



Addivant
1000 Morgantown Industrial Park
Morgantown, WV 26501

October 24, 2017

Director
West Virginia Department of Environmental Protection
Division of Air Quality – Permitting Section
601 57th Street S.E.
Charleston, WV 25304

**RE: Permit Determination Request – Addivant USA, LLC
North Plant – Weston Zero Phenol Process
DAQ Plant I.D. No.: 061-00061**

Dear Director,

Addivant USA, LLC (“Addivant”) has completed a 3-batch plant trial of a new Zero Phenol Product in June 2017 to demonstrate the ability to successfully produce a phenol-free version of an existing product. Three permit determinations (PD17-018, PD17-035, and PD17-62) have already been submitted and approved as part of the plant modifications for the Zero Phenol process. These were for trial runs of two Zero Phenol products called Weston 430ZP and Weston TDPZP. Addivant is requesting to install a new vacuum pump to limit the amount of wastewater generated through the water/steam jet system and manufacture at a higher production rate per year for this permit determination. The potential-to-emit calculations were based on the product and raw materials that yield the highest emissions rates to be conservative no matter which Zero Phenol product is being manufactured.

The existing facility is true minor source under Federal and State regulations, and will remain a true minor source after the proposed changes. Enclosed is the permit determination form (PDF) along with the following attachments:

- Attachment A – Map of Facility,
- Attachment B – Process Flow Diagram,
- Attachment C – Process Description,
- Attachment D – Safety Data Sheets, and
- Attachment E - Potential-to-Emit Estimates.

Based on the potential-to-emit calculations for the Zero Phenol process, the production will not increase the emission above the permitting thresholds for modification as defined in 45 CSR 13: the reasonably calculated maximum potential emissions are under two (2) lb/hr OR five (5) tons/year of total Hazardous Air Pollutants (HAPs); six (6) lbs/hr and ten (10) tons per year or 144 pounds per calendar day of any regulated pollutant.

As requested for all permitting actions, one hardcopy and two electronic copies are included with this submittal. Should the department have any questions or need clarification on any part of this application package, please contact me via e-mail or at 304-244-2604.

Sincerely,

Julie Szymanek
Environmental Engineer
Julie.Szymanek@addivant.com

Attachments: PDF and Attachment A, B, C, D, and E
Enclosures: 2 electronic copies



WEST VIRGINIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF AIR QUALITY
601 57th Street, SE
Charleston, WV 25304
Phone: (304) 926-0475
www.dep.wv.gov/daq

**PERMIT DETERMINATION FORM
(PDF)**

FOR AGENCY USE ONLY: PLANT I.D. # _____
PDF # _____ PERMIT WRITER: _____

1. NAME OF APPLICANT (AS REGISTERED WITH THE WV SECRETARY OF STATE'S OFFICE):
Addivant USA, LLC

2. NAME OF FACILITY (IF DIFFERENT FROM ABOVE):
Morgantown North Plant

3. NORTH AMERICAN INDUSTRY CLASSIFICATION SYSTEM (NAICS) CODE:
325199

4A. MAILING ADDRESS:
1000 Morgantown Industrial Park,
Morgantown, WV 26501

4B. PHYSICAL ADDRESS:
1000 Morgantown Industrial Park,
Morgantown, WV 26501

5A. DIRECTIONS TO FACILITY (PLEASE PROVIDE **MAP AS ATTACHMENT A**): I-79 Exit 152. Proceed on Rt 19 N approximately ¾ miles. Turn right onto DuPont Road and proceed to first stop sign. Cross over County Road 45 and enter Morgantown Industrial Park. Take a left at the first stop sign, and then take the next immediate left.

5B. NEAREST ROAD:
County Road 45

5C. NEAREST CITY OR TOWN:
Morgantown

5D. COUNTY:
Monongalia

5E. UTM NORTHING (KM):
4384.842

5F. UTM EASTING (KM):
587.954

5G. UTM ZONE:
17

6A. INDIVIDUAL TO CONTACT IF MORE INFORMATION IS REQUIRED:
Julie Szymanek

6B. TITLE:
Environmental Engineer

6C. TELEPHONE:
(304) 244-2604

6D. FAX:
(304) 284-2363

6E. E-MAIL:
Julie.Szymanek@addivant.com

7A. DAQ PLANT I.D. NO. (FOR AN EXISTING FACILITY ONLY):
061-00061

7B. PLEASE LIST ALL CURRENT 45CSR13, 45CSR14, 45CSR19 AND/OR TITLE V (45CSR30) PERMIT NUMBERS ASSOCIATED WITH **THIS** PROCESS (FOR AN EXISTING FACILITY ONLY):
None

7C. IS THIS PDF BEING SUBMITTED AS THE RESULT OF AN ENFORCEMENT ACTION? IF YES, PLEASE LIST:
NA

8A. TYPE OF EMISSION SOURCE (CHECK ONE):
 NEW SOURCE ADMINISTRATIVE UPDATE
 MODIFICATION OTHER (PLEASE EXPLAIN IN 11B)

8B. IF ADMINISTRATIVE UPDATE, DOES DAQ HAVE THE APPLICANT'S CONSENT TO UPDATE THE EXISTING PERMIT WITH THE INFORMATION CONTAINED HEREIN?
 YES NO

9. IS *DEMOLITION* OR *PHYSICAL RENOVATION* AT AN EXISTING FACILITY INVOLVED? YES NO

10A. DATE OF ANTICIPATED INSTALLATION OR CHANGE:
11/03/2017

10B. DATE OF ANTICIPATED START-UP:
11/10/2017

11A. PLEASE PROVIDE A **DETAILED PROCESS FLOW DIAGRAM** SHOWING EACH PROPOSED OR MODIFIED PROCESS EMISSION POINT AS **ATTACHMENT B**.

11B. PLEASE PROVIDE A **DETAILED PROCESS DESCRIPTION** AS **ATTACHMENT C**.

12. PLEASE PROVIDE **MATERIAL SAFETY DATA SHEETS (MSDS)** FOR ALL MATERIALS PROCESSED, USED OR PRODUCED AS **ATTACHMENT D**. FOR CHEMICAL PROCESSES, PLEASE PROVIDE A MSDS FOR EACH COMPOUND EMITTED TO AIR.

13A. REGULATED AIR POLLUTANT EMISSIONS:

⇒ **FOR A NEW FACILITY**, PLEASE PROVIDE PLANT WIDE EMISSIONS BASED ON THE POTENTIAL TO EMIT (PTE) FOR THE FOLLOWING AIR POLLUTANTS INCLUDING ALL PROCESSES.
 ⇒ **FOR AN EXISTING FACILITY**, PLEASE PROVIDE THE PROPOSED CHANGE IN EMISSIONS BASED ON THE PTE OF ALL PROCESS CHANGES FOR THE FOLLOWING AIR POLLUTANTS.
PTE FOR A GIVEN POLLUTANT IS TYPICALLY BEFORE AIR POLLUTION CONTROL DEVICES AND IS COLLECTED BASED ON THE MAXIMUM DESIGN CAPACITY OF PROCESS EQUIPMENT.

POLLUTANT	HOURLY PTE (LB/HR)	YEARLY PTE (TON/YR) (HOURLY PTE MULTIPLIED BY 8760 HR/YR) DIVIDED BY 2000 LB/TON
PM		
PM ₁₀		
VOCs	5.79	6.74
CO		
NO _x		
SO ₂		
Pb		
HAPs (AGGREGATE AMOUNT)	1.83	2.51
TAPs (INDIVIDUALLY)*		
OTHER - Methanol	1.83	2.51

* ATTACH ADDITIONAL PAGES AS NEEDED

13B. PLEASE PROVIDE ALL SUPPORTING CALCULATIONS AS ATTACHMENT E.

CALCULATE AN HOURLY AND YEARLY PTE OF EACH PROCESS EMISSION POINT (SHOWN IN YOUR DETAILED PROCESS FLOW DIAGRAM) FOR ALL AIR POLLUTANTS LISTED ABOVE INCLUDING INDIVIDUAL HAP'S (LISTED IN SECTION 112[b] OF THE 1990 CAAA), TAP'S (LISTED IN 45CSR27), AND OTHER AIR POLLUTANTS (E.G. POLLUTANTS LISTED IN TABLE 45-13A OF 45CSR13, MINERAL ACIDS PER 45CSR7, ETC.).

