipment) potential-to-emit (PTE) of the proposed facility is given in the following table:

Table 2: Facility-Wide PTE

Source	PM _{2.5}		PM ₁₀		PM		VOCs	
	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY
Material Handling	3.70	0.04	3.95	0.07	4.27	0.10	0.00	0.00
Haulroads	0.68	0.45	6.77	4.47	22.94	15.14	0.00	0.00
Storage/Mixing Tanks	0.00	0.00	0.00	0.00	0.00	0.00	8.37	0.12
Truck Loadout	0.00	0.00	0.00	0.00	0.00	0.00	0.84	0.04
Totals →	4.38	0.49	10.72	4.54	27.21	15.24	9.21	0.16

The change in PTE from the previous (SSA) facility is given in the following table:

Table 3: Change In Facility-Wide Annual PTE

Pollutant	R13-3038 ⁽¹⁾		R13-3038A		Change	
	lbs/hour	tons/year	lbs/hour	tons/year	lbs/hour	tons/year
PM _{2.5}	0.53	0.70	4.38	0.49	3.85	-0.21
PM ₁₀	5.17	6.30	10.72	4.54	5.55	-1.76
PM	17.16	19.73	27.21	15.24	10.05	-4.49
VOCs	0.00	0.00	9.21	0.16	9.21	0.16

(1) Emissions taken from R13-3038 Fact Sheet.

REGULATORY APPLICABILITY

The proposed Integrity facility is subject to the following substantive state air quality rules and regulations: 45CSR7 and 45CSR13. Each applicable rule (and those that have questionable non-applicability), and SSA's compliance therewith, will be discussed in detail below.

45CSR7: To Prevent and Control Particulate Air Pollution from Manufacturing Process Operations

45CSR7 has three substantive requirements potentially applicable to the particulate matter-generating operations at the modified synthetic mud mixing facility. These are the opacity requirements under Section 3, the mass emission standards under Section 4, and the fugitive emission standards under Section 5. Each of these sections will be discussed below.

45CSR7 Opacity Standards - Section 3

Section 3.1 sets an opacity limit of 20% on the dry additive transfer points. The manual dry additive transfer points shall take place at a hopper and be required to be done in such a manner so as to minimize any fugitive escape of particulate matter. The pneumatic transfer of dry material will be controlled by dust filters. This should mitigate any substantive opacity problems from these sources.

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Integrity Delaware, LLC
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45CSR7 Weight Emission Standards - Section 4

Section 4.1 of 45CSR7 requires that each manufacturing process source operation or duplicate source operation meet a particulate matter limit based on the weight of material processed through the source operation. The mixing operations are defined as a type 'a' source type operation under §45-7-2.38. Section 4.1 compliance is given in the following table:

Table 4: 45CSR7 Section 4.1 Compliance

Source Operation	Source Type	Process Weight Rate (lb/hr)	Table 45-7A Limit (lb/hr)	PTE (lb/hr)	% of Limit	Control Device
TP1	A	5,000	5.00	0.61	12.2%	None
TP2A/3A ⁽¹⁾	A	100,000	33.00	1.83	5.5	Dust Filter
TP2B/3B ⁽²⁾	A	100,000	33.00	1.83	5.5	Dust Filter

(1) Both sources emitted from dust filter 1E. PTE represents aggregate emissions from both transfer points.

(2) Both sources emitted from dust filter 2E. PTE represents aggregate emissions from both transfer points.

45CSR7 Fugitive Emissions - Section 5

Sections 5.1 and 5.2 of Rule 7 states that each manufacturing process or storage structure must include a system to minimize the emissions of fugitive particulate matter. The potential fugitive particulate emissions from the facility are the storage and use of the dry additives and the haulroads/plant mobile work areas. The draft permit requires the following under 4.1.3. and 4.1.4.:

4.1.3. Fugitive escape of particulate matter from use of dry additives shall be mitigated by the following:

- a. Air displaced from silos BRS1 and BRS2 during pneumatic loading shall be controlled by venting exhausting the air through the diesel/mud mixers so as to be controlled by baghouses on those units;
- b. Good operating practices shall be implemented for all manual addition of bagged or otherwise open dry additive to the mixers so as to minimize any fugitive escape of particulate matter. Good operating practices shall include the use of a hopper of reasonable depth or a suitable enclosure around the hopper to minimize the blowing of dry additive;
- c. The building and plant grounds shall be regularly cleaned of any spilled dry additives; and
- d. Dry additives delivered to the facility in bags or other containers shall, where reasonable, remain unopened until they are used in the mixing process.

4.1.5. The permittee shall maintain all paved and unpaved areas on plant grounds in good condition, including shoulder areas, where truck traffic or forklift activity may occur.

These methods of control are determined to be sufficient to meet Section 5 of 45CSR7.

45CSR13: Permits for Construction, Modification, Relocation and Operation of Stationary Sources of Air Pollutants, Notification Requirements, Administrative Updates, Temporary Permits, General Permits, and Procedures for Evaluation

The proposed modification of the old SSA Ben's Run facility has the potential to increase a regulated pollutant (see Table 2 above). However, no regulated pollutant is increased is in excess of six (6) lbs/hour and ten (10) TPY or 144 lbs/day and, therefore, the proposed changes would normally be eligible to be reviewed as a Class II Administrative Update. However, Integrity voluntarily submitted the application as a modification and it was reviewed as such. Pursuant to §45-13-5.1, "[n]o person shall cause, suffer, allow or permit the construction, modification, relocation and operation of any stationary source to be commenced without . . . obtaining a permit to construct." Therefore, Integrity is required to obtain a permit under 45CSR13 for the modification of the old SSA Ben's Run facility.

As required under §45-13-8.3 ("Notice Level A"), SSA placed a Class I legal advertisement in a "newspaper of general circulation in the area where the source is . . . located." The ad ran on November 25, 2015 in the *Tyler Star News* and the affidavit of publication for this legal advertisement was submitted on December 1, 2015.

45CSR30: Requirements for Operating Permits - (NON APPLICABILITY)

45CSR30 provides for the establishment of a comprehensive air quality permitting system consistent with the requirements of Title V of the Clean Air Act. The modified Integrity-Friendly WV Site does not meet the definition of a "major source under §112 of the Clean Air Act" as outlined under §45-30-2.26 and clarified (fugitive policy) under 45CSR30b. The modified facility-wide PTE of any regulated pollutant does not exceed 100 TPY, 10 TPY of any individual HAP, or 25 TPY of aggregate HAPs. Further, no equipment or processes at the proposed facility are subject to a federal standard under 40 CFR 60, 61, or 63. Therefore, Title V will not apply to the modified facility.

40 CFR60, Subpart Kb: Standards of Performance for Volatile Organic Liquid Storage Vessels (Including Petroleum Liquid Storage Vessels) for Which Construction, Reconstruction, or Modification Commenced After July 23, 1984

Subpart Kb of 40 CFR 60 is the New Source Performance Standard (NSPS) for storage tanks containing Volatile Organic Liquids (VOLs) which construction commenced after July 23, 1984. The Subpart applies to storage vessels used to store volatile organic liquids with a capacity greater than or equal to 75 m³ (19,813 gallons). However, storage tanks with a capacity greater than or equal to 151 m³ (39,890 gallons) storing a liquid with a maximum true vapor pressure less than 3.5 kilopascals (kPa) or with a capacity greater than or equal to 75 m³ but less than 151 m³ storing a liquid with a maximum true vapor pressure less than 15.0 kPa are exempt from Subpart Kb.

The diesel, synthetic base, and product storage tanks are 21,000 gallons, which are larger than the minimum applicability threshold under Subpart Kb. However, as each material has a true vapor pressure less than 15.0 kPa (the highest is diesel at a maximum of ~1.33 kPa @ 100°F), each of these tanks are, as noted above, exempt from the requirements of Subpart Kb.

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TOXICITY OF NON-CRITERIA REGULATED POLLUTANTS

This section provides an analysis for those regulated pollutants that may be emitted from the modified Monroe Compressor Station and that are not classified as "criteria pollutants." Criteria pollutants are defined as Carbon Monoxide (CO), Lead (Pb), Oxides of Nitrogen (NO_x), Ozone, Particulate Matter (PM), Particulate Matter less than 10 microns (PM₁₀), Particulate Matter less than 2.5 microns (PM_{2.5}), and Sulfur Dioxide (SO₂). These pollutants have National Ambient Air Quality Standards (NAAQS) set for each that are designed to protect the public health and welfare. Other pollutants of concern, although designated as non-criteria and without national concentration standards, are regulated through various federal and programs designed to limit their emissions and public exposure. These programs include federal source-specific Hazardous Air Pollutants (HAPs) limits promulgated under 40 CFR 61 (NESHAPS) and 40 CFR 63 (MACT). Any potential applicability to these programs for the modified sources were discussed above under REGULATORY APPLICABILITY.

Integrity did not identify any potential emissions of HAPs from the modified facility. However, diesel and other petroleum-based additives that are used in the process do contain small amounts of HAPs (ethylbenzene, xylene, naphthalene). However, based on the expected small emissions from the use of these liquids (based on the relatively low vapor pressures), no substantive amount of HAP emissions are expected from the facility.

In searching the MSDS, several other chemicals were noted as constituents of materials used at the modified facility: 2-Butoxyethanol (111-76-2) and 2-Ethylhexanol (104-76-7). Both were determined not to be HAPs and are otherwise unregulated (as air pollutants) in West Virginia. However, a search of the Integrated Risk Information System (IRIS) indicated that 2-Butoxyethanol was not likely to be carcinogenic to humans. No information on the IRIS database could be found for 2-Ethylhexanol. It is noted that emission rates of both chemicals are expected to be insignificant due to the low emission rates of the materials in question.

AIR QUALITY IMPACT ANALYSIS

The estimated maximum emissions of the modified facility are less than applicability thresholds that would define the proposed facility as "major" under 45CSR14 and, therefore, no air quality impacts modeling analysis was required. Additionally, based on the nature and location of the modified source, an air quality impacts modeling analysis was not required under 45CSR13, Section 7.

MONITORING, COMPLIANCE DEMONSTRATIONS, REPORTING, AND RECORDING OF OPERATIONS

The following substantive monitoring, compliance demonstration, and record-keeping requirements (MRR) shall be required:

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- For the purposes of demonstrating continuous compliance with the material usage and production limitations set forth in 4.1.2. of the draft permit, the permittee shall be required to monitor and record the monthly and rolling twelve month usage of dry additive used in all mixing operations and the amount of mud produced at the facility.

PERFORMANCE TESTING OF OPERATIONS

The following substantive performance testing requirements shall be required:

- At such reasonable time(s) as the Secretary may designate, in accordance with the provisions of 3.3 of the draft permit, SSA shall be required to conduct or have conducted test(s) to determine compliance with the emission limitations established in this permit and/or applicable regulations.

RECOMMENDATION TO DIRECTOR

The information provided in the permit application indicates that compliance with all applicable state and federal air quality regulations will be achieved. Therefore, I recommend to the Director the issuance of a Permit Number R13-3038A to Integrity Delaware, LLC for the proposed modification of the Integrity-Friendly WV Site located near Friendly, Tyler County, WV.



Joe Kessler, PE
Engineer

2/04/16

Date

R13-3038A
Integrity Delaware, LLC
Integrity-Friendly WV Site

West Virginia Department of Environmental Protection

Division of Air Quality

*Earl Ray Tomblin
Governor*

*Randy C. Huffman
Cabinet Secretary*

Permit to Modify



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R13-3038A

This permit is issued in accordance with the West Virginia Air Pollution Control Act (West Virginia Code §§ 22-5-1 et seq.) and 45 C.S.R. 13 — Permits for Construction, Modification, Relocation and Operation of Stationary Sources of Air Pollutants, Notification Requirements, Temporary Permits, General Permits and Procedures for Evaluation. The permittee identified at the facility listed below is authorized to construct the stationary sources of air pollutants identified herein in accordance with all terms and conditions of this permit.

Issued to:

**Integrity Delaware, LLC
Integrity-Friendly WV Site
095-00025**

DRAFT

*William F. Durham
Director*

Issued: **DRAFT**

This permit supercedes and replaces R13-3038 issued on April 15, 2013.

Facility Location: 162 Industrial Park Road, Friendly, Tyler County, West Virginia
Mailing Address: 2000 W. Sam Houston Parkway S., Suite 400, Houston, TX 77042
Facility Description: Drilling Mud Mixing Operation
SIC/NAICS Code: 3952/325998
UTM Coordinates: 491.561 km Easting • 4,369.371 km Northing • Zone 17
Latitude/Longitude: 39.4739/-81.0981
Permit Type: Modification
Description: Modification of the existing synthetic mud mixing facility (purchased from Steve Simpson & Associates, Inc. and which has been dismantled) to a similar process with new equipment.

Any person whose interest may be affected, including, but not necessarily limited to, the applicant and any person who participated in the public comment process, by a permit issued, modified or denied by the Secretary may appeal such action of the Secretary to the Air Quality Board pursuant to article one [§§ 22B-1-1 et seq.], Chapter 22B of the Code of West Virginia. West Virginia Code §22-5-14.

The source is not subject to 45CSR30.

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1.0 Emission Units

Emission Unit ID	Emission Point ID	Emission Unit Description	Year Installed	Design Capacity	Control Device
MT1	1E	Synthetic Mud Mixer	2016	14,700 gal	Baghouse
MT2	2E	Diesel Mud Mixer	2016	14,700 gal	Baghouse
TK1-16	TK1-16	Synthetic Mud Vertical Storage Tanks	2016	21,000 gal	None
TK17-19	TK17-19	Synthetic Oil Vertical Storage Tanks	2016	21,000 gal	None
BRS1	1E	Barite Silo No. 1	2016	100 tons	Baghouse
BRS2	2E	Barite Silo No. 2	2016	100 tons	Baghouse
TK22-27	TK22-27	Diesel Mud Vertical Hold Tanks	2016	21,000 gal	None
TK28-30	TK28-30	Diesel Storage Tanks	2016	21,000 gal	None
Truck	Truck	Truck Loading	2016	200 gal/min	None

2.0. General Conditions

2.1. Definitions

- 2.1.1. All references to the "West Virginia Air Pollution Control Act" or the "Air Pollution Control Act" mean those provisions contained in W.Va. Code §§ 22-5-1 to 22-5-18.
- 2.1.2. The "Clean Air Act" means those provisions contained in 42 U.S.C. §§ 7401 to 7671q, and regulations promulgated thereunder.
- 2.1.3. "Secretary" means the Secretary of the Department of Environmental Protection or such other person to whom the Secretary has delegated authority or duties pursuant to W.Va. Code §§ 22-1-6 or 22-1-8 (45 CSR § 30-2.12.). The Director of the Division of Air Quality is the Secretary's designated representative for the purposes of this permit.

2.2. Acronyms

CAAA	Clean Air Act Amendments	NSPS	New Source Performance Standards
CBI	Confidential Business Information	PM	Particulate Matter
CEM	Continuous Emission Monitor	PM _{2.5}	Particulate Matter less than 2.5µm in diameter
CES	Certified Emission Statement	PM ₁₀	Particulate Matter less than 10µm in diameter
C.F.R. or CFR	Code of Federal Regulations	Ppb	Pounds per Batch
CO	Carbon Monoxide	pph	Pounds per Hour
C.S.R. or CSR	Codes of State Rules	ppm	Parts per Million
DAQ	Division of Air Quality	Ppmv or ppmv	Parts per million by volume
DEP	Department of Environmental Protection	PSD	Prevention of Significant Deterioration
dscm	Dry Standard Cubic Meter	psi	Pounds per Square Inch
FOIA	Freedom of Information Act	SIC	Standard Industrial Classification
HAP	Hazardous Air Pollutant	SIP	State Implementation Plan
HON	Hazardous Organic NESHAP	SO ₂	Sulfur Dioxide
HP	Horsepower	TAP	Toxic Air Pollutant
lbs/hr	Pounds per Hour	TPY	Tons per Year
LDAR	Leak Detection and Repair	TRS	Total Reduced Sulfur
M	Thousand	TSP	Total Suspended Particulate
MACT	Maximum Achievable Control Technology	USEPA	United States Environmental Protection Agency
MDHI	Maximum Design Heat Input	UTM	Universal Transverse Mercator
MM	Million	VEE	Visual Emissions Evaluation
MMBtu/hr or mmbtu/hr	Million British Thermal Units per Hour	VOC	Volatile Organic Compounds
MMCF/hr or mmcf/hr	Million Cubic Feet per Hour	VOL	Volatile Organic Liquids
NA	Not Applicable		
NAAQS	National Ambient Air Quality Standards		
NESHAPS	National Emissions Standards for Hazardous Air Pollutants		
NO _x	Nitrogen Oxides		

2.3. Authority

This permit is issued in accordance with West Virginia Air Pollution Control Law W.Va. Code §§22-5-1 et seq. and the following Legislative Rules promulgated thereunder:

- 2.3.1. 45CSR13 – *Permits for Construction, Modification, Relocation and Operation of Stationary Sources of Air Pollutants, Notification Requirements, Temporary Permits, General Permits and Procedures for Evaluation.*

2.4. Term and Renewal

- 2.4.1. This permit shall remain valid, continuous and in effect unless it is revised, suspended, revoked or otherwise changed under an applicable provision of 45CSR13 or any applicable legislative rule.

2.5. Duty to Comply

- 2.5.1. The permitted facility shall be constructed and operated in accordance with the plans and specifications filed in Permit Application R13-3038A and any modifications, administrative updates, or amendments thereto. The Secretary may suspend or revoke a permit if the plans and specifications upon which the approval was based are not adhered to;
[45CSR§§13-5.11 and 13-10.3]
- 2.5.2. This permit supercedes and replaces R13-3038. The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the West Virginia Code and the Clean Air Act and is grounds for enforcement action by the Secretary or USEPA;
- 2.5.3. Violations of any of the conditions contained in this permit, or incorporated herein by reference, may subject the permittee to civil and/or criminal penalties for each violation and further action or remedies as provided by West Virginia Code 22-5-6 and 22-5-7;
- 2.5.4. Approval of this permit does not relieve the permittee herein of the responsibility to apply for and obtain all other permits, licenses and/or approvals from other agencies; i.e., local, state and federal, which may have jurisdiction over the construction and/or operation of the source(s) and/or facility herein permitted.

2.6. Duty to Provide Information

The permittee shall furnish to the Secretary within a reasonable time any information the Secretary may request in writing to determine whether cause exists for administratively updating, modifying, revoking or terminating the permit or to determine compliance with the permit. Upon request, the permittee shall also furnish to the Secretary copies of records to be kept by the permittee. For information claimed to be confidential, the permittee shall furnish such records to the Secretary along with a claim of confidentiality in accordance with 45CSR31. If confidential information is to be sent to USEPA, the permittee shall directly provide such information to USEPA along with a claim of confidentiality in accordance with 40 C.F.R. Part 2.