14. CERTIFICATION OF DATA

I, JON KIMMEL, (TYPE NAME) ATTEST THAT ALL THE REPRESENTATIONS CONTAINED IN THIS APPLICATION, OR APPENDED HERETO, ARE TRUE, ACCURATE, AND COMPLETE TO THE BEST OF MY KNOWLEDGE BASED ON INFORMATION AND BELIEF AFTER REASONABLE INQUIRY, AND THAT I AM A **RESPONSIBLE OFFICIAL**** (PRESIDENT, VICE PRESIDENT, SECRETARY OR TREASURER, GENERAL PARTNER OR SOLE PROPRIETOR) OF THE APPLICANT.

SIGNATURE OF RESPONSIBLE OFFICIAL: _____

TITLE: SITE DIRECTOR

DATE: 10/24/2017

**THE DEFINITION OF THE PHRASE 'RESPONSIBLE OFFICIAL' CAN BE FOUND AT 45CSR13, SECTION 2.23.

NOTE: PLEASE CHECK ENCLOSED ATTACHMENTS:

ATTACHMENT A ATTACHMENT B ATTACHMENT C ATTACHMENT D ATTACHMENT E

RECORDS ON ALL CHANGES ARE REQUIRED TO BE KEPT AND MAINTAINED ON-SITE FOR TWO (2) YEARS.

THE PERMIT DETERMINATION FORM WITH THE INSTRUCTIONS CAN BE FOUND ON DAQ'S PERMITTING SECTION WEB SITE:

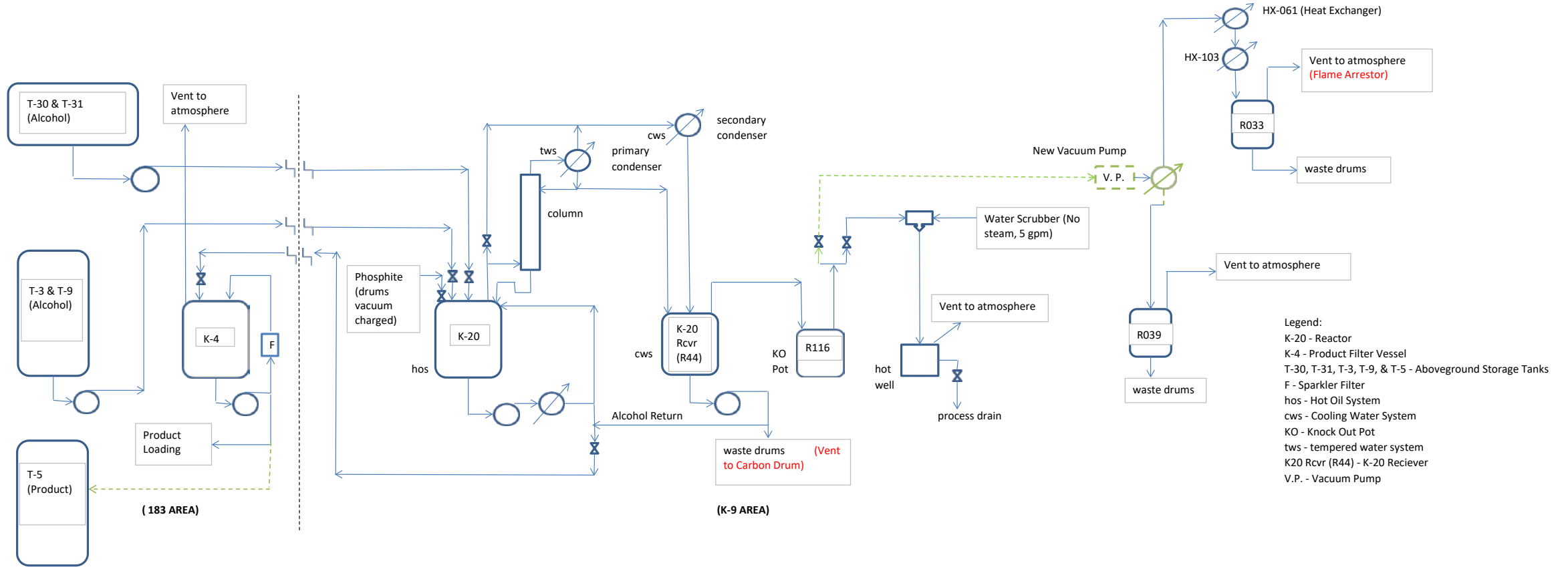
www.dep.wv.gov/daq

Attachment A – Map of Facility



Attachment B – Process Flow Diagram

Process Flow Diagram for Zero Phenol Process with Vacuum Pump



Attachment C – Process Description

Description of Zero Phenol Process in K-20 Reactor System

Currently, Addivant has completed a 3-batch plant trial of a new Zero Phenol Product in June 2017 to demonstrate the ability to successfully produce a phenol-free version of an existing product. There are several grades of the Zero Phenol product that Addivant would like to produce as described below.

The reaction is done in the K-20 reactor, located in the K-9 Production Building. The alcohol raw material would be metered into the K-20 reactor from existing storage tanks consisting of either tank T-30, T-31, T-3, and T-9. The drums of phosphite raw material would be vacuum transferred into the reactor. Catalyst would also be added.

Methanol would be distilled through an existing, distillation column and condenser and would collect in an existing receiver, R-044. Chilled water would be used on the condenser and receiver jacket to collect the methanol. Once the methanol is removed from the batch by a combination of atmospheric and vacuum distillation, the methanol from K-20's receiver will be pumped into waste drums. Vapors from the methanol drumming operations will be exhausted through an activated carbon drum unit.

Excess alcohol would then be vacuum distilled into the same receiver to complete the distillation process for the batch. The collected alcohol in the receiver will be transferred into drums or returned back to K-20 for recycled use. The resulting product in K-20 would then be cooled down using an external product cooler and transferred to the K-4 filtration vessel, located at the 183 Production Building. The product will then be filtered in K-4, using a bag filter or sparkler filter, and then transferred into plastic totes, drums, or storage tank after passing approval testing.

For the trial batch, an existing water/steam jet utility was used in the distillation process. The effluent from the water/steam jets was collected into a temporary portable holding tanks and slowly drained to the waste water treatment system. To continue production, the water/steam jet system would be replaced with a new vacuum pump. The existing jet system would be used as a vent scrubber for the reactor charging and initial heat-up steps, with minimal water flow used. The majority of the methanol from the vacuum pump would be condensed in an aftercooler on the exhaust line from the vacuum pump. This condensed methanol would flow into an existing receiver, R-039. The remaining vapors would then flow into an existing vapor recovery system consisting of an air cooler, HX-061, a chilled glycol cooler, HX-103, and a receiver, R-033. The collected methanol would then be drained from receivers into waste drums. The water from the scrubber (jet system with minimal water flow) will flow into a hot well (rectangular fiberglass receiver) then into the process wastewater treatment system.

The new, dry-screw vacuum pump system will consist of a rotary blower, a double-screw vacuum pump, and an aftercooler which will replace the current steam jet unit for

the K-20 reactor system. This will significantly reduce the amount of effluent generated by the steam jet system, and the new aftercooler will reduce the temperature of the vacuum system exhaust. In addition, the exit of the aftercooler will go to an existing vapor recovery system where existing heat exchangers (air cooled and chilled glycol cooled) will further reduce the temperature of the vacuum system exhaust. Condensed methanol from the process will be collected in existing receivers and wasted. Any remaining process vapors will be discharged through the existing air emission point, through an existing flame arrestor. A very small flow of water only, no steam, will still flow through the existing jet system. This will serve as a scrubber during the raw material charging and heat up process, until a new scrubber is installed as part of a larger, scale-up project.

Three permit determinations (PD17-018, PD17-035, and PD17-62) have already been submitted and approved as part of the Zero Phenol process. These were for trial runs of W430 ZP and WTDP ZP based on limited batches per month due to the amount of effluent generated from the water/steam jet system. Addivant is requesting to install a new vacuum pump to limit the amount of wastewater generated and manufacture and a higher production rate per year for this permit determination.

The potential-to-emit calculations were based on the product and raw materials that yield the highest emissions rates to be conservative no matter which product is being manufactured.

The potential-to-emit emissions for the reactor, small scrubber, methanol waste loading, receiver emissions, product loading and fugitive equipment were based on the production of 350 batches a year. The throughput for the tank emissions, T-30, T-31, T-3, T-9, T-5, T-4, were based on 365 batches per year.

Attachment D – Safety Data Sheets



WESTON® 430ZP

Version	10
Revision Date	01/18/2017
Print Date	02/07/2017
Country	US
Language:	EN

SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

Product code : 400000006372
Chemical nature : Polymer stabilizer

Details of the supplier of the safety data sheet

Company: Addivant USA, LLC
4 Mountainview Terrace
Suite 200
Danbury, CT
United States of America (USA)
06810
Telephone : 1-800-962-8641 (US) only

Prepared by msdsrequest@addivant.com

Further information for the safety data sheet :
msdsrequest@addivant.com

Emergency telephone number

Emergency telephone number: 866-928-0789
For additional emergency telephone numbers see section 16 of the Safety Data Sheet.

Disposal considerations : msdsrequest@addivant.com

Recommended use of the chemical and restrictions on use

Recommended use : Polymer
Stabilizer

Restrictions on use : For professional and industrial installation and use only.

SECTION 2. HAZARDS IDENTIFICATION

Emergency Overview

Appearance	liquid
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Version	10
Revision Date	01/18/2017
Print Date	02/07/2017
Country	US
Language:	EN

Colour	clear, to, yellow
Odour	mild
Hazard Summary	No information available.

GHS Classification

Skin sensitisation : Category 1

GHS label elements

Hazard pictograms :



Signal word : Warning

Hazard statements : H317 May cause an allergic skin reaction.

Precautionary statements :

Prevention:
P261 Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P272 Contaminated work clothing should not be allowed out of the workplace.
P280 Wear protective gloves.

Response:
P302 + P352 IF ON SKIN: Wash with plenty of soap and water.
P333 + P313 If skin irritation or rash occurs: Get medical advice/ attention.
P363 Wash contaminated clothing before reuse.

Disposal:
P501 Dispose of contents/ container to an approved waste disposal plant.

Potential Health Effects

Aggravated Medical Condition : None known.

Symptoms of Overexposure : Sensitisation

Carcinogenicity:

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance / Mixture : Mixture

Chemical nature : Polymer stabilizer

Hazardous components

Version	10
Revision Date	01/18/2017
Print Date	02/07/2017
Country	US
Language:	EN

Chemical name	CAS-No.	Concentration (%)
7-[2-(2-hydroxymethylethoxy)methylethoxy]tetramethyl-3,6,8,11-tetraoxa-7-phosphatridecane-1,13-diol	36788-39-3	>= 90 - <= 100

SECTION 4. FIRST AID MEASURES

- If inhaled : Move to fresh air in case of accidental inhalation of dust or fumes from overheating or combustion.
If symptoms persist, call a physician.
- In case of skin contact : Take off contaminated clothing and shoes immediately.
Wash off with soap and plenty of water.
- In case of eye contact : IF IN EYES: Rinse cautiously with water for several minutes.
Remove contact lenses, if present and easy to do. Continue rinsing.
- If swallowed : Clean mouth with water and drink afterwards plenty of water.
Do not give milk or alcoholic beverages.
Never give anything by mouth to an unconscious person.
- Most important symptoms and effects, both acute and delayed : May cause an allergic skin reaction.
Sensitisation
- Notes to physician : The first aid procedure should be established in consultation with the doctor responsible for industrial medicine.

SECTION 5. FIREFIGHTING MEASURES

- Suitable extinguishing media : Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
- Specific hazards during firefighting : No information available.
- Specific extinguishing methods :
- Further information : Standard procedure for chemical fires.
- Special protective equipment for firefighters : In the event of fire, wear self-contained breathing apparatus.

SECTION 6. ACCIDENTAL RELEASE MEASURES

- Environmental precautions : No special environmental precautions required.



WESTON® 430ZP

Version	10
Revision Date	01/18/2017
Print Date	02/07/2017
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Methods and materials for containment and cleaning up : Wipe up with absorbent material (e.g. cloth, fleece).
Keep in suitable, closed containers for disposal.

SECTION 7. HANDLING AND STORAGE

Advice on safe handling : For personal protection see section 8.
No special handling advice required.

Materials to avoid : No special restrictions on storage with other products.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Contains no substances with occupational exposure limit values.

Hazardous components without workplace control parameters

Personal protective equipment

Respiratory protection : No personal respiratory protective equipment normally required.

Hand protection

Remarks : For prolonged or repeated contact use protective gloves.

Eye protection : Safety glasses

Skin and body protection : Protective suit

Hygiene measures : General industrial hygiene practice.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance : liquid

Colour : clear, to, yellow

Odour : mild

Odour Threshold : No data available

pH : No data available

Melting point/range : No data available

Boiling point/boiling range : No data available



WESTON® 430ZP

Version	10
Revision Date	01/18/2017
Print Date	02/07/2017
Country	US
Language:	EN

Flash point	: > 200 °C
Vapour pressure	: No data available
Relative density	: No data available
Density	: No data available
Solubility(ies) Water solubility	: No data available
Partition coefficient: n-octanol/water	: No data available
Viscosity Viscosity, kinematic	: Not applicable
Explosive properties	: Not applicable
Oxidizing properties	: No data available
Surface tension	: not determined

SECTION 10. STABILITY AND REACTIVITY

Reactivity	: Stable under recommended storage conditions.
Chemical stability	: No decomposition if stored and applied as directed.
Possibility of hazardous reactions	: No hazards to be specially mentioned.
Conditions to avoid	: No data available
Incompatible materials	: Water
Hazardous decomposition products	: No hazardous decomposition products are known.

SECTION 11. TOXICOLOGICAL INFORMATION

Acute toxicity

Product:

Acute oral toxicity	: Remarks: Not classified due to lack of data.
Acute dermal toxicity	: Acute toxicity estimate : 2,778 mg/kg Method: Calculation method

Version	10
Revision Date	01/18/2017
Print Date	02/07/2017
Country	US
Language:	EN

Components:**7-[2-(2-hydroxymethylethoxy)methylethoxy]tetramethyl-3,6,8,11-tetraoxa-7-phosphatridecane-1,13-diol:**

Acute oral toxicity : LD50 (Rat): > 5,000 mg/kg

Acute inhalation toxicity : LC50 (Rat): > 2 mg/l
Test atmosphere: dust/mist

Acute dermal toxicity : LD50 (Rabbit): > 2,000 mg/kg

Skin corrosion/irritation**Product:**

Remarks: Not classified due to lack of data.

Serious eye damage/eye irritation**Product:**

Remarks: According to the classification criteria of the European Union, the product is not considered as being an eye irritant.

Respiratory or skin sensitisation**Product:**

Remarks: No data available

Germ cell mutagenicity**Product:**

Genotoxicity in vitro : Remarks: No data available

Carcinogenicity**Product:**

Remarks: This information is not available.

Reproductive toxicity**Product:**

Effects on fertility : Remarks: No data available

Effects on foetal development : Remarks: No data available

Repeated dose toxicity**Product:**



Version	10
Revision Date	01/18/2017
Print Date	02/07/2017
Country	US
Language:	EN

Remarks: No data available

Aspiration toxicity

Product:

No data available

Further information

Product:

Remarks: No data available

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity

Product:

Toxicity to fish : Remarks: No data is available on the product itself.

Toxicity to algae : Remarks: No data is available on the product itself.

Toxicity to bacteria : Remarks: No data is available on the product itself.