2.7. Duty to Supplement and Correct Information

Upon becoming aware of a failure to submit any relevant facts or a submittal of incorrect information in any permit application, the permittee shall promptly submit to the Secretary such supplemental facts or corrected information.

2.8. Administrative Update

The permittee may request an administrative update to this permit as defined in and according to the procedures specified in 45CSR13.

[45CSR§13-4]

2.9. Permit Modification

The permittee may request a minor modification to this permit as defined in and according to the procedures specified in 45CSR13.

[45CSR§13-5.4.]

2.10. Major Permit Modification

The permittee may request a major modification as defined in and according to the procedures specified in 45CSR14 or 45CSR19, as appropriate.

[45CSR§13-5.1]

2.11. Inspection and Entry

The permittee shall allow any authorized representative of the Secretary, upon the presentation of credentials and other documents as may be required by law, to perform the following:

- a. At all reasonable times (including all times in which the facility is in operation) enter upon the permittee's premises where a source is located or emissions related activity is conducted, or where records must be kept under the conditions of this permit;
- b. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;
- c. Inspect at reasonable times (including all times in which the facility is in operation) any facilities, equipment (including monitoring and air pollution control equipment), practices, or operations regulated or required under the permit;
- d. Sample or monitor at reasonable times substances or parameters to determine compliance with the permit or applicable requirements or ascertain the amounts and types of air pollutants discharged.

2.12. Emergency

2.12.1. An "emergency" means any situation arising from sudden and reasonable unforeseeable events beyond the control of the source, including acts of God, which situation requires immediate corrective action to restore normal operation, and that causes the source to exceed a technology-based emission limitation under the permit, due to unavoidable increases in emissions attributable to the emergency. An emergency shall not include noncompliance to the extent caused by improperly designed equipment, lack of preventative maintenance, careless or improper operation, or operator error.

2.12.2. Effect of any emergency. An emergency constitutes an affirmative defense to an action brought for noncompliance with such technology-based emission limitations if the conditions of Section 2.12.3 are met.

- 2.12.3. The affirmative defense of emergency shall be demonstrated through properly signed, contemporaneous operating logs, or other relevant evidence that:
- a. An emergency occurred and that the permittee can identify the cause(s) of the emergency;
 - b. The permitted facility was at the time being properly operated;
 - c. During the period of the emergency the permittee took all reasonable steps to minimize levels of emissions that exceeded the emission standards, or other requirements in the permit; and,
 - d. The permittee submitted notice of the emergency to the Secretary within one (1) working day of the time when emission limitations were exceeded due to the emergency and made a request for variance, and as applicable rules provide. This notice must contain a detailed description of the emergency, any steps taken to mitigate emission, and corrective actions taken.
- 2.12.4. In any enforcement proceeding, the permittee seeking to establish the occurrence of an emergency has the burden of proof.
- 2.12.5. The provisions of this section are in addition to any emergency or upset provision contained in any applicable requirement.

2.13. Need to Halt or Reduce Activity Not a Defense

It shall not be a defense for a permittee in an enforcement action that it should have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit. However, nothing in this paragraph shall be construed as precluding consideration of a need to halt or reduce activity as a mitigating factor in determining penalties for noncompliance if the health, safety, or environmental impacts of halting or reducing operations would be more serious than the impacts of continued operations.

2.14. Suspension of Activities

In the event the permittee should deem it necessary to suspend, for a period in excess of sixty (60) consecutive calendar days, the operations authorized by this permit, the permittee shall notify the Secretary, in writing, within two (2) calendar weeks of the passing of the sixtieth (60) day of the suspension period.

2.15. Property Rights

This permit does not convey any property rights of any sort or any exclusive privilege.

2.16. Severability

The provisions of this permit are severable and should any provision(s) be declared by a court of competent jurisdiction to be invalid or unenforceable, all other provisions shall remain in full force and effect.

2.17. Transferability

This permit is transferable in accordance with the requirements outlined in Section 10.1 of 45CSR13. [45CSR§13-10.1]

2.18. Notification Requirements

The permittee shall notify the Secretary, in writing, no later than thirty (30) calendar days after the actual startup of the operations authorized under this permit.

2.19. Credible Evidence

Nothing in this permit shall alter or affect the ability of any person to establish compliance with, or a violation of, any applicable requirement through the use of credible evidence to the extent authorized by law. Nothing in this permit shall be construed to waive any defense otherwise available to the permittee including, but not limited to, any challenge to the credible evidence rule in the context of any future proceeding.

3.0. Facility-Wide Requirements

3.1. Limitations and Standards

- 3.1.1. **Open burning.** The open burning of refuse by any person, firm, corporation, association or public agency is prohibited except as noted in 45CSR§6-3.1.
[45CSR§6-3.1.]
- 3.1.2. **Open burning exemptions.** The exemptions listed in 45CSR§6-3.1 are subject to the following stipulation: Upon notification by the Secretary, no person shall cause, suffer, allow or permit any form of open burning during existing or predicted periods of atmospheric stagnation. Notification shall be made by such means as the Secretary may deem necessary and feasible.
[45CSR§6-3.2.]
- 3.1.3. **Asbestos.** The permittee is responsible for thoroughly inspecting the facility, or part of the facility, prior to commencement of demolition or renovation for the presence of asbestos and complying with 40 C.F.R. § 61.145, 40 C.F.R. § 61.148, and 40 C.F.R. § 61.150. The permittee, owner, or operator must notify the Secretary at least ten (10) working days prior to the commencement of any asbestos removal on the forms prescribed by the Secretary if the permittee is subject to the notification requirements of 40 C.F.R. § 61.145(b)(3)(i). The USEPA, the Division of Waste Management and the Bureau for Public Health - Environmental Health require a copy of this notice to be sent to them.
[40CFR§61.145(b) and 45CSR§34]
- 3.1.4. **Odor.** No person shall cause, suffer, allow or permit the discharge of air pollutants which cause or contribute to an objectionable odor at any location occupied by the public.
[45CSR§4-3.1 State-Enforceable only.]
- 3.1.5. **Permanent shutdown.** A source which has not operated at least 500 hours in one 12-month period within the previous five (5) year time period may be considered permanently shutdown, unless such source can provide to the Secretary, with reasonable specificity, information to the contrary. All permits may be modified or revoked and/or reapplication or application for new permits may be required for any source determined to be permanently shutdown.
[45CSR§13-10.5.]
- 3.1.6. **Standby plan for reducing emissions.** When requested by the Secretary, the permittee shall prepare standby plans for reducing the emissions of air pollutants in accordance with the objectives set forth in Tables I, II, and III of 45 C.S.R. 11.
[45CSR§11-5.2.]

3.2. Monitoring Requirements

- 3.2.1. **Emission Limit Averaging Time.** Unless otherwise specified, compliance with all annual limits shall be based on a rolling twelve month total. A rolling twelve month total shall be the sum of the measured parameter of the previous twelve calendar months. Compliance with all hourly emission limits shall be based on the applicable NAAQS averaging times or, where applicable, as given in any approved performance test method.

3.3. Testing Requirements

- 3.3.1. **Stack testing.** As per provisions set forth in this permit or as otherwise required by the Secretary, in accordance with the West Virginia Code, underlying regulations, permits and orders, the

permittee shall conduct test(s) to determine compliance with the emission limitations set forth in this permit and/or established or set forth in underlying documents. The Secretary, or his duly authorized representative, may at his option witness or conduct such test(s). Should the Secretary exercise his option to conduct such test(s), the operator shall provide all necessary sampling connections and sampling ports to be located in such manner as the Secretary may require, power for test equipment and the required safety equipment, such as scaffolding, railings and ladders, to comply with generally accepted good safety practices. Such tests shall be conducted in accordance with the methods and procedures set forth in this permit or as otherwise approved or specified by the Secretary in accordance with the following:

- a. The Secretary may on a source-specific basis approve or specify additional testing or alternative testing to the test methods specified in the permit for demonstrating compliance with 40 C.F.R. Parts 60, 61, and 63 in accordance with the Secretary's delegated authority and any established equivalency determination methods which are applicable. If a testing method is specified or approved which effectively replaces a test method specified in the permit, the permit may be revised in accordance with 45CSR§13-4 or 45CSR§13-5.4 as applicable.
- b. The Secretary may on a source-specific basis approve or specify additional testing or alternative testing to the test methods specified in the permit for demonstrating compliance with applicable requirements which do not involve federal delegation. In specifying or approving such alternative testing to the test methods, the Secretary, to the extent possible, shall utilize the same equivalency criteria as would be used in approving such changes under Section 3.3.1.a. of this permit. If a testing method is specified or approved which effectively replaces a test method specified in the permit, the permit may be revised in accordance with 45CSR§13-4 or 45CSR§13-5.4 as applicable.
- c. All periodic tests to determine mass emission limits from or air pollutant concentrations in discharge stacks and such other tests as specified in this permit shall be conducted in accordance with an approved test protocol. Unless previously approved, such protocols shall be submitted to the Secretary in writing at least thirty (30) days prior to any testing and shall contain the information set forth by the Secretary. In addition, the permittee shall notify the Secretary at least fifteen (15) days prior to any testing so the Secretary may have the opportunity to observe such tests. This notification shall include the actual date and time during which the test will be conducted and, if appropriate, verification that the tests will fully conform to a referenced protocol previously approved by the Secretary.
- d. The permittee shall submit a report of the results of the stack test within sixty (60) days of completion of the test. The test report shall provide the information necessary to document the objectives of the test and to determine whether proper procedures were used to accomplish these objectives. The report shall include the following: the certification described in paragraph 3.5.1.; a statement of compliance status, also signed by a responsible official; and, a summary of conditions which form the basis for the compliance status evaluation. The summary of conditions shall include the following:
 1. The permit or rule evaluated, with the citation number and language;
 2. The result of the test for each permit or rule condition; and,
 3. A statement of compliance or noncompliance with each permit or rule condition.**[WV Code § 22-5-4(a)(14-15) and 45CSR13]**

3.4. Recordkeeping Requirements

- 3.4.1. **Retention of records.** The permittee shall maintain records of all information (including monitoring data, support information, reports and notifications) required by this permit recorded in a form suitable and readily available for expeditious inspection and review. Support information includes all calibration and maintenance records and all original strip-chart recordings for continuous monitoring instrumentation. The files shall be maintained for at least five (5) years following the date of each occurrence, measurement, maintenance, corrective action, report, or record. At a minimum, the most recent two (2) years of data shall be maintained on site. The remaining three (3) years of data may be maintained off site, but must remain accessible within a reasonable time. Where appropriate, the permittee may maintain records electronically (on a computer, on computer floppy disks, CDs, DVDs, or magnetic tape disks), on microfilm, or on microfiche.
- 3.4.2. **Odors.** For the purposes of 45CSR4, the permittee shall maintain a record of all odor complaints received, any investigation performed in response to such a complaint, and any responsive action(s) taken.
[45CSR§4. *State-Enforceable only.*]

3.5. Reporting Requirements

- 3.5.1. **Responsible official.** Any application form, report, or compliance certification required by this permit to be submitted to the DAQ and/or USEPA shall contain a certification by the responsible official that states that, based on information and belief formed after reasonable inquiry, the statements and information in the document are true, accurate and complete.
- 3.5.2. **Confidential information.** A permittee may request confidential treatment for the submission of reporting required by this permit pursuant to the limitations and procedures of W. Va. Code § 22-5-10 and 45CSR31.
- 3.5.3. **Correspondence.** All notices, requests, demands, submissions and other communications required or permitted to be made to the Secretary of DEP and/or USEPA shall be made in writing and shall be deemed to have been duly given when delivered by hand, or mailed first class with postage prepaid to the address(es) set forth below or to such other person or address as the Secretary of the Department of Environmental Protection may designate:

If to the DAQ:

Director
WVDEP
Division of Air Quality
601 57th Street, SE
Charleston, WV 25304-2345

If to the USEPA:

Associate Director
Office of Air Enforcement and Compliance Assistance
(3AP20)
U. S. Environmental Protection Agency
Region III
1650 Arch Street
Philadelphia, PA 19103-2029

3.5.4. Operating Fee.

- 3.5.4.1. In accordance with 45CSR22 – Air Quality Management Fee Program, the permittee shall not operate nor cause to operate the permitted facility or other associated facilities on the same or contiguous sites comprising the plant without first obtaining and having in current effect a Certificate to Operate (CTO). Such Certificate to Operate (CTO) shall be renewed annually, shall

be maintained on the premises for which the certificate has been issued, and shall be made immediately available for inspection by the Secretary or his/her duly authorized representative.

- 3.5.5. **Emission inventory.** At such time(s) as the Secretary may designate, the permittee herein shall prepare and submit an emission inventory for the previous year, addressing the emissions from the facility and/or process(es) authorized herein, in accordance with the emission inventory submittal requirements of the Division of Air Quality. After the initial submittal, the Secretary may, based upon the type and quantity of the pollutants emitted, establish a frequency other than on an annual basis.

4.0. Source-Specific Requirements

4.1. Limitations and Standards

- 4.1.1. Only those emission units as identified in Table 1.0, with the exception of any *de minimis* sources as identified under Table 45-13B of 45CSR13, are authorized at the permitted facility. In accordance with the information filed in Permit Applications R13-3038A, the emission units identified under Table 1.0 of this permit shall be installed, maintained, and operated so as to minimize any fugitive escape of pollutants, and shall not exceed the listed maximum design capacities.
- 4.1.2. The maximum aggregate amount of dry additive used in all mixing operations shall not exceed 1,500 tons per year (TPY) and the maximum amount of mud produced shall not exceed 500,000 gallons per year (GPY).
- 4.1.3. Fugitive escape of particulate matter from use of dry additives shall be mitigated by the following:
 - a. Air displaced from silos BRS1 and BRS2 during pneumatic loading shall be controlled by venting exhausting the air through the diesel/mud mixers so as to be controlled by baghouses on those units;
 - b. Good operating practices shall be implemented for all manual addition of bagged or otherwise open dry additive to the mixers so as to minimize any fugitive escape of particulate matter. Good operating practices shall include the use of a hopper of reasonable depth or a suitable enclosure around the hopper to minimize the blowing of dry additive;
 - c. The building and plant grounds shall be regularly cleaned of any spilled dry additives; and
 - d. Dry additives delivered to the facility in bags or other containers shall, where reasonable, remain unopened until they are used in the mixing process.
- 4.1.4. Dust filters shall be installed, maintained, and operated so as to achieve a minimum efficiency of 95% in the control of particulate matter emissions from the Mixing Tanks MT1/MT2 and Barite Silos BRS1/BRS2. At such times that is necessary to maintain the minimum particulate matter collection efficiency, or according to manufacture's recommendations (whichever comes first), the dust filters shall be replaced.
- 4.1.5. The permittee shall maintain all paved and unpaved areas on plant grounds in good condition, including shoulder areas, where truck traffic or forklift activity may occur.
- 4.1.6. The facility-wide VOC limit from the use diesel and base oils shall not exceed 9.21 lb/hr or 0.16 TPY.
- 4.1.7. The material handling operations and use of haulroads shall comply with all applicable limitations and standards under 45CSR7, including the requirements given below under (a) through (d).
 - a. No person shall cause, suffer, allow or permit emission of smoke and/or particulate matter into the open air from any process source operation which is greater than twenty (20) percent opacity, except as noted in subsections 3.2, 3.3, 3.4, 3.5, 3.6, and 3.7.
[45CSR§7-3.1]

- b. The provisions of subsection 3.1 shall not apply to smoke and/or particulate matter emitted from any process source operation which is less than forty (40) percent opacity for any period or periods aggregating no more than five (5) minutes in any sixty (60) minute period.
[45CSR§7-3.2]
- c. No person shall cause, suffer, allow or permit any manufacturing process or storage structure generating fugitive particulate matter to operate that is not equipped with a system, which may include, but not be limited to, process equipment design, control equipment design or operation and maintenance procedures, to minimize the emissions of fugitive particulate matter. To minimize means such system shall be installed, maintained and operated to ensure the lowest fugitive particulate matter emissions reasonably achievable.
[45CSR§7-5.1]
- d. The owner or operator of a plant shall maintain particulate matter control of the plant premises, and plant owned, leased or controlled access roads, by paving, application of asphalt, chemical dust suppressants or other suitable dust control measures. Good operating practices shall be implemented and when necessary particulate matter suppressants shall be applied in relation to stockpiling and general material handling to minimize particulate matter generation and atmospheric entrainment.
[45CSR§7-5.2]

- 4.1.8. **Operation and Maintenance of Air Pollution Control Equipment.** The permittee shall, to the extent practicable, install, maintain, and operate all pollution control equipment listed in Section 1.0 and associated monitoring equipment in a manner consistent with safety and good air pollution control practices for minimizing emissions and according to manufacturer's recommendations, or comply with any more stringent limits set forth in this permit or as set forth by any State rule, Federal regulation, or alternative control plan approved by the Secretary.
[45CSR§13-5.11.]

4.2. Monitoring Requirements

- 4.2.1. For the purposes of demonstrating continuous compliance with the material usage and production limitations set forth in 4.1.2., the permittee shall monitor and record the monthly and rolling twelve month usage of dry additive used in all mixing operations and the amount of mud produced at the facility.

4.3. Testing Requirements

- 4.3.1. At such reasonable time(s) as the Secretary may designate, in accordance with the provisions of 3.3 of this permit, the permittee shall conduct or have conducted test(s) to determine compliance with the emission limitations or emission control requirements established in this permit and/or applicable regulations.

4.4. Recordkeeping Requirements

- 4.4.1. **Record of Monitoring.** The permittee shall keep records of monitoring information that include the following:
- a. The date, place as defined in this permit and time of sampling or measurements;
 - b. The date(s) analyses were performed;

- c. The company or entity that performed the analyses;
 - d. The analytical techniques or methods used;
 - e. The results of the analyses; and
 - f. The operating conditions existing at the time of sampling or measurement.
- 4.4.2. **Record of Maintenance of Air Pollution Control Equipment.** For all pollution control equipment listed in Section 1.0, the permittee shall maintain accurate records of all required pollution control equipment inspection and/or preventative maintenance procedures.
- 4.4.3. **Record of Malfunctions of Air Pollution Control Equipment.** For all air pollution control equipment listed in Section 1.0, the permittee shall maintain records of the occurrence and duration of any malfunction or operational shutdown of the air pollution control equipment during which excess emissions occur. For each such case, the following information shall be recorded:
- a. The equipment involved;
 - b. Steps taken to minimize emissions during the event.
 - c. The duration of the event.
 - d. The estimated increase in emissions during the event.

For each such case associated with an equipment malfunction, the additional information shall also be recorded:

- e. The cause of the malfunction.
- f. Steps taken to correct the malfunction.
- g. Any changes or modifications to equipment or procedures that would help prevent future recurrences of the malfunction.

CERTIFICATION OF DATA ACCURACY

I, the undersigned, hereby certify that, based on information and belief formed after reasonable inquiry, all information contained in the attached _____, representing the period beginning _____ and ending _____, and any supporting documents appended hereto, is true, accurate, and complete.