Persistence and degradability

Product:

Biodegradability : Remarks: No data available

Bioaccumulative potential

Product:

Bioaccumulation : Remarks: No data available

Components:

7-[2-(2-hydroxymethylethoxy)methylethoxy]tetramethyl-3,6,8,11-tetraoxa-7-phosphatridecane-1,13-diol:

Partition coefficient: n-octanol/water : log Pow: -1.56 (25 °C)

Mobility in soil

No data available

Other adverse effects

No data available



WESTON® 430ZP

Version	10
Revision Date	01/18/2017
Print Date	02/07/2017
Country	US
Language:	EN

Product:

Regulation 40 CFR Protection of Environment; Part 82 Protection of Stratospheric Ozone - CAA Section 602 Class I Substances

Remarks This product neither contains, nor was manufactured with a Class I or Class II ODS as defined by the U.S. Clean Air Act Section 602 (40 CFR 82, Subpt. A, App.A + B).

Additional ecological information : There is no data available for this product.

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal methods

Waste from residues : Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging : Empty remaining contents.
Empty containers should be taken to an approved waste handling site for recycling or disposal.

SECTION 14. TRANSPORT INFORMATION

DOT

Not dangerous goods

TDG

Not dangerous goods

ADR

Not dangerous goods

IATA

Not dangerous goods

IMDG

Not dangerous goods

RID

Not dangerous goods



WESTON® 430ZP

Version	10
Revision Date	01/18/2017
Print Date	02/07/2017
Country	US
Language:	EN

SECTION 15. REGULATORY INFORMATION

TSCA list : No substances are subject to a Significant New Use Rule.
 No substances are subject to TSCA 12(b) export notification requirements.

EPCRA - Emergency Planning and Community Right-to-Know Act

CERCLA Reportable Quantity

This material does not contain any components with a CERCLA RQ.

SARA 304 Extremely Hazardous Substances Reportable Quantity

This material does not contain any components with a section 304 EHS RQ.

SARA 311/312 Hazards : Acute Health Hazard

SARA 302 : No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 : This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

Clean Air Act

This product does not contain any hazardous air pollutants (HAP), as defined by the U.S. Clean Air Act Section 112 (40 CFR 61).

This product does not contain any chemicals listed under the U.S. Clean Air Act Section 112(r) for Accidental Release Prevention (40 CFR 68.130, Subpart F).

The following chemical(s) are listed under the U.S. Clean Air Act Section 111 SOCM I Intermediate or Final VOC's (40 CFR 60.489):

oxydipropanol	25265-71-8	50 %
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Clean Water Act

This product does not contain any Hazardous Substances listed under the U.S. CleanWater Act, Section 311, Table 116.4A.

This product does not contain any Hazardous Chemicals listed under the U.S. CleanWater Act, Section 311, Table 117.3.

This product does not contain any toxic pollutants listed under the U.S. Clean Water Act Section 307

California Prop 65 : This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

The components of this product are reported in the following inventories:

REACH : Not in compliance with the inventory

:
:

DSL : This product contains the following components listed on the Canadian NDSL. All other components are on the Canadian

Version	10
Revision Date	01/18/2017
Print Date	02/07/2017
Country	US
Language:	EN

DSL.

- AICS : On the inventory, or in compliance with the inventory
- NZIoC : Not in compliance with the inventory
- ENCS : On the inventory, or in compliance with the inventory
- ISHL : On the inventory, or in compliance with the inventory
- KECI : On the inventory, or in compliance with the inventory
- PICCS : Not in compliance with the inventory
- IECSC : On the inventory, or in compliance with the inventory
- TCSI : Not in compliance with the inventory
- TSCA : On TSCA Inventory

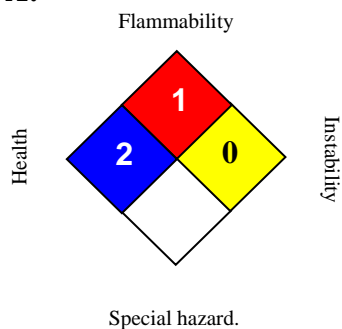
Inventories

AICS (Australia), DSL (Canada), IECSC (China), REACH (European Union), ENCS (Japan), ISHL (Japan), KECI (Korea), NZIoC (New Zealand), PICCS (Philippines), TCSI (Taiwan), TSCA (USA)

SECTION 16. OTHER INFORMATION

Further information

NFPA:



HMIS III:

HEALTH	2/
FLAMMABILITY	1
PHYSICAL HAZARD	0

0 = not significant, 1 =Slight,
 2 = Moderate, 3 = High
 4 = Extreme, * = Chronic



WESTON® 430ZP

Version	10
Revision Date	01/18/2017
Print Date	02/07/2017
Country	US
Language:	EN

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.

Carechem24 International Worldwide Coverage - Addivant

Emergency Phone Numbers:

<u>Europe:</u>	All European Countries	+44 (0) 1235 239 670
<u>Asia Pacific:</u>	East / South East Asia	Regional Number : +65 3158 1074
	Australia	+61 2801 44558
	New Zealand	+64 9929 1483
	China Taiwan	+86 10 5100 3039
	Japan	+81 345 789 341
	Indonesia	00780 3011 0293
	:Malaysia	+60 3 6207 4347
	Thailand	001800 1 2066 6751
	Korea	+65 3158 1285
	Vietnam	+65 3158 1255
	India	+65 3158 1198
	Pakistan	+65 3158 1329
	Philippines	+65 31581203
	Sri Lanka	+65 3158 1195
	Bangladesh	+65 3158 1200
<u>Middle East / Africa:</u>	Arabic speaking countries	+44 (0) 1235 239 671
	All other countries	+44 (0) 1235 239 670
<u>America</u>	United States / Canada	001866 928 0789
<u>Latin America:</u>	Brazil	+55 113 711 9144
	All other countries	+44 (0) 1235 239 670
	Mexico	+52 555 004 8763



WESTON® TDP ZP

Version	10
Revision Date	03/20/2017
Print Date	03/20/2017
Country	US
Language:	Z8

SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

Product name : WESTON® TDP ZP

Product code : 400000009277

Details of the supplier of the safety data sheet

Company: Addivant USA, LLC
4 Mountainview Terrace
Suite 200
Danbury, CT
United States of America (USA)
06810
Telephone : 1-800-962-8641 (US) only

Prepared by msdsrequest@addivant.com

Further information for the material safety data sheet :
msdsrequest@addivant.com

Emergency telephone

Emergency telephone: 866-928-0789
For additional emergency telephone numbers see section 16 of the Safety Data Sheet.

Disposal considerations : msdsrequest@addivant.com

Recommended use of the chemical and restrictions on use

Recommended use : Antioxidant

Restrictions on use : For professional and industrial installation and use only.

SECTION 2. HAZARDS IDENTIFICATION

Emergency Overview

Appearance	liquid
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Version	10
Revision Date	03/20/2017
Print Date	03/20/2017
Country	US
Language:	Z8

Color	colorless, to, light yellow
Odor	slight, alcohol-like
Hazard Summary	No information available.

GHS Classification

Skin sensitization : Category 1

GHS label elements

Hazard pictograms :



Signal Word : Warning

Hazard Statements : H317 May cause an allergic skin reaction.

Precautionary Statements : **Prevention:**
 P261 Avoid breathing dust/ fume/ gas/ mist/ vapors/ spray.
 P272 Contaminated work clothing must not be allowed out of the workplace.
 P280 Wear protective gloves.
Response:
 P302 + P352 IF ON SKIN: Wash with plenty of soap and water.
 P333 + P313 If skin irritation or rash occurs: Get medical advice/ attention.
 P363 Wash contaminated clothing before reuse.
Disposal:
 P501 Dispose of contents/ container to an approved waste disposal plant.

Potential Health Effects

Aggravated Medical Condition : None known.

Symptoms of Overexposure : Sensitization

Carcinogenicity:

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance / Mixture : Pure substance

Hazardous ingredients

Chemical name	CAS-No.	Concentration (%)
---------------	---------	-------------------



WESTON® TDP ZP

Version	10
Revision Date	03/20/2017
Print Date	03/20/2017
Country	US
Language:	Z8

triisodecyl phosphite

25448-25-3

>= 90 - <= 100

SECTION 4. FIRST AID MEASURES

- General advice : No hazards which require special first aid measures.
- If inhaled : Move to fresh air in case of accidental inhalation of dust or fumes from overheating or combustion.
If symptoms persist, call a physician.
- In case of skin contact : Take off contaminated clothing and shoes immediately.
Wash off with soap and plenty of water.
- In case of eye contact : IF IN EYES: Rinse cautiously with water for several minutes.
Remove contact lenses, if present and easy to do. Continue rinsing.

Flush eyes with water as a precaution.
Remove contact lenses.
Protect unharmed eye.
Keep eye wide open while rinsing.
- If swallowed : Clean mouth with water and drink afterwards plenty of water.
Do not give milk or alcoholic beverages.
Never give anything by mouth to an unconscious person.
- Most important symptoms and effects, both acute and delayed : May cause an allergic skin reaction.
Sensitization
- Notes to physician : The first aid procedure should be established in consultation with the doctor responsible for industrial medicine.

SECTION 5. FIRE-FIGHTING MEASURES

- Suitable extinguishing media : Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
- Specific hazards during fire fighting : No information available.
- Specific extinguishing methods :
- Further information : Standard procedure for chemical fires.
- Special protective equipment for fire-fighters : In the event of fire, wear self-contained breathing apparatus.

SECTION 6. ACCIDENTAL RELEASE MEASURES



WESTON® TDP ZP

Version	10
Revision Date	03/20/2017
Print Date	03/20/2017
Country	US
Language:	Z8

- Environmental precautions : No special environmental precautions required.
- Methods and materials for containment and cleaning up : Wipe up with absorbent material (e.g. cloth, fleece).
Keep in suitable, closed containers for disposal.

SECTION 7. HANDLING AND STORAGE

- Advice on safe handling : For personal protection see section 8.
No special handling advice required.
- Conditions for safe storage : Keep container tightly closed in a dry and well-ventilated place.
Containers which are opened must be carefully resealed and kept upright to prevent leakage.
- Materials to avoid : No special restrictions on storage with other products.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Ingredients with workplace control parameters

Contains no substances with occupational exposure limit values.
Hazardous components without workplace control parameters

Personal protective equipment

- Respiratory protection : No personal respiratory protective equipment normally required.
- Hand protection
Remarks : For prolonged or repeated contact use protective gloves.
- Eye protection : Safety glasses
- Skin and body protection : Protective suit
- Hygiene measures : General industrial hygiene practice.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

- Appearance : liquid
- Color : colorless, to, light yellow
- Odor : slight, alcohol-like
- Odor Threshold : No data available



WESTON® TDP ZP

Version	10
Revision Date	03/20/2017
Print Date	03/20/2017
Country	US
Language:	Z8

pH	: Not applicable
Melting point/range	: No data available
Initial boiling point and boiling range	: No data available
Flash point	: 160 °C
Evaporation rate	: No data available
Upper explosion limit	: No data available
Lower explosion limit	: No data available
Vapor pressure	: 6.7 hPa (180 °C)
Relative vapor density	: No data available
Density	: 0.89 g/cm ³
Solubility(ies) Water solubility	: insoluble, hydrolyzes
Partition coefficient: n-octanol/water	: No data available
Autoignition temperature	: No data available
Thermal decomposition	: No data available
Viscosity Viscosity, kinematic	: No data available
Explosive properties	: No data available
Oxidizing properties	: No data available
Surface tension	: not determined
Oxidizing potential	: No information available.
Molecular weight	: 502.8 g/mol

SECTION 10. STABILITY AND REACTIVITY

Reactivity	: Stable under recommended storage conditions.
Chemical stability	: No decomposition if stored and applied as directed.
Possibility of hazardous	: No hazards to be specially mentioned.



Version	10
Revision Date	03/20/2017
Print Date	03/20/2017
Country	US
Language:	Z8

reactions

- Conditions to avoid : No data available
- Incompatible materials : Water
- Hazardous decomposition products : Carbon monoxide
Carbon dioxide (CO2)
Oxides of phosphorus
Phosphorus trihydride (phosphine)

SECTION 11. TOXICOLOGICAL INFORMATION

Acute toxicity

Ingredients:

triisodecyl phosphite:

- Acute oral toxicity : LD50 Oral (Rat, male and female): 5,000 mg/kg
- Acute inhalation toxicity : LC50 (Rat, male and female): > 12.6 mg/l
Exposure time: 1 h
GLP: yes
- Acute dermal toxicity : LD50 (Rabbit, male and female): 5,000 mg/kg

Skin corrosion/irritation

Product:

Remarks: According to the classification criteria of the European Union, the product is not considered as being a skin irritant.

Serious eye damage/eye irritation

Product:

Remarks: According to the classification criteria of the European Union, the product is not considered as being an eye irritant.

Ingredients:

triisodecyl phosphite:

- Species: Rabbit
- Result: No eye irritation

Respiratory or skin sensitization

Product:

Remarks: No data available



WESTON® TDP ZP

Version	10
Revision Date	03/20/2017
Print Date	03/20/2017
Country	US
Language:	Z8

Germ cell mutagenicity

Product:

Genotoxicity in vitro : Remarks: No data available

Genotoxicity in vivo : Remarks: No data available

Ingredients:

triisodecyl phosphite:

Genotoxicity in vitro : Test Type: Ames test
Metabolic activation: with and without metabolic activation
Result: negative

Test Type: Chromosome aberration test in vitro
Method: Mutagenicity (micronucleus test)
Result: negative

Genotoxicity in vivo : Test Type: In vivo micronucleus test
Test species: Mouse
Application Route: Oral
Result: negative
GLP: yes

Germ cell mutagenicity-Assessment : Animal testing did not show any mutagenic effects.

Carcinogenicity

Product:

Remarks: This information is not available.

Reproductive toxicity

Product:

Effects on fertility : Remarks: No data available

Effects on fetal development : Remarks: No data available

Ingredients:

triisodecyl phosphite:

Reproductive toxicity - Assessment : No toxicity to reproduction
No effects on or via lactation



WESTON® TDP ZP

Version	10
Revision Date	03/20/2017
Print Date	03/20/2017
Country	US
Language:	Z8

Ingredients:

triisodecyl phosphite:

Routes of exposure: Oral

Assessment: The substance or mixture is not classified as specific target organ toxicant, repeated exposure.

Repeated dose toxicity

Product:

Remarks: No data available

Aspiration toxicity

Product:

No aspiration toxicity classification

Further information

Product:

Remarks: No data available

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity

Product:

Toxicity to fish :
Remarks: No data is available on the product itself.

Toxicity to algae :
Remarks: No data is available on the product itself.

Toxicity to bacteria :
Remarks: No data is available on the product itself.

Persistence and degradability

Product:

Biodegradability :
Remarks: No data available

Ingredients:

triisodecyl phosphite:

Biodegradability : aerobic
Result: According to the results of tests of biodegradability this product is not readily biodegradable.
Biodegradation: 1.31 %



WESTON® TDP ZP

Version	10
Revision Date	03/20/2017
Print Date	03/20/2017
Country	US
Language:	Z8

Exposure time: 28 d

Bioaccumulative potential

Product:

Bioaccumulation : Remarks: No data available

Mobility in soil

No data available

Other adverse effects

No data available

Product:

Regulation 40 CFR Protection of Environment; Part 82 Protection of Stratospheric Ozone - CAA Section 602 Class I Substances

Remarks This product neither contains, nor was manufactured with a Class I or Class II ODS as defined by the U.S. Clean Air Act Section 602 (40 CFR 82, Subpt. A, App.A + B).

Additional ecological information : There is no data available for this product.

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal methods

Waste from residues : Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging : Empty remaining contents.
Empty containers should be taken to an approved waste handling site for recycling or disposal.