Signature¹ _____
(please use blue ink) Responsible Official or Authorized Representative Date

Name and Title _____
(please print or type) Name Title

Telephone No. _____ Fax No. _____

¹ This form shall be signed by a "Responsible Official." "Responsible Official" means one of the following:

- a. For a corporation: The president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation, or a duly authorized representative of such person if the representative is responsible for the overall operation of one or more manufacturing, production, or operating facilities applying for or subject to a permit and either:
 - (I) the facilities employ more than 250 persons or have a gross annual sales or expenditures exceeding \$25 million (in second quarter 1980 dollars), or
 - (ii) the delegation of authority to such representative is approved in advance by the Director;
- b. For a partnership or sole proprietorship: a general partner or the proprietor, respectively;
- c. For a municipality, State, Federal, or other public entity: either a principal executive officer or ranking elected official. For the purposes of this part, a principal executive officer of a Federal agency includes the chief executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., a Regional Administrator of USEPA); or
- d. The designated representative delegated with such authority and approved in advance by the Director.

INTERNAL PERMITTING DOCUMENT TRACKING MANIFEST

Company Name INTEGRITY DELAWARE LLC

Permitting Action Number R13-3038A Total Days 8378 DAQ Days 5749

Permitting Action:

- | | | |
|---|------------------------------------|---|
| <input type="radio"/> Permit Determination | <input type="radio"/> Temporary | <input checked="" type="radio"/> Modification |
| <input type="radio"/> General Permit | <input type="radio"/> Relocation | <input type="radio"/> PSD (Rule 14) |
| <input type="radio"/> Administrative Update | <input type="radio"/> Construction | <input type="radio"/> NNSR (Rule 19) |

Documents Attached:

- | | |
|--|---|
| <input checked="" type="radio"/> Engineering Evaluation/Memo | <input checked="" type="radio"/> Completed Database Sheet |
| <input checked="" type="radio"/> Draft Permit | <input type="radio"/> Withdrawal |
| <input checked="" type="radio"/> Notice | <input type="radio"/> Letter |
| <input type="radio"/> Denial | <input type="radio"/> Other (specify) _____ |
| <input type="radio"/> Final Permit/General Permit Registration | _____ |

Date	From	To	Action Requested
2/04/14	Joe Kessler	Bev McKeone	NOTICE APPROVAL
2/5	Bev	Joe	Go to Notice

NOTE: Retain a copy of this manifest for your records when transmitting your document(s).

Kessler, Joseph R

From: Patrick E. Ward <PEWard@potesta.com>
Sent: Friday, February 05, 2016 11:17 AM
To: Kessler, Joseph R
Subject: FW: Integrity R13-3038 Question

See comments below on pump rate.

Regards,
Patrick Ward
Potesta & Associates, Inc.
7012 MacCorkle Avenue, S.E.
Charleston, West Virginia 25304
Ph: (304) 342-1400
Direct: (304) 414-4751
Fax: (304) 343-9031

Entire Document
NON-CONFIDENTIAL

I.D. No. 015-0285 Reg. 3038A
Company INTEGRITY-DELAWARE
Facility FERRYWAY Region _____
Initials 

This electronic communication and its attachments contain confidential information. The recommendations and/or design data included herein are provided as a matter of convenience and should not be used for final design or ultimate decision making. Rely only on the final hardcopy materials bearing the consultant's original signature and seal. If you have received this information in error, please notify the sender immediately.

From: Aukerman, Brett [mailto:BAukerman@IntegrityIndustries.com]
Sent: Thursday, February 04, 2016 11:15 AM
To: Patrick E. Ward <PEWard@potesta.com>
Subject: RE: Integrity R13-3038 Question

What is the truck load-out rate? Does it use 2,000 gallon/minute pumps as well? And just confirming the pumps servicing the tanks are 2,000 gpm. That seems like larger than normal pumps for this type of operation. **2000 gal/minute is our mixing pump. The load rating is roughly 200 gallons/ minute. We do not load the truck with our own pump the carriers use their own equipment.**

From: Patrick E. Ward [mailto:PEWard@potesta.com]
Sent: Wednesday, February 3, 2016 10:28 AM
To: Aukerman, Brett <BAukerman@IntegrityIndustries.com>; Lisembee, Justin <Lisembee@IntegrityIndustries.com>
Cc: Hamilton, Brandy <Brandy.Hamilton@Lubrizol.com>; Lisa K. Burgess <LKBurgess@potesta.com>
Subject: FW: Integrity R13-3038 Question

Please see the below question and verify.

Regards,
Patrick Ward
Potesta & Associates, Inc.
7012 MacCorkle Avenue, S.E.
Charleston, West Virginia 25304
Ph: (304) 342-1400
Direct: (304) 414-4751
Fax: (304) 343-9031

This electronic communication and its attachments contain confidential information. The recommendations and/or design data included herein are provided as a matter of convenience and should not be used for final design or ultimate decision

making. Rely only on the final hardcopy materials bearing the consultant's original signature and seal. If you have received this information in error, please notify the sender immediately.

From: Kessler, Joseph R [<mailto:Joseph.R.Kessler@wv.gov>]

Sent: Wednesday, February 03, 2016 10:06 AM

To: Patrick E. Ward <PEWard@potesta.com>

Subject: Integrity R13-3038 Question

What is the truck load-out rate? Does it use 2,000 gallon/minute pumps as well? And just confirming the pumps servicing the tanks are 2,000 gpm. That seems like larger than normal pumps for this type of operation.

Thanks,

Joe Kessler, PE

Engineer

West Virginia Division of Air Quality

601-57th St., SE

Charleston, WV 25304

Phone: (304) 926-0499 x1219

Fax: (304) 926-0478

Joseph.r.kessler@wv.gov

Kessler, Joseph R

From: Patrick E. Ward <PEWard@potesta.com>
Sent: Friday, February 05, 2016 11:37 AM
To: Kessler, Joseph R
Cc: Aukerman, Brett
Subject: Vapor Pressures/SDS's
Attachments: 2014_04_28-sds-us_-hy-p40.pdf; 2014_05_07-sds-us_-hy-p43.pdf; Tanks 4 for 500 BBL 21,000 GAL Tank.pdf; Revised Attachment N.pdf

Following are the vapor pressures for the base oils. Also, attached are new SDS's for the synthetic base oils.

For P40, VP = 0.0625 mmHg @ 70°F summer base oil
For P43, VP = 0.124 mmHg @ 70°F winter base oil
For ULSD, VP = 0.54 mmHg @ 70°F diesel

We have forced the dimensions for the 500 BBL tank to allow the 21,000 gallons to be inserted into the program. The resulting emission are higher as you anticipated. We revised the calculations and they are attached.

Please let me know if we need to submit any other documentation based on this information.

Regards,
Patrick Ward
Potesta & Associates, Inc.
7012 MacCorkle Avenue, S.E.
Charleston, West Virginia 25304
Ph: (304) 342-1400
Direct: (304) 414-4751
Fax: (304) 343-9031

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I.D. No. 095-00025 Reg. 3038A
Company INTEGRITY-DELAWARE
Facility F2PENOLY Region _____
Initials [Signature]

SAFETY DATA SHEET

Ergon-West Virginia, Inc.

1. Identification

Product identifier HY P40
Other means of identification Not available.
Recommended use Drilling fluid; Explosives manufacturing
Recommended restrictions None known.
Manufacturer/Importer/Supplier/Distributor information
Manufacturer
Manufacturer: Ergon - West Virginia, Inc.
Address: 9995 Ohio River Blvd.
Newell, WV 26050
Contact Name: Will Poe
Telephone: 1-601-630-8619
E-mail: will.poe@ergon.com
Emergency Contacts
Ergon - West Virginia, Inc. : 1-304-387-4343 Normal Business Hours
Chemtrec: 1-800-424-9300 After Business Hours (North America Only)
1-703-527-3887 After Business Hours (International)

2. Hazard(s) identification

Physical hazards Not classified.
Health hazards Aspiration hazard Category 1
Environmental hazards Not classified.
OSHA defined hazards Not classified.

Label elements



Signal word Danger
Hazard statement May be fatal if swallowed and enters airways.
Prevention Do not breathe gas/mist/vapors/spray.
Response IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician. Do NOT induce vomiting. IF exposed or concerned: Get medical advice/attention.
Storage Store in accordance with local/regional/national/international regulation. Store locked up.
Disposal Dispose of contents/container to an appropriate treatment and disposal facility in accordance with applicable laws and regulations, and product characteristics at time of disposal. See section 13 of this SDS for disposal instructions.
Hazard(s) not otherwise classified (HNOC) None known.
Supplemental information None.

3. Composition/information on ingredients

Substances

Chemical name	Common name and synonyms	CAS number	%
DISTILLATES (PETROLEUM), HYDROTREATED MIDDLE		64742-46-7	100

4. First-aid measures

Inhalation Move to fresh air. Oxygen or artificial respiration if needed. IF exposed or concerned: Get medical advice/attention.
Skin contact Wash contact areas with soap and water. Remove contaminated clothing. Launder contaminated clothing before reuse. If skin irritation or an allergic skin reaction develops, get medical attention.

Eye contact	Flush thoroughly with water. If irritation occurs, get medical assistance.
Ingestion	Do NOT induce vomiting. If vomiting occurs naturally, have victim lean forward to reduce risk of aspiration. Call a poison control center immediately.
Most important symptoms/effects, acute and delayed	Defatting of the skin.
Indication of immediate medical attention and special treatment needed	Treat symptomatically.
General information	Contact physician if discomfort continues.

5. Fire-fighting measures

Suitable extinguishing media	Halon. Dry chemicals. Foam. Carbon dioxide (CO2). Water spray or fog. Do not use water jet as an extinguisher, as this will spread the fire.
Unsuitable extinguishing media	Do not use a solid water stream as it may scatter and spread fire.
Specific hazards arising from the chemical	No unusual fire or explosion hazards noted.
Special protective equipment and precautions for firefighters	Wear full protective clothing, including helmet, self-contained positive pressure or pressure demand breathing apparatus, protective clothing and face mask.
Fire-fighting equipment/instructions	Cool containers exposed to flames with water until well after the fire is out. Firefighters must use standard protective equipment including flame retardant coat, helmet with face shield, gloves, rubber boots, and in enclosed spaces, SCBA. Use pressurized air mask if product is involved in a fire.
General fire hazards	No unusual fire or explosion hazards noted. Flammability Class: Combustible IIIB

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures	Keep unnecessary personnel away. Local authorities should be advised if significant spillages cannot be contained. Wear appropriate protective equipment and clothing during clean-up. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Ensure adequate ventilation.
Methods and materials for containment and cleaning up	Large Spills: ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible. Cover with plastic sheet to prevent spreading. Absorb in vermiculite, dry sand or earth or absorbent material then place into containers. Following product recovery, flush area with water. Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination.
Environmental precautions	Never return spills in original containers for re-use. For waste disposal, see section 13 of the SDS. Prevent further leakage or spillage if safe to do so. Prevent entry into waterways, sewer, basements or confined areas. Avoid discharge to the aquatic environment. Contact local authorities in case of spillage to drain/aquatic environment. Avoid discharge into drains, water courses or onto the ground. If this material is spilled into navigable waters and creates a visible sheen, it is reportable to the National Response Center.

7. Handling and storage

Precautions for safe handling	DO NOT handle, store or open near an open flame, sources of heat or sources of ignition. Protect material from direct sunlight. Do not breathe dust/fume/gas/mist/vapors/spray. Wash hands after handling and before eating. Do not get this material in contact with eyes. Avoid contact with skin. Avoid prolonged exposure. All handling to take place in well-ventilated area. Shower after work. Remove and wash contaminated clothing promptly.
Conditions for safe storage, including any incompatibilities	Store locked up. Keep away from heat, sparks and open flame. Store in a well-ventilated place. Use care in handling/storage.

8. Exposure controls/personal protection

Occupational exposure limits

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Components	Type	Value	Form
DISTILLATES (PETROLEUM), HYDROTREATED MIDDLE (CAS 64742-46-7)	PEL	5 mg/m3	Mist.

US. ACGIH Threshold Limit Values

Material	Type	Value	Form
HY P40	TWA	5 mg/m3	Inhalable fraction.
Components	Type	Value	Form
DISTILLATES (PETROLEUM), HYDROTREATED MIDDLE (CAS 64742-46-7)	TWA	5 mg/m3	Inhalable fraction.

US. NIOSH: Pocket Guide to Chemical Hazards

Material	Type	Value	Form
HY P40	STEL	10 mg/m3	Mist.
	TWA	5 mg/m3	Mist.
Components	Type	Value	Form
DISTILLATES (PETROLEUM), HYDROTREATED MIDDLE (CAS 64742-46-7)	STEL	10 mg/m3	Mist.
	TWA	5 mg/m3	Mist.

Biological limit values

No biological exposure limits noted for the ingredient(s).

Appropriate engineering controls

Adequate ventilation should be provided whenever the material is heated or mists are generated. Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level.

Individual protection measures, such as personal protective equipment

Eye/face protection

Goggles/face shield are recommended.

Hand protection

Chemical resistant gloves are recommended. If contact with forearms is likely wear gauntlet style gloves.

Other

Chemical/oil resistant clothing is recommended. Launder contaminated clothing before reuse.

Respiratory protection

Under normal conditions, respirator is not normally required. When workers are facing concentrations above the exposure limit they must use appropriate certified respirators.

Thermal hazards

Not available.

General hygiene considerations

Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing to remove contaminants. Discard contaminated footwear that cannot be cleaned.

9. Physical and chemical properties

Appearance	Clear to cloudy.
Physical state	Liquid.
Form	Liquid.
Color	Colorless.
Odor	Hydrocarbon-like.
Odor threshold	Not available.
pH	Not applicable
Melting point/freezing point	< 0 °F (< -17.78 °C) ASTM D 5949/ ISO 3016
Initial boiling point and boiling range	395 °F (201.67 °C) ASTM D 2887/ ISO 3294
Flash point	>= 270.0 °F (>= 132.2 °C) Cleveland Open Cup ASTM D 92/ ISO 2592
Evaporation rate	Not available.
Flammability (solid, gas)	Not available.

Material name: HY P40

5544 Version #: 01 Issue date: 04-28-2014

SDS US

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Upper/lower flammability or explosive limits

Flammability limit - lower (%)	Not available.
Flammability limit - upper (%)	Not available.
Explosive limit - lower (%)	Not available.
Explosive limit - upper (%)	Not available.
Vapor pressure	Not available.
Vapor density	> 1
Relative density	Not available.
Solubility(ies)	
Solubility (water)	Negligible
Partition coefficient (n-octanol/water)	Not established.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Viscosity	37 SUS (100 °F (37.78 °C) ASTM D 2161)

10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Stable.
Possibility of hazardous reactions	Hazardous polymerization does not occur.
Conditions to avoid	Heat, flames and sparks. Avoid temperatures exceeding the flash point.
Incompatible materials	Strong oxidizing agents.
Hazardous decomposition products	Upon decomposition, this product emits carbon monoxide, carbon dioxide and/or low molecular weight hydrocarbons.

11. Toxicological information**Information on likely routes of exposure**

Ingestion	May cause gastrointestinal discomfort if swallowed. Do not induce vomiting. Vomiting may increase risk of product aspiration. May be fatal if swallowed and enters airways.
Inhalation	May be fatal if swallowed and enters airways.
Skin contact	Frequent or prolonged contact may defat and dry the skin, leading to discomfort and dermatitis.
Eye contact	May be irritating to eyes.
Symptoms related to the physical, chemical and toxicological characteristics	Defatting of the skin. Coughing. Shortness of breath. Discomfort in the chest.

Information on toxicological effects

Acute toxicity	Not applicable.
Skin corrosion/irritation	May cause defatting of the skin, but is neither an irritant nor a sensitizer.
Serious eye damage/eye irritation	Not classified. May cause minor irritation on eye contact.
Respiratory or skin sensitization	
Respiratory sensitization	Not classified.
Skin sensitization	Not classified. May cause defatting of the skin, but is neither an irritant nor a sensitizer.
Germ cell mutagenicity	No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.
Carcinogenicity	This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA. Nota L - Meets EU requirement of less than 3% (w/w) DMSO extract for total polycyclic aromatic compound (PAC) using IP 346. Not classified.

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not listed.

Reproductive toxicity	Contains no ingredient listed as toxic to reproduction
Specific target organ toxicity - single exposure	Not classified.

Material name: HY P40

5544 Version #: 01 Issue date: 04-28-2014

SDS US

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Specific target organ toxicity - repeated exposure	Not classified.
Aspiration hazard	May be fatal if swallowed and enters airways.
Chronic effects	Prolonged inhalation may be harmful. Prolonged exposure may cause chronic effects.
Further information	Risk of chemical pneumonia after aspiration.

12. Ecological information

Ecotoxicity	Not expected to be harmful to aquatic organisms.
Persistence and degradability	Not inherently biodegradable.
Bioaccumulative potential	Bioaccumulation is unlikely to be significant because of the low water solubility of this product.
Mobility in soil	Not available.
Other adverse effects	No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.

13. Disposal considerations

Disposal instructions	When this product as supplied is to be discarded as waste, it does not meet the definition of a RCRA waste under 40 CFR 261. Disposal recommendations are based on material as supplied. Disposal must be in accordance with current applicable laws and regulations, and material characteristics at time of disposal.
Hazardous waste code	Not applicable.
Waste from residues / unused products	Dispose of in accordance with local regulations. Avoid discharge into water courses or onto the ground.
Contaminated packaging	Empty containers should be taken to an approved waste handling site for recycling or disposal. Since emptied containers may retain product residue, follow label warnings even after container is emptied. Offer rinsed packaging material to local recycling facilities.

14. Transport information

DOT	Not regulated as dangerous goods.
IATA	Not regulated as dangerous goods.
IMDG	Not regulated as dangerous goods.
Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code	Not available.

15. Regulatory information

US federal regulations	This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200. All components are on the U.S. EPA TSCA Inventory List. CERCLA/SARA Hazardous Substances - Not applicable.
TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)	Not regulated.
CERCLA Hazardous Substance List (40 CFR 302.4)	Not listed.
US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)	Not listed.
Superfund Amendments and Reauthorization Act of 1986 (SARA)	
Hazard categories	Immediate Hazard - Yes Delayed Hazard - No Fire Hazard - No Pressure Hazard - No Reactivity Hazard - No
SARA 302 Extremely hazardous substance	Not listed.
SARA 311/312 Hazardous chemical	Yes

SARA 313 (TRI reporting)

Not regulated.

Other federal regulations**Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List**

Not regulated.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

Safe Drinking Water Act (SDWA) Not regulated.**US state regulations**

This product does not contain a chemical known to the State of California to cause cancer, birth defects or other reproductive harm. California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65): This material is not known to contain any chemicals currently listed as carcinogens or reproductive toxins.

US. Massachusetts RTK - Substance List

Not regulated.

US. New Jersey Worker and Community Right-to-Know Act

Not regulated.

US. Pennsylvania RTK - Hazardous Substances

Not regulated.

US. Rhode Island RTK

Not regulated.

US. California Proposition 65

Not Listed.

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision**Issue date** 04-28-2014**Version #** 01**References**

ACGIH
 EPA: AQUIRE database
 NLM: Hazardous Substances Data Base
 US. IARC Monographs on Occupational Exposures to Chemical Agents
 IARC Monographs. Overall Evaluation of Carcinogenicity
 National Toxicology Program (NTP) Report on Carcinogens
 ACGIH Documentation of the Threshold Limit Values and Biological Exposure Indices
 Chemical Abstracts Service Registry Handbook
 CRC: Handbook of Chemistry and Physics
 ILO Safety Cards
 International Labour Organization
 International Maritime Organization Marine Pollutants List
 NFPA Hazardous Chemical Data Sheets
 NIOSH Pocket Guide
 Registry of Toxic Effects of Chemical Substances (RTECS)
 US DOT Hazardous Materials Regulations

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

Revision Information

Product and Company Identification: Synonyms
Physical & Chemical Properties: Multiple Properties

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Identification and Physical Characteristics

Identification

User Identification:	500 BBL Diesel Tank
City:	Charleston
State:	West Virginia
Company:	Integrity Industries, Inc.
Type of Tank:	Vertical Fixed Roof Tank
Description:	Diesel is used to estimate the emissions from the synthetic oil, synthetic oil based mud, diesel based mud, and diesel tanks being utilized.

Tank Dimensions

Shell Height (ft):	20.00
Diameter (ft):	14.00
Liquid Height (ft):	19.00
Avg. Liquid Height (ft):	18.00
Volume (gallons):	21,000.00
Turnovers:	1.00
Net Throughput(gal/yr):	21,000.00
Is Tank Heated (y/n):	N

Paint Characteristics

Shell Color/Shade:	Gray/Medium
Shell Condition:	Good
Roof Color/Shade:	Gray/Medium
Roof Condition:	Good

Roof Characteristics

Type:	Dome
Height (ft):	0.50
Radius (ft) (Dome Roof):	14.00

Breather Vent Settings

Vacuum Settings (psig):	-0.40
Pressure Settings (psig):	0.00

Metereological Data used in Emissions Calculations: Charleston, West Virginia (Avg Atmospheric Pressure = 14.25 psia)

**TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank**

**500 BBL Diesel Tank - Vertical Fixed Roof Tank
Charleston, West Virginia**

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F)			Liquid Bulk Temp (deg F)	Vapor Pressure (psia)			Vapor Mol. Weight	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
		Avg.	Min.	Max.		Avg.	Min.	Max.					
Distillate fuel oil no. 2	AI	63.43	53.60	73.28	68.06	0.0076	0.0066	0.0100	130.0000			188.00	Option 1: VP80 = .0074 VP70 = .009

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

500 BBL Diesel Tank - Vertical Fixed Roof Tank
Charleston, West Virginia

<u>Annual Emission Calculations</u>	
Standing Losses (lb):	1,1920
Vapor Space Volume (cu ft):	348,6280
Vapor Density (lb/cu ft):	0.0002
Vapor Space Expansion Factor:	0.0474
Vented Vapor Saturation Factor:	0.8531
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	348,6280
Tank Diameter (ft):	14.0000
Vapor Space Height (ft):	2.2604
Tank Shell Height (ft):	20.0000
Average Liquid Height (ft):	18.0000
Roof Outage (ft):	0.2604
Roof Outage (Dome Roof)	
Roof Outage (ft):	0.2604
Dome Radius (ft):	14.0000
Shell Radius (ft):	7.0000
Vapor Density	
Vapor Density (lb/cu ft):	0.0002
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0079
Daily Avg. Liquid Surface Temp. (deg. F):	623.0982
Daily Average Ambient Temp. (deg. F):	54.9833
Ideal Gas Constant R (psia-cu-ft/lb-mole-deg. F):	10.731
Liquid Bulk Temperature (deg. F):	517.7393
Tank Paint Solar Absorptance (Shell):	0.6800
Tank Paint Solar Absorptance (Roof):	0.6300
Daily Total Solar Insolation Factor (Btu/sq-ft day):	1,280,6728
Vapor Space Expansion Factor:	
Vapor Space Expansion Factor:	0.0474
Daily Vapor Temperature Range (deg. F):	38.9148
Daily Vapor Pressure Range (psia):	0.0044
Brusher Vent Press. Setting (psia):	0.4000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0079
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0055
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0100
Daily Avg. Liquid Surface Temp. (deg. F):	623.0982
Daily Min. Liquid Surface Temp. (deg. F):	513.2876
Daily Max. Liquid Surface Temp. (deg. F):	632.8949
Daily Ambient Temp. Range (deg. F):	21.5333
Vented Vapor Saturation Factor:	
Vented Vapor Saturation Factor:	0.8531
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0079
Vapor Space Outage (ft):	2.2604
Working Losses (lb):	
Working Losses (lb):	0.5188
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0079
Annual Net Throughput (gal/yr):	21,000,0000
Annual Turnover:	1.0000
Turnover Factor:	1.0000
Maximum Liquid Volume (gal):	21,000,0000
Maximum Liquid Height (ft):	19.0000
Tank Diameter (ft):	14.0000
Working Loss Product Factor:	1.0000
Total Losses (lb):	1,6108

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

500 BBL Diesel Tank - Vertical/Fixed Roof Tank
Charleston, West Virginia

Components	Losses(lbs)		Total Emissions
	Working Loss	Breathing Loss	
Distillate fuel oil no. 2	0.52	1.10	1.62

Ethylene glycol monobutyl ether (EGBE) (2-Butoxyethanol); CASRN 111-76-2

Human health assessment information on a chemical substance is included in the IRIS database only after a comprehensive review of toxicity data, as outlined in the [IRIS assessment development process](#). Sections I (Health Hazard Assessments for Noncarcinogenic Effects) and II (Carcinogenicity Assessment for Lifetime Exposure) present the conclusions that were reached during the assessment development process. Supporting information and explanations of the methods used to derive the values given in IRIS are provided in the [guidance documents located on the IRIS website](#).

STATUS OF DATA FOR Ethylene glycol monobutyl ether (EGBE)

Entire Document
NON-CONFIDENTIAL

File First On-Line 12/30/1999

Category (section)	Assessment Available?	Last Revised
Oral RfD (I.A.)	yes	03/31/2010
Inhalation RfC (I.B.)	yes	03/31/2010
Carcinogenicity Assessment (II.)	yes	03/31/2010

I. Health Hazard Assessments for Noncarcinogenic Effects

I.A. Reference Dose (RfD) for Chronic Oral Exposure

Substance Name — Ethylene glycol monobutyl ether (EGBE)
CASRN — 111-76-2
Last Revised — 3/31/2010

I.D. No. 095-0025 Reg. 303B A
Company INTELLECTY-DELMAR
Facility FERRIS Region _____
Initials JA

The RfD is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily oral exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime. The RfD is intended for use in risk assessments for health effects known or assumed to be produced through a nonlinear (presumed threshold) mode of action. It is expressed in units of mg/kg-day. Please refer to the guidance documents at <http://www.epa.gov/iris/backgrd.html> for an elaboration of

these concepts. Because RfDs can be derived for the noncarcinogenic health effects of substances that are also carcinogens, it is essential to refer to other sources of information concerning the carcinogenicity of this chemical substance. If the U.S. EPA has evaluated this substance for potential human carcinogenicity, a summary of that evaluation will be contained in Section II of this file.

The previous oral RfD for EGBE (posted on the IRIS database in 1999) was 0.5 mg/kg-day, based on a National Toxicology Program (NTP, 1993, [042063](#)) subchronic drinking water study in rats and mice using changes in mean corpuscular volume as the critical effect. C_{max} (peak blood concentrations) for 2-butoxyacetic acid (BAA) in arterial blood of female rats following oral exposure was estimated using the physiologically based pharmacokinetic (PBPK) model of Corley et al. (1994, [041977](#)) as modified by Corley et al. (1997, [041984](#)). The benchmark dose (BMD)₀₅ was determined to be 64 μ M, using the 95% lower confidence limit of the dose-response curve expressed in terms of the C_{max} for BAA in blood. The PBPK model of Corley was used to "back-calculate" to a human equivalent dose (HED) of 5.1 mg/kg day, assuming that rats and humans receive their entire dose of EGBE from drinking water over a 12 hour period each day. The RfD was calculated by applying an uncertainty factor (UF) of 10 for intrahuman variability to the benchmark dose, 95% lower bound (BMDL) HED of 5.1 mg/kg day.

I.A.1. Chronic Oral RfD Summary

Critical Effect	Point of Departure*	UF	Chronic RfD
Hemosiderin deposition in the liver	BMDL(HED): 1.4 mg/kg-day (PBPK and BMD ₁₀)	10	0.1 mg/kg-day
Chronic (rat and mouse) inhalation study			
NTP (2000, 196293)			

*Conversion Factors and Assumptions - Based on the limited oral database and because the critical endpoint, hemosiderin pigmentation, was more pronounced in the chronic inhalation study (NTP, 2000, [196293](#)), versus the available subchronic oral study (NTP, 1993, [042063](#)), EPA used a route to route extrapolation from the NTP, 2000 ([196293](#)) study for the derivation for the RfD. As with the animal-to-human extrapolation used in the development of the reference concentration (RfC), the dose metric used for animal-to-human and route-to-route (inhalation-to-oral) extrapolation for the derivation of the RfD is the area under the curve (AUC) of BAA at 12 months in arterial blood. This dose metric was used for dose-response

modeling of chronic inhalation data to derive the point of departure (POD) of 133 μmol -hour/L, expressed as a BMDL based on animal data. The corresponding human BMDL was then back-calculated using the human PBPK model (Corley et al., 1994, [041977](#); Corley et al., 1997, [041984](#)) to obtain an equivalent human oral drinking water dose (BMDL_{HED}) of 1.4 mg/kg-day. A simplifying assumption was used that the entire dose of drinking water EGBE was consumed over a 12-hour period each day.

I.A.2. Principal and Supporting Studies (Oral RfD)

NTP (National Toxicology Program) (2000, [196293](#)) NTP technical report on the toxicology and carcinogenesis studies of 2 butoxyethanol (CAS No. 111 76 2) in F344/N rats and B6C3F₁ mice (inhalation studies). <http://ntp.niehs.nih.gov/?objectid=070AC403-B110-CA79-3A23AF79DE7B752A>; <http://ntp.niehs.nih.gov/ntp/htdocs/LTrpts/tr484.pdf>

NTP (2000, [196293](#)) completed a 2-year inhalation study on EGBE in both genders of rats and mice. In this chronic study, animals were exposed to EGBE 6 hours/day, 5 days/week at concentrations of 0, 31, 62.5, and 125 ppm (0, 150, 302, and 604 mg/m³) for groups of 50 F344/N rats and 0, 62.5, 125, and 250 ppm (0, 302, 604, and 1,208 mg/m³) for groups of 50 B6C3F₁ mice. The researchers stated that the highest exposure was selected to produce a 10-15% depression in hematologic indices. They reported that no effect on survival was observed in rats, but survival was statistically significantly decreased in male mice exposed to 125 or 250 ppm, compared with chamber controls (54, 52, and 78% respectively). Although statistics were not reported for mean body weights, the rats exposed to 31 and 62.5 ppm had similar mean body weights to the control rats. Mean body weights of the exposed mice were generally less than for controls, with females experiencing greater and earlier reductions. From week 17 to the end of the study, the mean body weights of 125 ppm female rats were generally less than those of controls. Non-neoplastic effects in rats included hyaline degeneration of the olfactory epithelium in males (13/48, 21/49, 23/49, 40/50) and females (13/50, 18/48, 28/50, 40/49) and Kupffer cell pigmentation in the livers of males (23/50, 30/50, 34/50, 42/50) and females (15/50, 19/50, 36/50, 47/50). The severity of the olfactory lesion was not affected by exposure. The Kupffer cell pigmentation is a result of hemosiderin accumulation and is a recognized secondary effect of the hemolytic activity of EGBE.

Statistically significant effects observed in mice included forestomach ulcers and epithelial hyperplasia, hematopoietic cell proliferation and hemosiderin pigmentation in the spleen, Kupffer cell pigmentation in the livers, and bone marrow hyperplasia (males only). Hyaline degeneration of the olfactory epithelium (females only) was increased relative to chamber controls but was not statistically significant. As in the rats, the Kupffer cell pigmentation was considered a secondary effect of the hemolytic activity of EGBE. Bone marrow hyperplasia, hematopoietic cell proliferation, and hemosiderin pigmentation in the spleen were also

attributed to the primary hemolytic effect; it was followed by regenerative hyperplasia of the hematopoietic tissue. The forestomach lesions did not appear to be related to the hemolytic effect of EGBE. Incidences of ulcer were significantly increased in all exposed female groups, as well as males exposed to 125 ppm. Incidences of epithelial hyperplasia, usually focal, were significantly increased in all exposed groups of males and females. The hyperplasia was often associated with ulceration, particularly in the females, and consisted of thickness of the stratified squamous epithelium and sometimes the keratinized layer of the forestomach. Ulceration consisted of a defect in the forestomach wall that penetrated the full thickness of the epithelium and frequently contained accumulations of inflammatory cells and debris.

Using the same exposure levels described above, additional groups of rats (27/gender/exposure group) and mice (30/gender/exposure group) in the 2-year study were examined at 3, 6, and 12 months (8-10 animals/time point) for hematologic effects. Nine male and nine female rats were exposed to 31 ppm EGBE, specifically to evaluate hematology at 3 months and to receive a total evaluation at 6 months. Animals were continuously exposed, as described above, until their sacrifice at 3, 6, or 12 months. As in the 14-week study, inhalation of EGBE by both species resulted in the development of exposure-related hemolytic effects, inducing a responsive anemia. In rats, the anemia was persistent and did not progress or ameliorate in severity from 3 months to the final blood collection at 12 months. Statistically significant ($p < 0.05$) decreases in automated and manual hematocrit (Hct) values, hemoglobin (Hb) concentrations, and red blood cell (RBC) counts occurred at 3, 6, and 12 months in the 125 ppm female mice and the 250 ppm male and female mice. Statistically significant decreases in these same endpoints were also observed in 62.5 ppm females at 6 months and in 125 ppm males at 6 and 12 months (decreases in Hct were observed only at 3 and 6 months). Mean cell volume (MCV) was increased in female mice at the highest duration (12 months) and exposure (250 ppm) levels. Reticulocyte counts were increased significantly in the 125 ppm females at 3 and 6 months and in the 125 ppm males at 6 months of exposure.

In the subchronic portion of the inhalation NTP (2000, [196293](#)) study, F344 rats and B6C3F₁ mice (10/gender) were exposed to EGBE concentrations of 0, 31, 62.5, 125, 250, and 500 ppm (0, 150, 302, 604, 1,208, and 2,416 mg/m³) 6 hours/day, 5 days/week for 14 weeks. Hematologic and hemosiderin staining results are indicative of the various degrees of hemolysis caused by exposure to increasing concentrations of EGBE. Both rat genders exhibited clinical signs at the three highest doses, consistent with the hemolytic effects of EGBE, including: (1) deficits in RBCs as a result of lysis manifestation through the clear dose-related decrease in Hct, a finding consistent with decreases noted for both RBC count and Hb concentrations; and (2) increases in both reticulocytes and nucleated erythrocytes at higher doses, homeostatic responses that would be anticipated to occur as the lysed blood cells are being replaced. Female rats may be somewhat more sensitive: several statistically significant effects occurred at the 31 ppm level in females, as opposed to a single parameter for males. In

addition, the degree to which these various measures are affected is somewhat greater in females than males, indicated as percent control, particularly at the three highest concentrations. Hematologic evaluation showed mild-to-moderate regenerative anemia at all concentrations in females and at the three highest concentrations in males. Exposure-related trends were noted for reticulocyte count, RBC count, MCV, Hb concentration, and Hct. Liver-to-body-weight ratios increased significantly in males at the two highest concentrations and in females at the highest concentration. Histopathologic effects at concentrations in excess of 62.5 ppm for male rats and 31 ppm for females consisted of excessive splenic congestion in the form of extramedullary hematopoiesis, hemosiderin accumulation in Kupffer cells, liver necrosis, centrilobular hepatocellular degeneration, renal tubular degeneration, intracytoplasmic Hb and hemosiderin deposition, and bone marrow hyperplasia. In addition, five moribund female rats were sacrificed from the highest concentrations, and one from the 250 ppm group. The lowest-observed-adverse-effect level (LOAEL) for hematological alterations was 31 ppm for female rats and 62.5 ppm for male rats. The 31 ppm exposure level was considered a no-observed-adverse-effect level (NOAEL) for male rats.

The mice exposed via the inhalation route exhibited clinical signs consistent with the hemolytic effects of EGBE at the two highest concentrations for both genders. Hematologic evaluation indicated a moderate regenerative anemia (marked by decreased RBC counts, increased reticulocyte counts, and increased MCV) with an increase in platelets at the three highest concentrations in both genders. Histopathological effects consisted of excessive extramedullary splenic hematopoiesis, renal tubular degeneration, hemosiderin deposition in the spleen and kidney and accumulation in Kupffer cells, and testicular degeneration. Forestomach necrosis, ulceration, inflammation, and epithelial hyperplasia were observed at concentrations >31 ppm for females and 62.5 ppm for males. In addition, four females and four males either died or were sacrificed moribund at the highest concentration. The NOAEL for male and female mice was 31 ppm and the LOAEL in mice was 62.5 ppm, based on histopathological changes in the forestomach.

I.A.3. Uncertainty Factors

$$\begin{aligned} \text{UF} &= 10 \\ &= 10 (\text{UF}_H) \times 1(\text{UF}_A) \times 1(\text{UF}_D). \end{aligned}$$

A UF of 10 was selected to account for the uncertainty associated with the variability of the human response (UF_H) to the effects of EGBE. Potentially susceptible subpopulations include individuals with enhanced metabolism or decreased excretion of BAA and individuals whose RBC membranes are more susceptible to the lysis caused by BAA, the precursor step to developing hemosiderin staining in the liver. Human in vitro studies suggest that the elderly and patients with fragile RBCs would not be more sensitive to the hemolytic effects of EGBE

than normal adults. Laboratory animal studies suggest that older animals are more sensitive than neonates and that females are more sensitive than males. While developmental studies do not reveal increased susceptibility in infants, none of the developmental studies examined fetal or infant blood for signs of effects from prenatal exposure to EGBE. Additionally, human responses to EGBE have not been observed under a broad range of exposure conditions (e.g., repeated or long-term exposures) and potentially sensitive subjects (e.g., individuals predisposed to hemolytic anemia or infants).