SECTION 14. TRANSPORT INFORMATION

DOT

Not dangerous goods

TDG

Not dangerous goods



WESTON® TDP ZP

Version	10
Revision Date	03/20/2017
Print Date	03/20/2017
Country	US
Language:	Z8

ADR

Not dangerous goods

IATA

Not dangerous goods

IMDG

Not dangerous goods

RID

Not dangerous goods

SECTION 15. REGULATORY INFORMATION

TSCA list : No substances are subject to a Significant New Use Rule.

No substances are subject to TSCA 12(b) export notification requirements.

EPCRA - Emergency Planning and Community Right-to-Know

CERCLA Reportable Quantity

This material does not contain any components with a CERCLA RQ.

SARA 304 Extremely Hazardous Substances Reportable Quantity

This material does not contain any components with a section 304 EHS RQ.

SARA 302 : No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 : This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

Clean Air Act

This product does not contain any hazardous air pollutants (HAP), as defined by the U.S. Clean Air Act Section 112 (40 CFR 61).

This product does not contain any chemicals listed under the U.S. Clean Air Act Section 112(r) for Accidental Release Prevention (40 CFR 68.130, Subpart F).

This product does not contain any chemicals listed under the U.S. Clean Air Act Section 111 SOCMII Intermediate or Final VOC's (40 CFR 60.489).

Clean Water Act

This product does not contain any Hazardous Substances listed under the U.S. CleanWater Act, Section 311, Table 116.4A.

This product does not contain any Hazardous Chemicals listed under the U.S. CleanWater Act, Section 311, Table 117.3.



WESTON® TDP ZP

Version	10
Revision Date	03/20/2017
Print Date	03/20/2017
Country	US
Language:	Z8

This product does not contain any toxic pollutants listed under the U.S. Clean Water Act Section 307

California Prop 65 : This product does not contain any chemicals known to the State of California to cause cancer, birth, or any other reproductive defects.

The ingredients of this product are reported in the following inventories:

DSL : All components of this product are on the Canadian DSL

AICS : On the inventory, or in compliance with the inventory

NZIoC : Not in compliance with the inventory

ENCS :
: On the inventory, or in compliance with the inventory

ISHL : On the inventory, or in compliance with the inventory

KECI : On the inventory, or in compliance with the inventory

PICCS : On the inventory, or in compliance with the inventory

IECSC : On the inventory, or in compliance with the inventory

TCSI : Not in compliance with the inventory

TSCA :
: On TSCA Inventory

Inventories

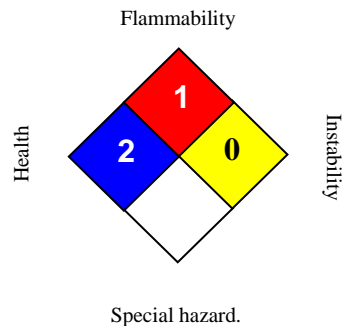
AICS (Australia), DSL (Canada), IECSC (China), REACH (European Union), ENCS (Japan), ISHL (Japan), KECI (Korea), NZIoC (New Zealand), PICCS (Philippines), TCSI (Taiwan), TSCA (USA)

Version	10
Revision Date	03/20/2017
Print Date	03/20/2017
Country	US
Language:	Z8

SECTION 16. OTHER INFORMATION

Further information

NFPA:



HMIS III:

HEALTH	2*
FLAMMABILITY	1
PHYSICAL HAZARD	0

0 = not significant, 1 =Slight,
 2 = Moderate, 3 = High
 4 = Extreme, * = Chronic

The information provided in this Material 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.

Carechem24 International Worldwide Coverage - Addivant

Emergency Phone Numbers:

<u>Europe:</u>	All European Countries	+44 (0) 1235 239 670
<u>Asia Pacific:</u>	East / South East Asia	Regional Number : +65 3158 1074
	Australia	+61 2801 44558
	New Zealand	+64 9929 1483
	China Taiwan	+86 10 5100 3039
	Japan	+81 345 789 341
	Indonesia	00780 3011 0293
	:Malaysia	+60 3 6207 4347
	Thailand	001800 1 2066 6751
	Korea	+65 3158 1285
	Vietnam	+65 3158 1255
	India	+65 3158 1198
	Pakistan	+65 3158 1329
	Philippines	+65 31581203
	Sri Lanka	+65 3158 1195
	Bangladesh	+65 3158 1200



WESTON® TDP ZP

Version	10
Revision Date	03/20/2017
Print Date	03/20/2017
Country	US
Language:	Z8

<u>Middle East / Africa:</u>	Arabic speaking countries	+44 (0) 1235 239 671
	All other countries	+44 (0) 1235 239 670
<u>America</u>	United States / Canada	001866 928 0789
<u>Latin America:</u>	Brazil	+55 113 711 9144
	All other countries	+44 (0) 1235 239 670
	Mexico	+52 555 004 8763

Attachment E - Potential-to-Emit Estimates

Addivant; Weston Zero Phenol Process
Weston Zero Phenol Process Emission Summary Table

Emission Source	Process Emission Levels					
	VOCs		HAPs		Methanol	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
T-30 & T-31 Raw Material Storage Tanks	<0.01	<0.01	--	--	--	--
T-3 & T-9 Raw Material Storage Tanks	<0.01	<0.01	--	--	--	--
T-5 Zero Phenol Product Tank	<0.01	<0.01	--	--	--	--
K-20 Reactor	1.19	0.04	--	--	--	--
K-4 Storage & Filter Vessel	<0.01	<0.01	--	--	--	--
Methanol Waste Loading - R-044	0.35	0.06	0.35	0.06	0.35	0.06
Product Loading	<0.01	<0.01	--	--	--	--
Scrubber, Hot Well, Wastewater	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Methanol Waste Loading - R-033	<0.01	<0.01	0.20	<0.01	0.20	<0.01
Methanol Waste Loading - R-039	<0.01	<0.01	0.10	<0.01	0.10	<0.01
Process Equipment Leaks	4.24	6.62	1.18	2.43	1.18	2.43
Process Totals	5.79	6.74	1.83	2.51	1.83	2.51
Permit Thresholds	6.00	10.00	2.00	5.00	2.00	5.00

Addviant; Zero Phenol Process
T-30 & T-31 Raw Material Storage Tanks - Alcohol Working and Breathing Emissions Detail Sheet

Pollutant	Losses (lbs/yr) ¹			Losses (lb/hr)			Losses (tpy)		
	Working Loss	Breathing Loss	Total Emissions	Working Loss	Breathing Loss	Total Emissions	Working Loss	Breathing Loss	Total Emissions
VOC	2.00E-02	1.00E-02	3.00E-02	2.28E-06	1.14E-06	3.42E-06	1.00E-05	5.00E-06	1.50E-05

Note:
¹Losses from EPA TANKs Report - T-30 and T-31 (Each tank is 11,280-gallons)
²T-30 and T-31 stores Alcohol for the Weston TDPZP Product in K-20 Process.

Addviant; Zero Phenol Process
T-3 & T-9 Raw Material Storage Tanks - Alcohol Working and Breathing Emissions Detail Sheet

Pollutant	Losses (lbs/yr) ¹			Losses (lb/hr)			Losses (tpy)		
	Working Loss	Breathing Loss	Total Emissions	Working Loss	Breathing Loss	Total Emissions	Working Loss	Breathing Loss	Total Emissions
VOC	1.90E-01	0.00E+00	1.90E-01	2.17E-05	0.00E+00	2.17E-05	9.50E-05	0.00E+00	9.50E-05

Note:
¹Losses from EPA TANKs Report - T-3 and T-9 (Each tank is 8,000-gallons)
²EPA TANKs Report - T-3 and T-9 store Alcohol for the W430 Product in K-20 Process.

Addviant; Zero Phenol Process
T-5 Zero Phenol Product Storage Tank - Working and Breathing Emissions Detail Sheet

Pollutant	Losses (lbs/yr) ¹			Losses (lb/hr)			Losses (tpy)		
	Working Loss	Breathing Loss	Total Emissions	Working Loss	Breathing Loss	Total Emissions	Working Loss	Breathing Loss	Total Emissions
VOC	1.00E-02	0.00E+00	1.00E-02	1.14E-06	0.00E+00	1.14E-06	5.00E-06	0.00E+00	5.00E-06

Note:
¹Losses from EPA TANKs Report - T-5 (Tank is 8,000-gallons)
²EPA TANKs Report - T-5 uses Theoretical Yield of Product in K-20 Process.