A UF of 1 was selected to account for the uncertainty associated with interspecies variability resulting from toxicodynamic and toxicokinetic differences between animals and humans (UF_A). Traditionally, these components (toxicodynamic and toxicokinetic) are individually represented by partial UFs of 3 for a total UF of 10 in the absence of chemical-specific information; thus, application of a full UF of 10 would depend on two areas of uncertainty (i.e., toxicokinetic and toxicodynamic uncertainties). In this assessment, the toxicokinetic uncertainty is addressed by the determination of an HED, using a combination of measured internal blood levels in the test animals and PBPK modeling. A value of 1 was selected for the toxicokinetic portion of the UF_A . Regarding toxicodynamics, *in vivo* (Carpenter et al., 1956) and *in vitro* (Ghanayem and Sullivan, 1993, [041609](#); Udden, 2002, [042111](#); Udden and Patton, 1994, [056374](#)) studies indicate that humans may be significantly less sensitive than rats to the hematological effects of EGBE. A value of 1 was selected for the toxicodynamic portion of the UF_A .

A UF to account for extrapolation from subchronic to chronic exposure (UF_S) was not needed because the RfD was derived from a chronic inhalation study.

A UF for LOAEL to NOAEL (UF_L) was not applied because the current approach is to address this extrapolation as one of the considerations in selecting a benchmark response (BMR) for BMD modeling. In this case, EPA concluded a 10% increase in hemosiderin staining, indicating a precursor to an adverse effect, is appropriate for use in deriving the RfD under the assumption that it represents a minimal biologically significant change.

A UF of 1 was selected to account for deficiencies in the database (UF_D). While no chronic oral studies or adequate human data are available for EGBE, PBPK models allow for deriving a BMDL from the chronic inhalation study using measured internal dose metrics and then extrapolating it back to an equivalent human oral dose. The database for inhalation exposure includes chronic and subchronic studies in two species (rats and mice), and several reproductive and developmental studies, including a two-generation reproductive toxicity study.

I.A.4. Additional Studies/Comments

Carpenter et al. (1956, [066464](#)) conducted three controlled inhalation studies. In the first study, a group of two men and six rats were exposed simultaneously for 4 hours to an EGBE concentration of 113 ppm in a 1,250 cubic foot room. Effects observed in humans included nasal and ocular irritation, a metallic taste, and belching. Erythrocyte osmotic fragility did not change for the men, yet rose appreciably for the rats. In a second study, a group of two men, one woman, and three rats were exposed to 195 ppm EGBE for two 4-hour periods, separated by a 30-minute recess, in a 6.5 cubic foot room. There was no change in the subjects' blood pressure, erythrocyte fragility, or pulse rate. They experienced nose and throat irritation, followed by ocular irritation and disturbed taste; one subject reported a headache. In the rats, an increase in erythrocyte fragility values was noted. In the third study, two men and two women were exposed for 8 hours to a 100 ppm EGBE concentration. No changes in blood pressure, erythrocyte fragility, or pulse rate were observed. Again, nasal and throat irritation followed by ocular irritation and a disturbing metallic taste were experienced. Two subjects reported headaches.

There are a number of case reports of acute ingestion of EGBE, consisting primarily of accidental or intentional ingestion. Bauer et al. (1992, [100087](#)) reported the effects of acute ingestion of 500 mL of window cleaner containing 9.1% EGBE and 2.5% ethanol by a 53-year-old alcoholic male. He was comatose with metabolic acidosis, shock and noncardiogenic pulmonary edema when brought to a hospital, approximately 10 hours after ingestion. He had increased heart rate, decreased blood pressure, and transient polyuria and hypoxemia. Hypochromic anemia was evident with an Hb concentration of 9.1 g/100 mL, a Hct of 25%, and thrombocytopenia. The patient recovered and was discharged after 15 days.

Gijzenbergh et al. (1989, [100134](#)) reported that a 23-year-old woman weighing 64 kg ingested approximately 25-30 g of EGBE (~400-500 mg/kg) and ethanol (~4:1 ratio) as a window cleaner in an apparent suicide attempt. She was comatose when admitted to the hospital, exhibiting dilated pupils, obstructive respiration, and metabolic acidosis, including depression of blood Hb concentration and hematuria. The presence of EGBE in the blood and dialysis fluid was confirmed. Treatment consisted of supportive therapy, forced diuresis, bicarbonate administration, and hemodialysis. Her Hb concentration fell from 11.9 g Hb/100 mL upon admission to 8.9 g Hb/100 mL. She was discharged after 8 days.

Gualtieri et al. (2003, [100140](#)) reported a case of a suicide attempt with an industrial-strength window cleaner. The 18-year-old male weighed 71 kg; he consumed between 360 and 480 mL of a concentrated glass cleaner that contained 22% EGBE, a dose equivalent to 1,131-1,509 mg/kg. He was admitted to the hospital with no abnormalities other than epigastric discomfort within 3 hours postingestion. Approximately 10 hours postadmission, the patient was

noticeably lethargic, weak, and hyperventilating, symptoms consistent with the onset of metabolic acidosis. BAA was measured; the highest serum concentration found was 4.86 mmol/L, collected approximately 16 hours postingestion. The patient was transferred to a tertiary care hospital where hemodialysis was initiated at approximately 24 hours postingestion. Ethanol therapy was started 30 minutes later. Treatment also consisted of intravenous doses of 100 mg thiamine and 50 mg folic acid every 12 hours and 50 mg pyridoxine every 6 hours. Following 4 hours of dialysis, the patient was alert and remained hemodynamically stable. Ten days after discharge, the patient was readmitted following a second ingestion of 480 mL of the same cleaner, an EGBE dose equivalent to 1,509 mg/kg. Treatment included ethanol therapy and hemodialysis, and was initiated within a few hours of ingestion to control the metabolic acidosis. Due to this early treatment, ethanol therapy had an impact on the disposition of EGBE and BAA. As with the first episode, metabolic acidosis was manifest. This high-dose oral ingestion was nearly 1.1-1.5 g EGBE/kg body weight. The highest serum BAA concentration was 2.07 mmol/L, collected 22 hours postingestion. No evidence of hemolysis or renal abnormalities was detected.

A 50-year-old woman ingested approximately 250-500 mL of a window cleaner containing 12% EGBE, representing ~30-60 mL, in an apparent suicide attempt (Rambourg-Schepens et al., 1988, [100191](#)). She was diagnosed with metabolic acidosis, hypokalemia, a rise in serum creatinine level, and a marked increase in urinary excretion of oxalate crystals. Moderate hemoglobinuria appeared on the third day postexposure, and a progressive erythropenia was noted. In the absence of more complete hematologic details from this and other similar case studies, it is not possible to determine whether these effects were due to hemolysis or other factors related to the profound blood chemistry changes observed. The clinical status improved gradually and the patient was discharged on the 10th day.

Burkhart and Donovan (1998, [056375](#)) summarized the case of a 19-year-old male who ingested 20-30 ounces, or ~590-885 mL, of a product that contained 25-35% EGBE (an exposure equivalent to ~177-265 mL, estimated at >3,000 mg/kg) along with 15-25% propylene glycol, 5-10% monoethanolamine, and 1-3% potassium hydroxide. On his arrival at the hospital 3.5 hours after ingestion, the patient was deeply comatose with severe hypotension. Hematuria developed on the second day, with no evidence of renal or hepatic toxicity; however, pulmonary toxicity consisting of severe aspiration pneumonia was present. The patient had a significant recovery, despite severe neurologic deficits that were slow to resolve.

Osterhoudt (2002, [100186](#)) reported on a 16-month-old girl who ingested an unknown amount of cleaning solution containing EGBE (10-30%), monoethanolamine (5-10%), alkoxylated linear alcohols (1-5%), ethylenediaminetetraacetic acid (1-5%), and potassium hydroxide (1-5%). Metabolic acidosis was manifest, and a single dose (15 mg/kg) of the aldehyde

dehydrogenase (ALDH) inhibitor fomepizole was administered. Within 2 hours, the metabolic acidosis was completely resolved, and there was no evidence of alkaline mucosal injury, hepatic or renal dysfunction, or hemolysis.

Dean and Krenzelok (1991, [597279](#)) reported that 24 children, aged 7 months to 9 years, were observed subsequent to oral ingestion of at least 5 mL of glass window cleaner containing EGBE in the 0.5-9.9% range. Two children drank more than 15 mL and were treated by gastric lavage. No symptoms of EGBE poisoning, such as metabolic acidosis, and no hemolysis were observed in any of the children.

Raymond et al. (1998, [100193](#)) reported on seven clerical workers who were evaluated 8 months after they entered a file room where the supervisor believed that EGBE had been applied overnight to strip the floor. Exact details of the product used were unknown, but based on containers found and exposure symptoms of noted intense eye and respiratory irritation, marked dyspnea, nausea, and faintness, the authors suggested that they were exposed to EGBE concentrations of 200-300 ppm. Of major concern were skin spots—cherry angiomas—that appeared between 4 and 22 weeks after exposure in six of the seven workers. All workers continued to experience recurrent eye and tracheobronchial irritation; four had a dry cough. Workplace air sampling conducted by a certified industrial hygienist 1 week after the floor stripping found no detectable EGBE, although traces (0.1-0.2 ppm) of formaldehyde were identified. Five years after the exposure, four of the workers who could be contacted reported that they continued to have outbreaks of new cherry angiomas. It should be noted that no other studies linking EGBE exposure to outbreaks of cherry angiomas are available in the literature. The authors included the observation that, since this report, they had seen three patients who they believe were also exposed to EGBE vapor in an unrelated incident, and who did not develop any skin spots. Cherry angiomas are the most common cutaneous vascular lesion; they are benign and formed by a proliferation of dilated venules. The spots occur more frequently with increasing age but can appear in younger individuals. There are reports in the literature of cherry angiomas appearing following individual exposure to other chemicals, such as bromides (Cohen et al., 2001, [100096](#)), glutaraldehyde (Raymond et al., 1998, [100193](#)), and sulfur mustard gas (Firooz et al., 1999, [100115](#)).

A cross section of 31 male workers, aged 22-45 years, employed for 1-6 years, who were exposed to low levels of EGBE in a beverage packing production plant were monitored by Haufroid et al. (1997, [042040](#)). The effect of external EGBE exposure and internal BAA levels on erythrocyte lineage were investigated by monitoring: RBC count, Hb, Hct, MCV, mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), haptoglobin (Hp), reticulocyte count, and osmotic resistance (OR), a measure of osmotic fragility. Also studied were serum glutamic-oxaloacetic and glutamic-pyruvic transaminases and renal creatinine and urinary retinol binding protein parameters. The average airborne

concentration of EGBE was 2.91 mg/m³, or 0.6 ppm (standard deviation [SD] of ±1.30 mg/m³ or 0.27 ppm). In addition, there was coexposure to methyl ethyl ketone. Single determinations of BAA in postshift urine samples were used to assess exposure to low levels of EGBE. No differences were observed for RBC counts, Hb, MCV, MCH, Hp, reticulocyte count, or OR between exposed and control workers. The only statistically significant change observed in exposed workers when compared with a matched control group (n = 21) was a 3.3% decrease in Hct ($p = 0.03$) and a 2.1% increase in MCHC ($p = 0.02$). The implications of these small erythroid effects are unclear. Both values are within their corresponding normal clinical ranges and, given that no statistically significant changes were observed in other erythroid parameters, they do not appear to be related to the more severe adverse effects observed in laboratory animals. Furthermore, no correlation was found between any of the nine erythroid parameters measured and the parameters of internal exposure. No significant differences were observed in hepatic and renal biomarkers.

Several human studies investigated the dermal absorption of EGBE. Jakasa et al. (2004, [100151](#)) dermally exposed six male research subjects, ages 22-55 years, to 50%, 90%, or neat EGBE for 4 hours on the forearm over an area of 40 cm². The dermal absorption of EGBE from aqueous solutions was markedly higher than from neat EGBE. In Jones et al. (2003, [100161](#)), four research subjects were exposed via inhalation of 50 ppm EGBE for 2 hours on nine separate occasions, with each occasion separated by 3 weeks, at varying temperatures and humidity levels. Results show that "baseline" dermal contribution to total body absorption of EGBE vapor in appropriately dressed workers was, on average, 11%. Higher temperature (30°C, mean 14%, $p = 0.03$) and greater humidity (65% relative humidity, mean 13%, $p = 0.1$) both increased dermal absorption. The wearing of whole-body overalls did not attenuate absorption (mean 10%). By combining several factors together in the industrial scenario, dermal absorption of vapors was reported to be as high as 39% of the total absorbed dose.

For more detail on Susceptible Populations, exit to [the toxicological review, Section 4.7 \(PDF\)](#)

I.A.5. Confidence in the Chronic Oral RfD

Study — High

Database — Medium/High

RfD — Medium/High

The overall confidence in the RfD is medium to high because the RfD has been calculated using a route-to-route extrapolation from the PBPK/benchmark concentration (BMC) method used to derive the RfC. This method accounts for pharmacokinetic differences between rats and humans using a validated PBPK model (Corley et al., 1994, [041977](#); Corley et al., 1997,

[041984](#)). There is high confidence in the NTP (2000, [196293](#)) study because it was a chronic study, employed both male and female rats and mice, had a wide range of exposure levels, and animals were observed twice daily. There is medium-to-high confidence in the database, because data are available for a variety of animal species, including humans. Confidence in the database is not high, because the potential for effects in humans from repeated, long-term exposures has not been investigated.

For more detail on Characterization of Hazard and Dose Response, exit to [the toxicological review, Section 6 \(PDF\)](#).

I.A.6. EPA Documentation and Review of the Chronic Oral RfD

Source Document — U.S. EPA (2010, [597544](#))

This document was provided for review to EPA scientists, interagency reviewers from other federal agencies and White House offices, and the public, and peer reviewed by independent scientists external to EPA. A summary and EPA's disposition of the comments received from the independent external peer reviewers and from the public is included in Appendix A of the *Toxicological Review of Ethylene Glycol Monobutyl Ether* (U.S. EPA, 2010, [597544](#)). [To review this appendix, exit to the toxicological review, Appendix A, Summary of and Response to External Peer Review Comments \(PDF\)](#).

I.A.7. EPA Contacts

Please contact the IRIS Hotline for all questions concerning this assessment or IRIS, in general, at (202) 566-1676 (phone), (202) 566-1749 (fax), or hotline.iris@epa.gov (email address).

I.B. Reference Concentration (RfC) for Chronic Inhalation Exposure

Substance Name — Ethylene glycol monobutyl ether (EGBE)

CASRN — 111-76-2

Section I.B. Last Revised — 3/31/2010

The RfC is an estimate (with uncertainty spanning perhaps an order of magnitude) of a continuous inhalation exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime. The RfC considers toxic effects for both the respiratory system (portal of entry) and for effects

peripheral to the respiratory system (extrarespiratory effects). The inhalation RfC (generally expressed in units of mg/m^3) is analogous to the oral RfD and is similarly intended for use in risk assessments for health effects known or assumed to be produced through a nonlinear (presumed threshold) mode of action.

Inhalation RfC values are derived according to *Methods for Derivation of Inhalation Reference Concentrations and Application of Inhalation Dosimetry* (U.S. EPA, 1994, [006488](#)). Because RfC values can also be derived for the noncarcinogenic health effects of substances that are carcinogens, it is essential to refer to other sources of information concerning the carcinogenicity of this chemical substance. If the U.S. EPA has evaluated this substance for potential human carcinogenicity, a summary of that evaluation will be contained in Section II of this file.

The previous RfC for EGBE (posted on the IRIS database in 1999 (U.S. EPA, 1999, [597365](#))) was $13 \text{ mg}/\text{m}^3$, based on an NTP (1998, [594421](#)) subchronic inhalation study in rats using changes in mean RBC count as the critical effect. C_{max} (peak blood concentrations) for BAA in arterial blood of female rats following inhalation exposure was estimated using the PBPK model of Lee et al. (1998, [041983](#)). The BMD_{05} was calculated to be $225 \mu\text{M}$, using the 95% lower confidence limit of the dose-response curve expressed in terms of the C_{max} for BAA in blood. The PBPK model of Corley et al. (1994, [041977](#); 1997, [041984](#)) was used to "back-calculate" to a human equivalent concentration (HEC) of 78 ppm ($380 \text{ mg}/\text{m}^3$) assuming continuous exposure (24 hours/day). The RfC was calculated by applying a UF of 30 (10 for intrahuman variability and 3 for extrapolation from a LOAEL) to the benchmark concentration, 95% lower bound (BMCL) HEC of $380 \text{ mg}/\text{m}^3$.

I.B.1. Chronic Inhalation RfC Summary

Critical Effect	Point of Departure*	UF	Chronic RfC
Hemosiderin deposition in the liver	BMCL(HEC): $16 \text{ mg}/\text{m}^3$ (PBPK and BMCL_{10})	10	$1.6 \text{ mg}/\text{m}^3$
Chronic (rat and mouse) inhalation study			
NTP (2000, 196293)			

*Conversion Factors and Assumptions - For the purposes of deriving an RfC for EGBE, hemosiderin staining data were evaluated in male and female rats from the 2 year chronic study by NTP (2000). A 10% extra risk was used as a BMR level for quantal data as this is at or near the limit of sensitivity in most cancer bioassays and in some noncancer bioassays as

well. Because the hemosiderin staining endpoint was observed in control animals and a 10% increase in incidence was within the observable range of the data, 10% extra risk was considered an appropriate BMR and a $BMCL_{10}$ an appropriate POD for derivation of the RfC (U.S. EPA, 1995, [005992](#); U.S. EPA, 2000, [052150](#)).

The AUC was selected as the appropriate dose metric due to the nature of the endpoint, hemosiderin deposition. This endpoint increased in severity with increased duration (subchronic to chronic) and is believed to be the result of the cumulative exposure to EGBE as opposed to a peak event. A $BMCL_{10}$ of 133 $\mu\text{mol hour/L}$ for hemosiderin staining in liver of male rats chronically exposed to EGBE (NTP, 2000, [196293](#)) was used as the POD to calculate the RfC. A human PBPK model (Corley et al., 1997, [041984](#)) was used to back-calculate to an HEC of 16 mg/m^3 (3.4 ppm) for the $BMCL_{HEC}$.

I.B.2. Principal and Supporting Studies

National Toxicology Program (NTP) (2000, [196293](#)) technical report on the toxicology and carcinogenesis studies of 2 butoxyethanol (CAS No. 111 76 2) in F344/N rats and B6C3F₁ mice (inhalation studies). <http://ntp.niehs.nih.gov/?objectid=070AC403-B110-CA79-3A23AF79DE7B752A>; <http://ntp.niehs.nih.gov/ntp/htdocs/LTrpts/tr484.pdf>

See Section 1.A.2 for a complete description.

I.B.3. Uncertainty Factors

$$\begin{aligned} UF &= 10 \\ &= 10 (UF_H) \times 1(UF_A) \times 1(UF_D). \end{aligned}$$

A UF of 10 was selected to account for the uncertainty associated with the variability of the human response (UF_H) to the effects of EGBE. Potentially susceptible subpopulations include individuals with enhanced metabolism or decreased excretion of BAA and individuals whose RBC membranes are more susceptible to the lysis caused by BAA, the precursor step to developing hemosiderin staining in the liver. Human in vitro studies suggest that the elderly and patients with fragile RBCs would not be more sensitive to the hemolytic effects of EGBE than normal adults. Laboratory animal studies suggest that older animals are more sensitive than neonates and that females are more sensitive than males. While developmental studies do not reveal increased susceptibility in infants, none of the developmental studies examined fetal or infant blood for signs of effects from prenatal exposure to EGBE. Additionally, human responses to EGBE have not been observed under a broad range of exposure conditions (e.g., repeated or long-term exposures) and potentially sensitive subjects (e.g., individuals predisposed to hemolytic anemia or infants).