De Minimis Sources: 45CSR13, Table 45-13B Item 58: Storage vessels less than 10,567-gallons capacity containing petroleum or organic liquids with a vapor pressure of 1.5 psia or less at storage temperature, provided that the emissions from all such organic liquid storage tanks, in the aggregate, are less than 2 tons per year for hazardous air pollutants or VOCs.

Tons Per Year
 Sum of T-3, T-9, & T-5. (Aggregate) **1.10E-04**

Note: Only one product can be made at a time in K-20 so the throughput is estimated high for the raw material and the tank reports were based on 365 batches per year.

**Addivant; Zero Phenol Process
Process Emissions - Reactor K-20**

Emission Points

Initial Preparation using Alcohol for Cleaning
Normal Operations

Note:

Reactor K-20 Area (A), Volumetric Flowrate (V), Gas Velocity over Liquid (U), and Equivalent Tank Diameter (Deq) assumed to be equal to Reactor K-20 specifications in W430ZP (PD17-018 and PD17-035).

Initial Preparation only needed after each campaign. Each campaign is approximately 5 batches.

References:

US EPA Guideline Series: Control of Volatile Organic Compound Emissions from Batch Processes, 1993

Initial Preparation using Alcohol for Cleaning

K-20 Vacuum System

Variable	Definition	Value	Basis
u	Gas Viscosity (g/cm-s)	0.65	Viscosity of air from Perry's Chemical Engineers' Handbook
p	Gas Density (g/cm ³)	1	Density of air from Perry's Chemical Engineers' Handbook
Dv	Gas Diffusivity (cm ² /s)	0.05	VOC diffusivity in air
Nsc	Schmidt Number	13	$Nsc = u/(p \cdot Dv)$
A	Cross-sectional Area of Liquid Surface (ft ²)	33	Tank dimensions for 2,000-gal reactor with 78"ID (Area of circle= pi*radius squared)
V	Volumetric Flowrate of Gas (ft ³ /min)	440	Volumetric Flowrate provided by Addivant
U	Gas Velocity over Liquid (m/hr)	244	$U = Q/A$ $U = V \text{ ft}^3/\text{min} \times 60 \text{ min/hr} \times 1/15 \text{ ft}^2 \times 0.3048 \text{ m/ft}$
Deq	Equivalent Tank Diameter (m)	2.5	$Deq = 4 \times \text{cross-sectional area/perimeter}$ $Deq = 4 \times 15 \text{ ft}^2/16 \text{ ft} \times 0.3048 \text{ m/ft}$
k	Mass Transfer Coefficient (ft/hr)	1.1	$k = 0.0958 \cdot U^{0.78} \cdot Deq^{-0.11} \cdot Nsc^{-0.67}$
MW	Molecular Weight (lb/lb-mol)	158.28	Molecular weight of Alcohol
P	Vapor Pressure (atm)	1.07E-01	Alcohol vapor pressure = 81.4 mmHg * (1 atm/760 mm Hg) @130 C
H	Emission Hours (hr/cleanup)	1.00	Assume each initial preparation/cleanup takes 1 hr
R	Universal Gas Constant (atm-ft ³ /lbmol-R)	0.7302	Engineering constant
T	Temperature (R)	725.67	Max Cleaning Temperature = 130°C
E	Emission Rate (lb)	1.19E+00	$E = (MW \cdot k \cdot P \cdot A \cdot H)/(R \cdot T)$, US EPA open top tank equation
	Emission Rate (lb/hr)	1.19E+00	Emission Rate ÷ hours per cleanup/preparation
n	Efficiency of control equipment	0%	Assumed 0% control efficiency for potential to emit calculations
	Estimated Potential Emissions (tons/cleanup)	5.96E-04	Emissions Rate * 1 ton/2,000 lb * (1-n)
	Cleanups per year	70	~5 batches per bulk load (High estimate if same product between campaigns)
	Estimated Potential Emissions (tpy)	4.17E-02	Emissions (lb/yr) * 1 ton/2,000 lb * (1-n)

Normal Operations

K-20 Vacuum System

Variable	Definition	Value	Basis
u	Gas Viscosity (g/cm-s)	0.65	Viscosity of air from Perry's Chemical Engineers' Handbook
p	Gas Density (g/cm ³)	1	Density of air from Perry's Chemical Engineers' Handbook
Dv	Gas Diffusivity (cm ² /s)	0.05	VOC diffusivity in air
Nsc	Schmidt Number	13	$Nsc = u/(p \cdot Dv)$
A	Cross-sectional Area of Liquid Surface (ft ²)	33	Tank dimensions for 2,000-gal reactor with 78"ID (Area of circle= pi*radius squared)
V	Volumetric Flowrate of Gas (ft ³ /min)	440	Volumetric Flowrate provided by Addivant
U	Gas Velocity over Liquid (m/hr)	244	$U = Q/A$ $U = V \text{ ft}^3/\text{min} \times 60 \text{ min/hr} \times 1/15 \text{ ft}^2 \times 0.3048 \text{ m/ft}$
Deq	Equivalent Tank Diameter (m)	2.5	$Deq = 4 \times \text{cross-sectional area/perimeter}$ $Deq = 4 \times 15 \text{ ft}^2/16 \text{ ft} \times 0.3048 \text{ m/ft}$
k	Mass Transfer Coefficient (ft/hr)	1.1	$k = 0.0958 \cdot U^{0.78} \cdot Deq^{-0.11} \cdot Nsc^{-0.67}$
MW	Molecular Weight (lb/lb-mol)	502	Molecular weight of TDP ZP
P	Vapor Pressure (atm)	0.0000	Vapor Pressure of TDP ZP= 0.0013 mmHg * (1 atm/760 mmHg)
H	Emission Hours (hrs/batch)	14.00	Vacuum pump reduce process to 14 hr run time per batch
R	Universal Gas Constant (atm-ft ³ /lbmol-R)	0.7302	Engineering constant
T	Temperature (R)	682.47	Average Temperature = 106°C (Initial 80, Stripping 200, Cooling 40)
E	Emission Rate (lb per batch)	0.00	$E = (MW \cdot k \cdot P \cdot A \cdot H)/(R \cdot T)$, US EPA open top tank equation
	Emission Rate (lb/hr)	0.00	lb/batch ÷ hours/batch
n	Efficiency of control equipment	0%	Assumed 0% control efficiency for potential to emit calculations
	Estimated Potential Emissions (ton per batch)	4.50E-07	Emissions (lb/yr) * 1 ton/2,000 lb * (1-n)
	Batches per Year	350	WCS
	Estimated Potential Emissions (tpy)	1.57E-04	Emissions (lb/yr) * 1 ton/2,000 lb * (1-n)

Addivant; Zero Phenol Process
 K-4 Product Filtration Tank - Working and Breathing Emissions Detail Sheet

Pollutant	Losses (lbs/yr) ¹			Losses (lb/hr)			Losses (tpy)		
	Working Loss	Breathing Loss	Total Emissions	Working Loss	Breathing Loss	Total Emissions	Working Loss	Breathing Loss	Total Emissions
VOC	1.00E-02	0.00E+00	1.00E-02	1.14E-06	0.00E+00	1.14E-06	5.00E-06	0.00E+00	5.00E-06

Note:

¹ Losses from EPA TANKs Report - K-4 Product

² EPA TANKs Report - K-4 Product uses WTDZP density and Theoretical Yield of WTDZP Product from K-20 Process.