A UF of 1 was selected to account for the uncertainty associated with interspecies variability resulting from toxicodynamic and toxicokinetic differences between animals and humans (UF_A). Traditionally, these components (toxicodynamic and toxicokinetic) are individually represented by partial UFs of 3 for a total UF of 10 in the absence of chemical-specific information; thus, application of a full UF of 10 would depend on two areas of uncertainty (i.e., toxicokinetic and toxicodynamic uncertainties). In this assessment, the toxicokinetic uncertainty is addressed by the determination of an HEC, using a combination of measured internal blood levels in the test animals and PBPK modeling. A value of 1 was selected for the toxicokinetic portion of the UF_A. Regarding toxicodynamics, in vivo (Carpenter et al., 1956, [066464](#)) and in vitro (Ghanayem and Sullivan, 1993, [041609](#); Udden, 2002, [042111](#); Udden and Patton, 1994, [056374](#)) studies indicate that humans may be significantly less sensitive than rats to the hematological effects of EGBE. A value of 1 was selected for the toxicodynamic portion of the UF_A.

A UF to account for extrapolation from subchronic to chronic exposure (UF_S) was not needed because the RfC was derived from a chronic inhalation study.

A UF to account for the extrapolation from a LOAEL to a NOAEL (UF_L) was not applied because the current approach is to address this extrapolation as one of the considerations in selecting a benchmark response (BMR) for BMD modeling. In this case, EPA concluded a 10% increase in hemosiderin staining, indicating a precursor to an adverse effect, is appropriate for use in deriving the RfC under the assumption that it represents a minimal biologically significant change.

A UF of 1 was selected to account for deficiencies in the database (UF_D). Studies that are available include chronic and subchronic studies for two species (rats and mice), and several reproductive and developmental studies, including a two-generation reproductive toxicity study. There are also limited human studies available following short-term inhalation exposure.

I.B.4. Additional Studies/Comments

See Section 1.A.4. for additional information.

For more detail on Susceptible Populations, exit to [the toxicological review, Section 4.7 \(PDF\)](#)

I.B.5. Confidence in the Chronic Inhalation RfC

Study — High
Data Base — Medium/High
RfC — Medium/High

The overall confidence in the RfC is medium to high because the RfC was derived from internal dose measures (PBPK method and combined PBPK/BMC method) which account for pharmacokinetic differences between rats and humans using PBPK models (Corley et al., 1997, [041984](#); Corley et al., 2005, [100100](#); Lee et al., 1998, [041983](#)) and actual measurements of internal blood concentrations in test animals of interest were used (Dill et al., 1998, [041981](#)). There is high confidence in the NTP (2000, [196293](#)) study because it was a chronic study, employed both male and female rats and mice, had a wide range of exposure levels, and animals were observed twice daily. There is medium-to-high confidence in the database, because data are available for a variety of animal species, including humans. Confidence is not high, because the potential for effects in humans from repeated, long-term exposures has not been investigated.

For more detail on Characterization of Hazard and Dose Response, exit to [the toxicological review, Section 6 \(PDF\)](#)

I.B.6. EPA Documentation and Review of the Chronic Inhalation RfC

Source Document — U.S. EPA (2010, [597544](#))

This document was provided for review to EPA scientists, interagency reviewers from other federal agencies and White House offices, and the public, and peer reviewed by independent scientists external to EPA. A summary and EPA's disposition of the comments received from the independent external peer reviewers and from the public is included in Appendix A of the *Toxicological Review of Ethylene Glycol Monobutyl Ether* (U.S. EPA, 2010, [597544](#)). *[To review this appendix, exit to the toxicological review, Appendix A, Summary of and Response to External Peer Review Comments \(PDF\)](#)*.

I.B.7. EPA Contacts

Please contact the IRIS Hotline for all questions concerning this assessment or IRIS, in general, at (202) 566-1676 (phone), (202) 566-1749 (fax), or hotline.iris@epa.gov (email address).

II. Carcinogenicity Assessment for Lifetime Exposure

Substance Name — Ethylene glycol monobutyl ether (EGBE)

CASRN — 111-76-2

Last Revised — 3/31/2010

This section provides information on three aspects of the carcinogenic assessment for the substance in question: the weight-of-evidence judgment of the likelihood that the substance is a human carcinogen, and quantitative estimates of risk from oral and inhalation exposure. Users are referred to Section I of this file for information on long-term toxic effects other than carcinogenicity.

The rationale and methods used to develop the carcinogenicity information in IRIS are described in the *Guidelines for Carcinogen Risk Assessment* (U.S. EPA, 2005, [086237](#)) and the *Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens* (U.S. EPA, 2005, [088823](#)). The quantitative risk estimates are derived from the application of a low-dose extrapolation procedure, and are presented in two ways to better facilitate their use. First, route-specific risk values are presented. The "oral slope factor" is a plausible upper bound on the estimate of risk per mg/kg-day of oral exposure. Similarly, a "unit risk" is a plausible upper bound on the estimate of risk per unit of concentration, either per µg/L drinking water (see Section II.B.1.) or per µg/m³ air breathed (see Section II.C.1.). Second, the estimated concentration of the chemical substance in drinking water or air when associated with cancer risks of 1 in 10,000, 1 in 100,000, or 1 in 1,000,000 is also provided.

This assessment revises the current carcinogenicity assessment of 1999 (U.S. EPA, 1999, [597365](#)) in which the human carcinogen potential could not be determined at that time.

II.A. Evidence for Human Carcinogenicity

II.A.1. Weight-Of-Evidence Characterization

Under the *Guidelines for Carcinogen Risk Assessment* (U.S. EPA, 2005, [086237](#)), EGBE is deemed "not likely to be carcinogenic to humans" at environmental concentrations at or below the RfD and RfC, based on laboratory animal evidence, mode-of-action information, and limited human study information. The available data indicate that carcinogenic effects from EGBE are not likely to occur in humans in the absence of the critical noncancer effects, including hepatic hemosiderin staining and irritant effects at the portal of entry, and are not likely to be carcinogenic to humans exposed at levels at or below the RfC and RfD values established in this assessment. Carpenter et al. (1956, [066464](#)) reported that no changes in erythrocyte osmotic fragility were found in human subjects exposed to up to 195 ppm (942

mg/m³; ~600 times the RfC) for two 4-hour periods separated by a 30-minute break. At oral doses of 400-500 mg/kg with a one-time bolus dose, hematuria has been noted in two human case reports. This dose is 3,000-3,500 times the RfD and would need to be sustained for a significant period of time to produce hemosiderin deposition. This is unlikely to occur because the primary response of humans to high oral doses of EGBE, as shown in the case studies, is metabolic acidosis, which, if not treated, can lead to shock and eventually death. No information is available on the carcinogenic effects of EGBE via the oral or inhalation route in humans. A 2 year inhalation bioassay with mice and rats (NTP, 2000, [196293](#)) reported tumors of the liver in male mice, forestomach tumors in female mice, and tumors of the adrenal medulla in female rats. Non-neoplastic effects in rats included hyaline degeneration of the olfactory epithelium and Kupffer cell pigmentation. Non-neoplastic effects in mice included forestomach ulcers and epithelial hyperplasia, hematopoietic cell proliferation, Kupffer cell pigmentation, hyaline degeneration of the olfactory epithelium (females only), and bone marrow hyperplasia (males only).

EGBE has been tested in conventional genotoxicity tests for its potential to induce gene mutations in vitro and for cytogenicity in both in vitro and in vivo assays. The available data do not support a mutagenic or clastogenic mechanism for EGBE. Two laboratories (Elias et al., 1996, [042011](#); Hoflack et al., 1995, [100147](#)) reported weak genotoxicity responses in vitro at high treatment concentrations, but results were not replicated in five other labs reporting negative results.

The hypothesized MOA for the tumors observed following EGBE treatment involves exposure to high doses for prolonged periods of time. The weight of evidence indicates that EGBE is not likely to be carcinogenic to humans at expected environmental concentrations.

For more detail on Characterization of Hazard and Dose Response, exit to [the toxicological review, Section 6 \(PDF\)](#)

For more detail on Susceptible Populations, exit to [the toxicological review, Section 4.7 \(PDF\)](#)

II.A.2. Human Carcinogenicity Data

There are currently no human studies addressing the potential carcinogenicity of EGBE.

II.A.3. Animal Carcinogenicity Data

NTP (2000, [196293](#)) conducted a 2-year inhalation study on EGBE in both genders of F344/N rats and B6C3F₁ mice. Rats (50/gender/group) were exposed to concentrations of 0, 31, 62.5,

and 125 ppm (0, 150, 302, and 604 mg/m³) and mice (50/gender/group) were exposed to concentrations of 0, 62.5, 125, and 250 ppm (0, 302, 604, and 1,208 mg/m³). The NTP report stated that the highest exposure was selected to produce a 10-15% depression in hematologic indices and survival was significantly decreased in male mice at 125 and 250 ppm (54.0 and 53.1%, respectively). While the NTP researchers report that no effect on survival was observed in rats, the female rats appeared to show a trend toward decreased survival that may have been attributable to the hematological effects. Mean body weights of rats exposed to 31 and 62.5 ppm were similar to those of control animals. Mean body weights of the exposed mice were generally less than for controls, with females experiencing greater and earlier reductions. From week 17 to the end of the study, the mean body weights of 125 ppm female rats were generally less than those of controls.

At the end of the 2-year chronic bioassay (NTP, 2000, [196293](#)), neoplastic effects were observed in female rats and in male and female mice. In female rats, the combined incidence of benign and/or malignant pheochromocytoma of the adrenal medulla was 3/50, 4/50, 1/49, and 8/49. The incidence in the high-dose group (16%) did not represent a statistically significant increase over the chamber control group (6%), but it exceeded the historical control ($6.4 \pm 3.5\%$; range 2-13%) for this effect.

The low survival rate in male mice exposed to 125 and 250 ppm EGBE may have been due to carcinogenic effects in the liver. A high rate of hepatocellular carcinomas was found in these exposure groups (10/50 [control], 11/50, 16/50, 21/50); the increase at the high-exposure level was statistically significant ($p < 0.01$). However, when hepatocellular adenomas and carcinomas were combined, no significant increase was observed in any exposure group. The incidence of hemangiosarcomas in males exposed to 250 ppm (8%) was also significantly increased ($p = 0.046$) relative to chamber controls (0/50, 1/50, 2/49, 4/49) and exceeded the range of historical controls (14/968; $1.5 \pm 1.5\%$; range 0-4%). No significant increases in benign or malignant hepatocellular tumors or hemangiosarcomas were noted in the female mice, and the incidence of hepatocellular adenomas actually decreased significantly ($p < 0.05$) in relation to the control chamber group (16/50, 8/50, 7/49, 8/49). It should be noted that in light of the high survival rate of the exposed female mice relative to controls (29/50, 31/50, 33/50, 36/50), the high exposure of 250 ppm may not have provided the maximum tolerated dose.

Forestomach squamous cell papillomas and carcinomas, combined, were significantly increased (trend test = 0.003) in female mice relative to the chamber control group (0/50, 1/50, 2/50, 6/50). The incidence of these tumor types (12%) at the highest exposure level was also statistically significant and exceeded the range for the occurrence of these tumors in historical controls ($0.9 \pm 1.1\%$; range 0-3%). The first incidence of these tumors appeared in the group exposed to 250 ppm at 582 days, as compared to 731 days at 62.5 and 125 ppm, indicating a

decreased latency period in the highest exposure group. While the incidence of these types of forestomach tumors was not significantly increased over controls in male mice (1/50, 1/50, 2/50, 2/50), the incidence of squamous cell papillomas (4%) in the two highest exposure groups exceeded the range for historical controls ($0.5 \pm 0.9\%$; range 0-2%). The increased incidence of forestomach neoplasms in males, as in females, occurred in groups with ulceration and hyperplasia.

The NTP (2000, [196293](#)) study concluded that there was no evidence showing carcinogenic activity in male F344/N rats and equivocal evidence of carcinogenic activity in female F344/N rats, based on increased combined incidences of benign (mainly) and malignant pheochromocytoma of the adrenal medulla. The researchers reported some evidence of carcinogenic activity in male B6C3F₁ mice based on increased incidences of hemangiosarcoma of the liver and an increase in the incidence of hepatocellular carcinoma, as well as some evidence of carcinogenic activity in female B6C3F₁ mice based on increased incidence of forestomach squamous cell papilloma (mainly) or carcinoma.

With respect to the pheochromocytomas reported in female rats, while the data showed a positive trend ($p = 0.044$) and the high-dose tumor frequencies (16%) were above the upper range of historical controls (13%), the tumor incidence data were not statistically significant. Further, the NTP (2000, [196293](#)) report noted that pheochromocytomas can be difficult to distinguish from non-neoplastic adrenal medullary hyperplasia. The presence of mild-to-moderate compression of the adjacent tissue is a primary criterion used to distinguish pheochromocytomas from medullary hyperplasia; most tumors observed were small and not substantially larger than the more severe grades of adrenal medullary hyperplasia. Interpretation of these tumors should be done cautiously. Given the marginal dose response, lack of tumor evidence in any other organ system of the rats, and reported difficulties in distinguishing pheochromocytomas from non-neoplastic adrenal medullary hyperplasia, this tumor type was not given significant weight in the qualitative or quantitative assessment of EGBE cancer potential.

II.A.4. Supporting Data for Carcinogenicity

Although weakly genotoxic responses have been obtained in two laboratories (Elias et al., 1996, [042011](#); Hoflack et al., 1995, [100147](#)), EGBE is not expected to be mutagenic or clastogenic based on the available data. The NTP reported negative responses for mutagenicity when EGBE was tested in *Salmonella typhimurium* strains TA97, TA98, TA100, TA1535, and TA1537 at up to 10 mg/plate with and without metabolic activation (Zeiger et al., 1992, [095748](#)). However, Hoflack et al. (1995, [100147](#)) reported that at 38 $\mu\text{mol/plate}$ (4.5 mg/plate), EGBE induced a weak mutagenic response in salmonella tester strain TA97a in the absence of S9 mix (Hoflack et al., 1995, [100147](#)). The work of Hoflack and colleagues was

repeated by Gollapudi et al. (1996, [100137](#)), and EGBE was found to be negative in these tester strains when evaluated at 0.5, 1.0, 2.5, 5.0, 8.5, and 10 mg/plate in the presence and absence of Aroclor-induced rat liver S9 mix. Thus, the weak positive result reported in salmonella TA97a by Hoflack et al. (1995, [100147](#)) is unconfirmed. A plausible explanation put forth by Gollapudi et al. (1996, [100137](#)) is that, given the sensitivity of the Ames test, perhaps the weak positive result reported by Hoflack et al. (1995, [100147](#)) is attributed to an impurity in their test material.

Elias et al. (1996, [042011](#)) reported that EGBE did not induce chromosomal aberrations in Chinese hamster V79 fibroblast cells but that EGBE, at treatment concentrations of ≥ 8.5 mM, weakly induced sister chromatid exchanges (SCEs) and micronuclei (MN) and potentiated the clastogenicity induced by methyl methanesulfonate. Elias et al. (1996, [042011](#)) also reported that EGBE weakly induced aneuploidy (numerical chromosomal anomalies) in V79 cells; however, this response was found at very high concentrations (16.8 mM EGBE).

When tested at doses nearing toxicity, EGBE and its metabolite butoxyacetaldehyde (BAL) were not mutagenic in an in vitro gene mutation assay using Chinese hamster ovary (CHO) cells (CHO-AS52) (Chiewchanwit and Au, 1995, [041999](#)). In contrast, Elias et al. (1996, [042011](#)) reported that both EGBE and BAL weakly induced gene mutations in Chinese hamster V79 cells only at high treatment concentrations (≥ 7.5 mg/mL). It should be noted that Chiewchanwit and Au (1995, [041999](#)) reported high cytotoxicity at 38.1 mM EGBE (4.5 mg/mL). The gene mutation data presented by Elias et al. (1996, [042011](#)) is in graphic form only with mean values and no SDs presented. The presence or absence of cytotoxicity was not reported. BAL was also tested for induction of deoxyribonucleic acid (DNA) damage in the mouse endothelial cell line, SVEC4-10, using the comet assay. BAL failed to produce a statistically significant increase in DNA strand breaks at any of the concentrations or time points examined (Klaunig and Kamendulis, 2004, [594442](#); Klaunig and Kamendulis, 2005, [100165](#); Reed et al., 2003, 594436). Other lines of evidence indicate that direct interaction of BAL with the DNA molecules does not play a significant role in the carcinogenic activity of EGBE. First, BAL causes cytotoxicity at levels associated with chromosome effects, and cytotoxicity itself can have effects that result in chromosome damage, such as reduction in the repair of SCEs. Second, acetaldehyde is recognized as "weakly mutagenic" and structural comparisons of the aldehyde metabolites of glycol ethers shows that longer-chain aldehydes such as BAL are less mutagenic (Chiewchanwit and Au, 1995, [041999](#)). Third, if BAL were a stable mutagenic metabolite in any of the in vitro assays exposed to EGBE, one would expect them to give positive results; however, the results were generally negative. Elias et al. (1996, [042011](#)) suggested that the V79 cells possess neither ALDH nor alcohol dehydrogenase. The relevance of these studies, or of any systems that lack these enzymes, is of limited value in elucidating the MOA of toxicity in biological systems that possess these enzymes. BAA has been found negative for reverse mutations in *S. typhimurium* his⁻ with and without metabolic

activation (Hoflack et al., 1995, [100147](#)). Concentrations of up to 8 $\mu\text{mol}/\text{plate}$ were tested, and dose was limited by toxicity. BAA (up to 10 mM) was also found negative for induction of DNA damage in SVEC4-10 mouse endothelial cells (Klaunig and Kamendulis, 2005, [100165](#)) and in an SCE assay in V79 cells (Elias et al., 1996, [042011](#)). BAA was weakly positive for aneuploidy in V79 cells at 0.38 mM and positive for MN induction in the same cell line at 10 mM, as reported by Elias et al. (1996, [042011](#)). As noted above, the data means are presented in graphic form without SDs and cannot be critically evaluated; no cytotoxicity data are reported.

EGBE did not increase the incidence of MN in the bone marrow cells of male mice or rats (NTP, 1996, [042064](#)). Animals were given three intraperitoneal injections of EGBE 24 hours apart and sacrificed 24 hours after the last injection; rats were dosed at 0, 7, 14, 28, 56, 112.5, 225, or 450 mg/kg and mice were dosed at 0, 17, 34, 69, 137.5, 275, or 550 mg/kg (NTP, 1996, [042064](#)). There was high mortality (2/5 mice survived) in mice injected with 1,000 mg/kg doses of EGBE. Keith et al. (1996, [041625](#)) treated Sprague-Dawley rats and transgenic FVB/N mice carrying the v-Ha-ras oncogene with a single oral dose of 120 mg/kg EGBE; there was no increase in DNA adducts in the brain, liver, kidney, testes, or spleen of the rats, and no changes in DNA methylation patterns in either species.

II.B. Quantitative Estimate of Carcinogenic Risk from Oral Exposure

No reliable human epidemiological studies or chronic oral animal studies are available that address the potential carcinogenicity of EGBE. However, the NTP (2000) performed a 2-year inhalation bioassay with rats and mice and found no evidence of carcinogenic activity in male F344/N rats and equivocal evidence of carcinogenic activity in female F344/N rats, based on increased combined incidences of benign and malignant pheochromocytoma (mainly benign) of the adrenal medulla. The researchers reported some evidence of carcinogenic activity in male B6C3F₁ mice, based on an increased incidence of hemangiosarcoma of the liver and an increase in the incidence of hepatocellular carcinoma that may have been exposure related. They also reported some evidence of carcinogenic activity in female B6C3F₁ mice, based on an increased incidence of forestomach squamous cell papilloma or carcinoma (mainly papilloma).

The MOAs presented for the animal tumors indicate that both high doses and sustained periods of exposure are necessary for the carcinogenic response. The available human exposure/response information indicates that these conditions are unlikely to occur because the primary response of humans to high oral doses of EGBE, as shown in the case studies, is metabolic acidosis, which, if not treated, can lead to shock and eventually death. Further,

based on simulations from PBPK modeling, the maximum blood concentrations of BAA that could be produced in humans following exposure to a saturated atmosphere of EGBE would be below those needed to produce hemolysis (Corley et al., 2005, [100100](#)).

The available data indicate that carcinogenic effects from EGBE are not likely to occur in humans in the absence of the critical noncancer effects, including hepatic hemosiderin staining and irritant effects at the portal of entry, and are not likely to be carcinogenic to humans exposed at levels at or below the RfD value established in this assessment. Based on its physical-chemical properties, toxicokinetic and dynamic factors, and MOA information, under existing EPA guidelines (U.S. EPA, 2005, [086237](#)), EGBE is judged not likely to be carcinogenic to humans at expected environmental concentrations.

Following the U.S. EPA (2005, [086237](#)) Guidelines for Carcinogen Risk Assessment, a nonlinear approach to dose-response assessment is taken for agents, such as EGBE, for which the most plausible mode of action at low doses is consistent with nonlinearity. The RfD of 0.1 mg/kg-day derived in Section 5.2 of the Toxicological Review represents the outcome of nonlinear assessment based on hemolytic effects (i.e., hemosiderin deposition) associated with oral and exposure to EGBE. Doses (or concentrations) of EGBE below the RfD would not be expected to produce hemolytic effects (i.e., hemosiderin deposition) and is therefore not expected to produce any increase in cancer risk.

II.C. Quantitative Estimate of Carcinogenic Risk from Inhalation Exposure

No reliable human epidemiological studies are available that address the potential carcinogenicity of EGBE. The NTP (2000, [196293](#)) performed a 2-year inhalation bioassay with rats and mice and found no evidence of carcinogenic activity in male F344/N rats and equivocal evidence of carcinogenic activity in female F344/N rats, based on increased combined incidences of benign and malignant pheochromocytoma (mainly benign) of the adrenal medulla. The researchers reported some evidence of carcinogenic activity in male B6C3F₁ mice, based on an increased incidence of hemangiosarcoma of the liver and an increase in the incidence of hepatocellular carcinoma that may have been exposure related. They also reported some evidence of carcinogenic activity in female B6C3F₁ mice, based on an increased incidence of forestomach squamous cell papilloma or carcinoma (mainly papilloma).

The MOAs presented for the animal tumors indicate that both high doses and sustained periods of exposure are necessary for the carcinogenic response. The available human exposure/response information indicates that these conditions are unlikely to occur because

the primary response of humans to high oral doses of EGBE, as shown in the case studies, is metabolic acidosis, which, if not treated, can lead to shock and eventually death. Further, based on simulations from PBPK modeling, the maximum blood concentrations of BAA that could be produced in humans following exposure to a saturated atmosphere of EGBE would be below those needed to produce hemolysis (Corley et al., 2005, [100100](#)).

The available data indicate that carcinogenic effects from EGBE are not likely to occur in humans in the absence of the critical noncancer effects, including hepatic hemosiderin staining and irritant effects at the portal of entry, and are not likely to be carcinogenic to humans exposed at levels at or below the RfC value established in this assessment. Based on its physical-chemical properties, toxicokinetic and dynamic factors, and MOA information, under existing EPA guidelines (U.S. EPA, 2005, [086237](#)), EGBE is judged not likely to be carcinogenic to humans at expected environmental concentrations.

Following the U.S. EPA (2005, [086237](#)) Guidelines for Carcinogen Risk Assessment, a nonlinear approach to dose-response assessment is taken for agents, such as EGBE, for which the most plausible mode of action at low doses is consistent with nonlinearity. The RfC of 1.6 mg/m³ derived in Section 5.1 of the Toxicological Review (U.S. EPA, 2010, [597544](#)) represents the outcome of a nonlinear assessment based on hemolytic effects (i.e., hemosiderin deposition) associated with inhalation exposures to EGBE. Doses (or concentrations) of EGBE below the RfC would not be expected to produce hemolytic effects (i.e., hemosiderin deposition) and is therefore not expected to produce any increase in cancer risk.

II.D. EPA Documentation, Review, And Contacts (Carcinogenicity Assessment)

II.D.1. EPA Documentation

Source Document — U.S. EPA (2010, [597544](#))

This document has been provided for review to EPA scientists, interagency reviewers from other federal agencies and White House offices, and the public, and peer reviewed by independent scientists external to EPA. A summary and EPA's disposition of the comments received from the independent external peer reviewers and from the public is included in Appendix A of the *Toxicological Review of Ethylene Glycol Monobutyl Ether* (U.S. EPA, 2010, [597544](#)). ***To review this appendix, exit to the toxicological review, Appendix A, Summary of and Response to External Peer Review Comments (PDF).***

II.D.2. EPA Review

Agency Consensus Date — 3/31/2010

II.D.3. EPA Contacts

Please contact the IRIS Hotline for all questions concerning this assessment or IRIS, in general, at (202) 566-1676 (phone), (202) 566-1749 (fax), or hotline.iris@epa.gov (email address).

III. [reserved]

IV. [reserved]

V. [reserved]

VI. Bibliography

Ethylene glycol monobutyl ether (EGBE)
CASRN — 111-76-2

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VII. Revision History

Ethylene glycol monobutyl ether (EGBE)
CASRN — 111-76-2
File First On-Line — 12/30/1999

Date	Section	Description
12/30/1999	I., II., VI.	RfD, RfC, and carcinogenicity assessment first on line
12/03/2002	I.A.6., I.B.6., II.D.2.	Screening-Level Literature Review Findings message has been added.
03/31/2010	I., II., VI.	RfD, RfC, and cancer assessment sections updated.

VIII. Synonyms

Ethylene glycol monobutyl ether (EGBE)
CASRN — 111-76-2
Section VII. Last Revised — 3/31/2010

- Bucs
- Butoxyethanol
- N-Butoxyethanol
- 2-Butoxyethanol
- 2-Butoxy-1-Ethanol
- Butyl Cellosolve
- O-Butyl Ethylene Glycol

- Butyl Glycol
- Butyl Oxitol
- Dowanol EB
- Ektasolve EB
- Ethylene Glycol N-Butyl
- Gafcol EB
- Glycol Butyl Ether
- Glycol Ether EB
- Glycol Ether EB Acetate
- Glycol Monobutyl Ether
- Jeffersol EB
- Monobutyl Ether Of Ethylene Glycol
- Monobutyl Glycol Ether
- 3-Oxa-1-Heptanol
- Poly-Solv EB



Data Sheet

SICC Product Code: V1391
 Shrieve Chemical Company Name: BIO-BASE™ 300
 Material ID: 47013146
 Updated: October 2008

Product Name	NEOFLO 3-14			
Category	Olefin & Paraffin Drilling Fluids			
Description	<ul style="list-style-type: none"> • NEOFLO 3-14 is part of our Standard level series in the family of olefin and paraffin drilling fluids. • NEOFLO 3-14 is supplied as a component to Shrieve Chemical Products Company which then markets paraffin base fluids under their BIO-BASE™ trade name. • NEOFLO 3-14 is especially well-suited for land-based applications. It biodegrades aerobically and is non-toxic in the water column. The product has a low viscosity and pour point and performs as well or better than mineral oil based fluids. • NEOFLO 3-14 is a linear paraffin with a carbon chain length between C11 and C14. 			
Classification	This product is classified as a synthetic according to the US EPA definition. "Synthetic material as applied to synthetic-based drilling fluid means material produced by the reaction of specific purified chemical feedstock, as opposed to the traditional base fluids such as diesel and mineral oil which are derived from crude oil solely through physical separation processes. Physical separation processes include fractionation and distillation and/or minor chemical reactions such as cracking and hydro processing."			
Typical Chemical Properties	Property	Unit	Value	Method
	C10 & Lower	%m/m	0.3	SCG 1078
	C11	%m/m	21.5	SCG 1078
	C12	%m/m	27.9	SCG 1078
	C13	%m/m	21.5	SCG 1078
	C14	%m/m	27.0	SCG 1078
	C15 & Higher	%m/m	1.7	SCG 1078
	Total Paraffins	%m/m	83.0	GC
	Total Olefins	%m/m	15.6	GC
	Branching	%m/m	16.2	SCG 1086
	Alcohols	%m/m	1.4	GC
	Color, Pt-Co		5	ASTM D 1209

Typical Physical Properties	Property	Unit	Value	Method
	Density @ 20°C	kg/m ³	759	ASTM D 4052
	Flash Point	°C	83	ASTM D 93
	Fire Point	°C	88	ASTM D 92
	Pour Point	°C	-17	ASTM D 97
	Aniline Point	°C	83	ASTM D 611
	Kinematic Viscosity			ASTM D 445
	@ 0°C	cSt	3.4	
	@ 25°C	cSt	2.0	
	@ 40°C	cSt	1.5	
	Boiling Range			ASTM D 86
	5%	°C	230	
	95%	°C	260	
Vapor Pressure @ 20°C	mmHg	0.135	HSGC	

Typical Environmental Properties	Property	Method/Endpoint	Value	Notes	
	<u>Biodegradation</u>				
	Anaerobic	Modified ISO 11734 275-d	17 %	BRR ¹ = 2.4	
	Aerobic	BOD 28-d	37 %		
	Aerobic	BOD 62-d	40 %		
	Aerobic	OECD 306 28-d	58 %		
	Aerobic	Sturm CO2 evolution 28-d	40 - 55 %		
	<u>Water Column</u>				
	<u>Toxicity</u>				
	<i>Pimephales promelas</i>	96-h LC ₅₀	> 1000 mg/L		
	<i>Daphnia magna</i>	48-h EC ₅₀	> 1000 mg/L		
	<u>Sediment Toxicity</u>				
	<i>Leptocheirus plumulosus</i>	Formulated sediment 10-d LC ₅₀	220 mg/kg	STR ² = 13	
PAH	EPA 1654A	< 5 mg/kg			

¹ BRR = biodegradation rate ratio (% biodegradation of C1618 internal olefin reference/% biodegradation of test material)

² STR = sediment toxicity ratio (C1618 internal olefin reference LC50/test material LC50)

<p>Limitation on Use</p>	<p>WARNING: FOR PARAFFIN BASE FLUIDS</p> <p><u>OFFSHORE DISCHARGE</u></p> <p>DO NOT USE THIS PRODUCT FOR DRILLING OPERATIONS INVOLVING MARINE DISCHARGE OF CUTTINGS CONTAINING THIS PRODUCT. DO NOT DISCHARGE THIS PRODUCT OR DRILL CUTTINGS CONTAINING THIS PRODUCT INTO ENVIRONMENTS THAT MAY BE OR MAY BECOME ANAEROBIC (ABSENT OF OXYGEN). Anaerobic conditions are likely to exist at the seafloor and within cuttings piles in certain conditions. Testing jointly developed by the E&P industry and the US EPA indicates that this product does not biodegrade anaerobically.</p> <p><u>LAND DRILLING AND ZERO DISCHARGE OPERATIONS</u></p> <p>THIS PRODUCT SHOULD ONLY BE USED FOR LAND DRILLING OPERATIONS AND ZERO DISCHARGE OPERATIONS WHERE DRILL CUTTINGS ARE MANAGED VIA ACCEPTED CUTTINGS MANAGEMENT PRACTICES SUCH AS INJECTION, THERMAL TREATMENT, LAND FARMING, OR COMPOSTING. Similar to diesel cuttings, if drill cuttings containing this product are discharged to or placed in the environment, best cuttings management practices should be used.</p>
<p>Storage and Handling</p>	<p>NEOFLO products may be stored in carbon steel tanks. Hoses manufactured from polyethylene, butyl rubber, or neoprene liners are suitable for discharging. A nitrogen blanket is recommended to reduce potential for product degradation. Antioxidants can be added, upon request, to enhance the long-term stability. The recommended storage temperature is 20°C, the recommended maximum is 65°C and the recommended minimum is -10°C to prevent freezing. NEOFLO 3-14 is classified as "combustible" by the United States Department of Transportation (US DOT). Additional advice on the storage and handling of NEOFLO products can be found on our website at www.shell.com/chemicals, or by contacting your local Shell chemicals companies representative.</p>
<p>Hazard Identification</p>	<p>NEOFLO products have been demonstrated to have a relatively low order of toxicity by the routes of exposure (oral, dermal, inhalation) encountered in normal handling. Like many hydrocarbon liquids, paraffins will dry and de-fat the skin on prolonged contact and will result in skin irritation and dermatitis. Also, like other hydrocarbons, this product can be dangerous when aspirated or ingested. Before handling the product, refer to the Material Safety Data Sheet that is available from your local Shell chemicals companies representative. Additional information can be found on our website at www.shell.com/chemicals in the Material Safety Data Sheet section.</p>
<p>Emergency Helpline</p>	<p>Europe (Rotterdam) + 31 (0) 10 431 3233 Americas (United States) + 1 800 424 9300 Asia (Singapore) +65 6263 2974 or the emergency telephone number mentioned in the Safety Data Sheet relevant for your company's country and language.</p>

**Shell
Warranties**

The information contained in this publication is to the best of our knowledge, true and accurate, but any recommendations or suggestions that may be made are without guarantee, since the conditions of use are beyond our control. Furthermore, nothing contained herein shall be construed as a recommendation to use any product in conflict with existing patents covering any material or its use.

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NEOFLO is a trademark owned and used by companies of the Shell Group.

Shrieve Chemical Products, Inc., located in The Woodlands, Texas, is a privately owned, independent supplier of performance fluids and specialty chemicals including drilling fluids, additives and production chemicals.

BIO-BASE™ is a trademark of Shrieve Chemical Products Company.

SAFETY DATA SHEET

SECTION 1: Identification of the substance/mixture and of the company/undertaking

Product identifier

Product name: Eastman(TM) 2-Ethylhexanol

Product No.: EAN 903608. 00175-00, P0017500, P0017501, P0017503, P0017505, P001750A, P001750B, E00175E1, E00175E2, E00175E3, E0017504, P0017506, P0017508

Synonyms, Trade Names: 2EH, 00175-00

Additional identification

Chemical name: 2-ethylhexanol
CAS-No.: 104-76-7

Relevant identified uses of the substance or mixture and uses advised against

Identified uses: Solvent

Uses advised against: None known.

Details of the supplier of the safety data sheet**Manufacturer / Supplier**

Eastman Chemical Company
200 South Wilcox Drive
Kingsport, TN 37660-5280 US
+14232292000

Visit our website at www.EASTMAN.com or email emnmsds@eastman.com

Emergency telephone number:

For emergency health, safety, and environmental information, call 1-423-229-4511 or 1-423-229-2000.

For emergency transportation information, in the United States: call CHEMTREC at 800-424-9300 or call 423-229-2000.

SECTION 2: Hazards identification

Hazard Classification:**Physical Hazards**

Flammable liquids Category 4

Health Hazards

Acute toxicity (Inhalation - vapor) Category 4
Skin Corrosion/Irritation Category 2
Serious Eye Damage/Eye Irritation Category 2A
Specific Target Organ Toxicity - Category 3
Single Exposure (Inhalation - vapor)

OSHA Specified Hazards: not applicable

Warning label items including precautionary statement:

Pictogram:**Signal Words:**

Warning

Hazard Statement(s):

H227: Combustible liquid.
H332: Harmful if inhaled.
H315: Causes skin irritation.
H319: Causes serious eye irritation.
H336: May cause drowsiness or dizziness.

Precautionary Statement:**Prevention:**

P210: Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P280: Wear protective gloves/protective clothing/eye protection/face protection.
P261: Avoid breathing dust/fume/gas/mist/vapors/spray.
P271: Use only outdoors or in a well-ventilated area.
P264: Wash hands thoroughly after handling.

Response:

P370 + 378: In case of fire: Use water spray, carbon dioxide, dry chemical or foam for extinction.
P304+P340: IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P312: Call a POISON CENTER/doctor/.../if you feel unwell.
P302+P352: IF ON SKIN: Wash with plenty of water/...
P332+P313: If skin irritation occurs: Get medical advice/attention.
P362: Take off contaminated clothing.
P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P337+P313: If eye irritation persists: Get medical advice/attention.

Storage:

P403+P235: Store in a well-ventilated place. Keep cool.
P233: Keep container tightly closed.
P405: Store locked up.

Disposal:

P501: Dispose of contents/container to an appropriate treatment and disposal facility in accordance with applicable laws and regulations, and product characteristics at time of disposal.

Hazard(s) not otherwise classified (HNOC):

None known.

SECTION 3: Composition/information on ingredients**Substances / Mixtures**

General information:

Chemical name	Concentration	Additional Identification	Notes
2-ethylhexanol	100%	CAS-No.: 104-76-7	

* All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

This substance has workplace exposure limit(s).

SECTION 4: First aid measures

Description of first aid measures

Inhalation:

Move to fresh air. If breathing is difficult, give oxygen. If breathing stops, provide artificial respiration. Get medical attention immediately.

Eye contact:

Immediately flush with plenty of water for at least 15 minutes. If easy to do, remove contact lenses. Get medical attention. In case of irritation from airborne exposure, move to fresh air. Get medical attention if symptoms persist.

Skin contact:

Immediately flush with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention. Wash contaminated clothing before reuse. Destroy or thoroughly clean contaminated shoes.

Ingestion:

Seek medical advice.

Most important symptoms and effects, both acute and delayed:

May irritate and cause redness and pain.

Indication of any immediate medical attention and special treatment needed

Hazards:

None known.

Treatment:

Treat symptomatically.

SECTION 5: Firefighting measures

General Fire Hazards:

Combustible liquid and vapor. USE WATER WITH CAUTION. Material will float and may ignite on surface of water.

Extinguishing media

Suitable extinguishing media:

Water spray. Dry chemical. Carbon Dioxide. Foam.

Unsuitable extinguishing media:

None known.

Special hazards arising from the substance or mixture:

None known.

Advice for firefighters

Special fire fighting procedures:

Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters: Self-contained breathing apparatus and full protective clothing must be worn in case of fire.

SECTION 6: Accidental release measures

Personal precautions, protective equipment and emergency procedures: Wear appropriate personal protective equipment.

Environmental Precautions: Avoid release to the environment.

Methods and material for containment and cleaning up: Eliminate sources of ignition. Absorb spill with vermiculite or other inert material, then place in a container for chemical waste. Large Spillages: Flush spill area with water spray. Prevent runoff from entering drains, sewers, or streams. Dike for later disposal.

Notification Procedures: In the event of a spill or accidental release, notify relevant authorities in accordance with all applicable regulations.

SECTION 7: Handling and storage:

Precautions for safe handling: Avoid breathing vapor. Avoid contact with eyes, skin, and clothing. Use only with adequate ventilation. Wash thoroughly after handling.

Conditions for safe storage, including any incompatibilities: Keep container closed.

Specific end use(s): Solvent

SECTION 8: Exposure controls/personal protection**Control Parameters
Occupational Exposure Limits**

Country specific exposure limits have not been established or are not applicable unless listed below.

Exposure controls

Appropriate engineering controls: Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level.

Individual protection measures, such as personal protective equipment

General information: Eye bath. Washing facilities. Safety shower.

Eye/face protection: Wear safety glasses with side shields (or goggles). Wear a full-face respirator, if needed.

Skin protection

Hand Protection: Wear chemical-resistant gloves, footwear, and protective clothing appropriate for the risk of exposure. Contact health and safety professional or manufacturer for specific information.

Other: No data available.

Respiratory Protection: If engineering controls do not maintain airborne concentrations below recommended exposure limits (where applicable) or to an acceptable level (in countries where exposure limits have not been established), an approved respirator must be worn. In the United States of America, if respirators are used, a program should be instituted to assure compliance with OSHA Standard 63 FR 1152, January 8, 1998. Respirator type: Air-purifying respirator with an appropriate, government approved (where applicable), air-purifying filter, cartridge or canister. Contact health and safety professional or manufacturer for specific information.

Hygiene measures: Observe good industrial hygiene practices.

Environmental Controls: No data available.

SECTION 9: Physical and chemical properties

Information on basic physical and chemical properties

Appearance

Physical state:	liquid
Form:	liquid
Color:	Colorless
Odor:	musty
Odor Threshold:	0.07 ppm
pH:	No data available.
Freezing Point:	-76 - -70 °C
Boiling Point:	184 °C
Flash Point:	73.3 °C (Tag closed cup)
Evaporation Rate:	Not determined.
Flammability (solid, gas):	not applicable
Flammability Limit - Upper (%)-:	No data available.
Flammability Limit - Lower (%)-:	No data available.
Vapor pressure:	Not determined.
Vapor density (air=1):	No data available.
Specific Gravity:	0.833 (20 °C)
Solubility(ies)	
Solubility in Water:	0.1 g/l
Solubility (other):	No data available.
Partition coefficient (n-octanol/water):	Pow: 1,260 log Pow: 3.1
Autoignition Temperature:	No data available.
Decomposition Temperature:	(DSC) No exotherm to 500°C
Dynamic viscosity:	No data available.
Kinematic viscosity:	Not determined.

Explosive properties: Not classified.
Oxidizing properties: Not classified.

SECTION 10: Stability and reactivity

Reactivity: None known.
Chemical Stability: Stable
Possibility of Hazardous Reactions: None known.
Conditions to Avoid: Heat, sparks, flames.
Incompatible Materials: Strong oxidizing agents.
Hazardous Decomposition Products: Carbon Dioxide. Carbon Monoxide.

SECTION 11: Toxicological information**Information on likely routes of exposure**

Inhalation: Harmful if inhaled. May cause respiratory irritation.
Ingestion: None known.
Skin contact: Causes skin irritation.
Eye contact: Causes serious eye irritation.

Information on toxicological effects**Oral**

Product: Oral LD-50: (Rat): 3,290 mg/kg Not classified.

Dermal

Product: Dermal LD-50: (Rat): > 3,000 mg/kg
Not classified.

Inhalation

Product: LC50 (Rat, 6 h): 1.2 mg/l Harmful if inhaled.

Repeated dose toxicity

Product: No data available.

Skin Corrosion/Irritation

Product: (Rabbit, 24 h): moderate

Serious Eye Damage/Eye Irritation

Product: (Rabbit): moderate

Respiratory or Skin Sensitization

Product: Skin Sensitization (Human): Not a skin sensitizer.

Carcinogenicity

Product:	This product does not contain any carcinogens or potential carcinogens as listed by OSHA, IARC or NTP.
Toxicity to reproduction Product:	No data available.
Developmental toxicity Product:	No data available.
Germ Cell Mutagenicity	
In vitro Product:	Mutagenicity: Not classified as hazardous.
In vivo Product:	Mutagenicity: Based on available data, the classification criteria are not met.
Specific Target Organ Toxicity - Single Exposure Product:	Inhalation: Respiratory system - Irritating to respiratory system.
Specific Target Organ Toxicity - Repeated Exposure Product:	No data available.
Aspiration Hazard Product:	No data available.
Other effects:	No data available.

SECTION 12: Ecological information**Ecotoxicity:****Acute hazards to the aquatic environment:**

**Fish
Product:** LC-50 (Fathead Minnow, 96 h): 28.2 mg/l

**Aquatic Invertebrates
Product:** EC-50 (daphnid, 48 h): 39 mg/l

Chronic hazards to the aquatic environment:

**Fish
Product:** No data available.

**Aquatic Invertebrates
Product:** NOEC (Daphnia magna, 21 d): 7.5 µg/l Read-across from a similar material

**Toxicity to Aquatic Plants
Product:** EC-50 : Not expected to be harmful to aquatic organisms.

Persistence and Degradability

Biodegradation
Product: 100 % (14 d)

BOD/COD Ratio
Product: No data available.

Bioaccumulative Potential
Bioconcentration Factor (BCF)

Product: No data available.

Partition Coefficient n-octanol / water (log Kow)
Product: Log Kow: 3.1

Mobility in Soil: No data available.

Other Adverse Effects: No data available.

SECTION 13: Disposal considerations**Waste treatment methods**

General information: The generation of waste should be avoided or minimized wherever possible. Dispose of waste and residues in accordance with local authority requirements.

Disposal methods: Dispose of waste and residues in accordance with local authority requirements. Incinerate. Since emptied containers retain product residue, follow label warnings even after container is emptied.

SECTION 14: Transport information

Important Note: Shipping descriptions may vary based on mode of transport, quantities, package size, and/or origin and destination. Consult your company's Hazardous Materials/Dangerous Goods expert for information specific to your situation.

DOT

Class combustible liquid, Packing group III for quantities of 450 liters (119 gallons) or more; not regulated for smaller quantities

Possible Shipping Description(s):

NA 1993 Combustible liquid, n.o.s. (2-Ethyl Hexanol) III

IMDG - International Maritime Dangerous Goods Code

Class not regulated

Possible Shipping Description(s):

not regulated

IATA

Class not regulated
Possible Shipping Description(s):

not regulated

SECTION 15: Regulatory information

Safety, health and environmental regulations/legislation specific for the substance or mixture.:

This product has been classified in accordance with hazard criteria of the Controlled Products Regulations and the SDS contains all the information required by the Controlled Products Regulations.

WHMIS (Canada) Status: controlled

WHMIS (Canada) Hazard Classification: B/3, D/2/B

SARA 311-312 Hazard Classification(s):

immediate (acute) health hazard
fire hazard

US EPCRA (SARA Title III) Section 313 - Toxic Chemical List

NONE

OSHA: hazardous

TSCA (US Toxic Substances Control Act): The intentional components of this product are listed on the TSCA inventory. Any impurities present in this product are exempt from listing.

DSL (Canadian Domestic Substances List) and CEPA (Canadian Environmental Protection Act): All intentional components of this product are listed on the DSL. Any impurities present in this product are exempt from listing.

AICS / NICNAS (Australian Inventory of Chemical Substances and National Industrial Chemicals Notification and Assessment Scheme): The intentional components of this product are listed on AICS or otherwise complies with NICNAS. Any impurities present in this product are exempt from listing.

MITI (Japanese Handbook of Existing and New Chemical Substances): This product is listed in the Handbook or has been approved in Japan by new substance notification.

ECL (Korean Toxic Substances Control Act): The intentional components of this product are listed on the Korean inventory or otherwise complies with the Korean Toxic Substances Control Act.KE-13766

Philippines Inventory (PICCS) : The intentional components of this product are listed on the Philippine Inventory or otherwise comply with PICCS.

Inventory of Existing Chemical Substances in China: All intentional components of this product are listed on the Inventory of Existing Chemical Substances in China (IECSC).

SECTION 16: Other information

HMIS® Hazard Ratings: Health - 2, Flammability - 2, Chemical Reactivity - 0

HMIS® rating involves data interpretations that may vary from company to company. They are intended only for rapid, general identification of the magnitude of the specific hazard. To deal adequately with the safe handling of this material, all the information contained in this MSDS must be considered.

Revision Information: Not relevant.

Key literature references and sources for data: No data available.

Training information: No data available.

Issue Date: 07/23/2015

SDS No.:

Disclaimer: This information is provided without warranty. The information is believed to be correct. This information should be used to make an independent determination of the methods to safeguard workers and the environment.

Kessler, Joseph R

From: Kessler, Joseph R
Sent: Thursday, December 17, 2015 1:47 PM
To: mduncan@integrityindustries.com; baukerman@integrityindustries.com
Cc: Patrick Ward (PEWard@POTESTA.com); Kessler, Joseph R
Subject: R13-3038A Permit Application Review Status

RE: Application Status: Complete
Integrity Delaware, LLC
Integrity-Friendly WV Site
Permit Application: R13-3038A
Plant ID No.: 095-00025

Mr. Duncan,

Your application for a modification permit was received by the Division of Air Quality (DAQ) on November 18, 2015 and assigned to the writer for review. Upon an initial review, the application has been deemed complete as of the date of this e-mail. The ninety (90) day statutory time frame began on that day.

This determination of completeness shall not relieve the permit applicant of the requirement to subsequently submit, in a timely manner, any additional or corrected information deemed necessary for a final permit determination.

Should you have any questions, please contact me at (304) 926-0499 ext. 1219 or reply to this email.

Joe Kessler, PE
Engineer
West Virginia Division of Air Quality
601-57th St., SE
Charleston, WV 25304
Phone: (304) 926-0499 x1219
Fax: (304) 926-0478
Joseph.r.kessler@wv.gov

Entire Document
NON-CONFIDENTIAL

Kessler, Joseph R

From: Ward, Beth A
Sent: Friday, November 20, 2015 1:28 PM
To: Adkins, Sandra K; mduncan@integrityindustries.com; baukerman@integrityindustries.com; peward@potesta.com; McKeone, Beverly D; Kessler, Joseph R
Subject: FW: WV DAQ Permit Application Status for Integrity Delaware, LLC; Bens Run
Attachments: 2015_11_20_13_23_28.pdf

Please see the attached receipt.

OASIS ID 1600057294

Thank You!

From: Adkins, Sandra K
Sent: Thursday, November 19, 2015 1:25 PM
To: mduncan@integrityindustries.com; baukerman@integrityindustries.com; peward@potesta.com
Cc: McKeone, Beverly D; Kessler, Joseph R; Ward, Beth A
Subject: WV DAQ Permit Application Status for Integrity Delaware, LLC; Bens Run

**RE: Application Status
Integrity Delaware, LLC
Bens Run
Plant ID No. 095-00025
Application No. R13-3038A**

Mr. Duncan,

Your application for a modification permit for the Bens Run location was received by this Division on November 18, 2015, and was assigned to Joe Kessler. The following items were not included in the initial application submittal:

Original affidavit for Class I legal advertisement not submitted.

Application fee AND/OR additional application fees:

**\$1,000 Construction, Modification, Relocation or Temporary Permit*

(You may contact the Accounts Receivable section at 304 926-0499 ext. 4888 or Beth Ward at ext. 1846 to pay via credit card. DEP accepts Visa and MasterCard only.)

These items are necessary for the assigned permit writer to continue the 30-day completeness review.

Within 30 days, you should receive a letter from Joe stating the status of the permit application and, if complete, given an estimated time frame for the agency's final action on the permit.

Any determination of completeness shall not relieve the permit applicant of the requirement to subsequently submit, in a timely manner, any additional or corrected information deemed necessary for a final permit decision.

Should you have any questions, please contact the assigned engineer, Joe Kessler, at 304-926-0499, extension 1219.

UC Defaulted Accounts Search Results

Sorry, no records matching your criteria were found.

FEIN:

Business name: INTEGRITY DELAWARE, LLC

Doing business

as/Trading as:

Please use your browsers back button to try again.

WorkforceWV	Unemployment Compensation	Offices of the Insurance Commissioner
-----------------------------	---	---

UC Defaulted Accounts Search Results

Sorry, no records matching your criteria were found.

FEIN: 742448483
Business name:
Doing business as/Trading as:

Please use your browsers back button to try again.

WorkforceWV	Unemployment Compensation	Offices of the Insurance Commissioner
-----------------------------	---	---



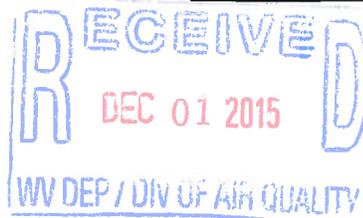
TRANSMITTAL MEMO

7012 MacCorkle Avenue, SE, Charleston, WV 25304 • Phone: (304) 342-1400 • Fax: (304) 343-9031

To: Director
Division of Air Quality
WV Department of Environmental Protection
601 57th Street, SE
Charleston, West Virginia 25304

Date: November 30, 2015

Project No.: 0101-14-0483-005



Sent Via: Mail Federal Express United Parcel Service
 Hand Carried Other: _____

Quantity	Description
1	Affidavit of Publication for Regulation 13 Permit Application for Drilling Mud Mixing Operation, Integrity-Friendly West Virginia Site – Integrity Delaware, LLC
Remarks: <p style="text-align: center;"><i>Entire Document</i> NON-CONFIDENTIAL</p>	

By: Patrick E. Ward/rh
c: Brett Aukerman, Integrity Industries, LLC

I.D. No. 095-00025 Reg. 3038A
Company Integrity - Delaware
Facility FERRANDY Region _____
Initials [Signature]

TYLER STAR NEWS

Sistersville, WV November 25, 2015

State of West Virginia, County of Tyler:

Personally appeared before the undersigned, a Notary Public,

..... Brian Clutter who, being duly sworn,

states that he is the manager of the Tyler Star News, a weekly

newspaper of general circulation, published at Sistersville,

County of Tyler, State of West Virginia, and that a copy of the

notice attached hereto was published for.....1..... successive

weeks in the Tyler Star News, beginning on the25..... day

of November, 2015 and ending on the25..... day

of November, 2015.

[Signature]
.....
Manager, Tyler Star News

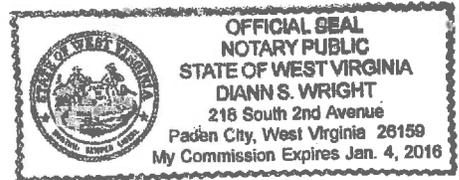
Subscribed and sworn to before me, a Notary Public of said

County, on this25..... day of November, 2015.

[Signature] Notary Public

My commission expires on the 4th day of January, 2016.

Printers Fee.....



AIR QUALITY PERMIT NOTICE

Notice of Application

Notice is given that Integrity Delaware, LLC (Integrity Industries, LLC) has applied to the West Virginia Department of Environmental Protection, Division of Air Quality (DAQ), for a modification to Regulation 13 Permit R13-3038 for Construction, Modification, and Operation of the Integrity-Friendly WV Site, a drilling mud mixing operation, located off of State Route 2 in Bens Run, Tyler County, West Virginia. The latitude and longitude coordinates (decimal degrees) are: 39.4739 N and 81.0981 W.

The applicant estimates that the potential to discharge of Regulated Air Pollutants will be: Particulate Matter (PM) of 15.24 tons per year (tpy) of which 15.14 tpy are fugitive, Particulate Matter less than 10 (PM10) of 4.54 tpy of which 4.47 are fugitive, and Particulate Matter less than 2.5 (PM2.5) of 0.49 tpy of which 0.45 tpy are fugitive, and volatile organic compounds of 0.15 tpy.

Modified operations will begin in February 2016. Written comments will be received by the West Virginia Department of Environmental Protection, DAQ, 601 57th Street, Charleston, WV 25304, for at least 30 calendar days from the date of publication of this notice.

Any questions regarding this permit application should be directed to the DAQ at (304) 926-0499, extension 1250, during normal business hours.

Dated this the 25th of November, 2015.

By:
Integrity Delaware, LLC
Max Duncan, President
2000 W. Sam Houston
Parkway S.
Suite 400
Houston, Texas 77042
TSN 2023 11/25

Adkins, Sandra K

From: Adkins, Sandra K
Sent: Thursday, November 19, 2015 1:25 PM
To: 'mduncan@integrityindustries.com'; 'baukerman@integrityindustries.com'; 'peward@potesta.com'
Cc: McKeone, Beverly D; Kessler, Joseph R; Ward, Beth A
Subject: WV DAQ Permit Application Status for Integrity Delaware, LLC; Bens Run

**RE: Application Status
Integrity Delaware, LLC
Bens Run
Plant ID No. 095-00025
Application No. R13-3038A**

Entire Document
NON-CONFIDENTIAL

Mr. Duncan,

Your application for a modification permit for the Bens Run location was received by this Division on November 18, 2015, and was assigned to Joe Kessler. The following items were not included in the initial application submittal:

Original affidavit for Class I legal advertisement not submitted.

Application fee AND/OR additional application fees:

**\$1,000 Construction, Modification, Relocation or Temporary Permit*

(You may contact the Accounts Receivable section at 304 926-0499 ext. 4888 or Beth Ward at ext. 1846 to pay via credit card. DEP accepts Visa and MasterCard only.)

These items are necessary for the assigned permit writer to continue the 30-day completeness review.

Within 30 days, you should receive a letter from Joe stating the status of the permit application and, if complete, given an estimated time frame for the agency's final action on the permit.

Any determination of completeness shall not relieve the permit applicant of the requirement to subsequently submit, in a timely manner, any additional or corrected information deemed necessary for a final permit decision.

Should you have any questions, please contact the assigned engineer, Joe Kessler, at 304-926-0499, extension 1219.