Addivant; Zero Phenol Process
Methanol Loading Losses to Waste Drums - R-044

Methanol Loading Losses

Compound	Molecular Weight (lb/lbmol)	True Vapor Pressure of Liquid (psia)	Saturation Factor	Temperature (°R)	Loading Loss Rate (lb/10 ³ gal)	Methanol Recovery Rate (gal/batch)	Number of Trial Runs (batches)	Methanol Recovery (gal/yr)	Annual Loading Losses (tpy)	Annual Loading Losses (lb/hr)
Methanol	32.04	1.16	1.45	513.27	1.31	266.00	350.00	93100.00	6.10E-02	3.48E-01

Note:

¹Emission calculation from AP 42 5.2-4 Equation (1) - Loading Loss (lb/10³ gal) of liquid loaded

²Methanol Recovery Rate from Production Yields during W430 Trial.

³Methanol Receiver (R44) chilled to 12°C (53.6°F). According to the Clausius–Clapeyron equation, vapor pressure of methanol at 12°C is 60.54 mmHg (1.161 psia).

⁴Drumming takes 1 hour per batch.

Saturated Vapor Pressure for Methanol	
Temp (°F)	Pressure (psia)
53.6	1.161

**Addivant; Zero Phenol Process
Product Loading Losses**

Product Loading Losses

Compound	Molecular Weight (lb/lbmol)	True Vapor Pressure of Liquid (psia)	Saturation Factor	Temperature (°R)	Loading Loss Rate (lb/10 ³ gal)	Production Rate (gal/batch)	Number of Batches (batches)	Production (gal/yr)	Annual Loading Losses (tpy)	Annual Loading Losses (lb/hr)
Product	502.00	3.22E-07	1.45	599.67	0.00	1224.00	350.00	428400.00	1.04E-06	1.49E-06

Note:

¹Emission calculation from AP 42 5.2-4 Equation (1) - Loading Loss (lb/10³ gal) of liquid loaded

²Temperature based off of max temperature of product during loading.

⁴Loading takes 4 hours per batch. (Worst Case Scenario - Load each batch 4x350 = 1,400 hr/yr)

Saturated Vapor Pressure for WTDPZP	
Temp (°F)	Pressure (psia)
140	0.0000003

**Addivant; Zero Phenol Process
Scrubber, Hot Well Loading Losses to Wastewater Treatment System**

Hot Well Flashing Losses

Compound	Molecular Weight (lb/lbmol)	True Vapor Pressure of Liquid (psia)	Saturation Factor	Temperature (°R)	Loading Loss Rate (lb/10 ³ gal)	Wastewater Recovery Rate (gal/batches)	Number of Batches (batches)	Methanol Recovery (gal/yr)	Annual Loading Losses (tpy)	Annual Loading Losses (lb/hr)
Methanol	32.04	1.86	1.45	527.67	2.04	42900.00	350.00	9009.00	9.17E-03	3.74E-03

Note:

¹Emission calculation methodology from AP 42 5.2-4 Equation (1) - Loading Loss (lb/10³ gal) of liquid loaded

²Methanol is assumed to be a maximum of 0.06% of the wastewater recovered.

³5 gpm *60 minutes per hour * 14 hour batch= 42,900 gallons/batch

⁴Scrubber discharges water at 5gpm. Potential vapors during 14 hour process*350 batches/year =4,900 hr/yr.

Saturated Vapor Pressure for Methanol	
Temp (°F)	Pressure (psia)
68	1.856

No steam

Addivant; Zero Phenol Process
Vacuum Pump Receiver R-033 - Working and Breathing Emissions Detail Sheet

Pollutant	Losses (lbs/yr) ¹			Losses (lb/hr)			Losses (tpy)		
	Working Loss	Breathing Loss	Total Emissions	Working Loss	Breathing Loss	Total Emissions	Working Loss	Breathing Loss	Total Emissions
VOC	9.65E-01	3.42E+00	4.39E+00	1.10E-04	3.90E-04	5.01E-04	4.83E-04	1.71E-03	2.19E-03
Methanol	9.65E-01	3.42E+00	4.39E+00	1.10E-04	3.90E-04	5.01E-04	4.83E-04	1.71E-03	2.19E-03

Note:

- ¹Losses from EPA TANKs Report - R-033/R-039 Tank (Tank vents to flame arrester)
- ²Waste is based on a throughput of 1,300 gal/yr (26 drums per year)

Addivant; Zero Phenol Process
Methanol Loading Losses to Waste Drums R-033

Methanol Loading Losses

Compound	Molecular Weight (lb/lbmol)	True Vapor Pressure of Liquid (psia)	Saturation Factor	Temperature (°R)	Loading Loss Rate (lb/10 ³ gal)	Methanol Recovery Rate (gal/batch)	Number of Batches (batches)	Methanol Recovery (gal/yr)	Annual Loading Losses (tpy)	Annual Loading Losses (lb/hr)
Methanol	32.04	1.86	1.45	545.67	1.97	3.71	350.00	1298.50	1.28E-03	1.97E-01

Note:

- ¹Emission calculation from AP 42 5.2-4 Equation (1) - Loading Loss (lb/10³ gal) of liquid loaded
- ²The 1,300 gal/yr = 3.71 gal/batch. Takes 30 minutes to load every two weeks.

3.47E-03 1.97E-01

Saturated Vapor Pressure for Methanol	
Temp (°F)	Pressure (psia)
86	1.856

Addivant; Zero Phenol Process
Vacuum Pump Receiver R-039 Tank - Working and Breathing Emissions Detail Sheet

Pollutant	Losses (lbs/yr) ¹			Losses (lb/hr)			Losses (tpy)		
	Working Loss	Breathing Loss	Total Emissions	Working Loss	Breathing Loss	Total Emissions	Working Loss	Breathing Loss	Total Emissions
VOC	9.65E-01	3.42E+00	4.39E+00	1.10E-04	3.90E-04	5.01E-04	4.83E-04	1.71E-03	2.19E-03
Methanol	9.65E-01	3.42E+00	4.39E+00	1.10E-04	3.90E-04	5.01E-04	4.83E-04	1.71E-03	2.19E-03

Note:

¹Losses from EPA TANKs Report - R-033/R-039 Tank

²Waste is based of a throughput of 650 gal/yr (26 drums per year)

Addivant; Zero Phenol Process
Methanol Loading Losses to Waste Drums R-039

Methanol Loading Losses

Compound	Molecular Weight (lb/lbmol)	True Vapor Pressure of Liquid (psia)	Saturation Factor	Temperature (°R)	Loading Loss Rate (lb/10 ³ gal)	Methanol Recovery Rate (gal/batch)	Number of Trial Runs (batches)	Methanol Recovery (gal/yr)	Annual Loading Losses (tpy)	Annual Loading Losses (lb/hr)
Methanol	32.04	1.86	1.45	545.67	1.97	1.86	350.00	651.00	6.41E-04	9.86E-02

Note:

¹Emission calculation from AP 42 5.2-4 Equation (1) - Loading Loss (lb/10³ gal) of liquid loaded

²The 650 gal/yr = 3.71 gal/batch. Takes 30 minutes to load every two weeks.

³The waste is 50% Oil and 50% Methane.

2.83E-03 9.91E-02

Saturated Vapor Pressure for Methanol	
Temp (°F)	Pressure (psia)
86	1.856

Addivant; Zero Phenol Process

Calculation Methodology

Emission factors are SOCOMI factors - US EPA. Emissions are calculated using the number of components and the maximum operating hours in a year.

VOC Equipment Leaks

Input Data

	Value	Basis
Heavy Liquid Valves EF:	0.00023 kg/hr	SOCMI Factors - US EPA. Protocol for Equipment Leak Emission Estimates, (EPA-453/R-95-017) November 1995, Table 2-1.
	0.00051 lbs VOC/valve/hr	
Light Liquid Valves EF:	0.00403 kg/hr	
	0.00888 lbs VOC/valve/hr	
Gas Valves EF:	0.00597 kg/hr	
	0.01316 lbs VOC/valve/hr	
Heavy Liquid Flanges EF ^[1] :	0.00183 kg/hr	
	0.00403 lbs VOC/flange/hr	
Light Liquid Flanges EF ^[1] :	0.00183 kg/hr	
	0.00403 lbs VOC/flange/hr	
Gas Flanges EF ^[1] :	0.00183 kg/hr	
	0.00403 lbs VOC/flange/hr	
Heavy Liquid Pump Seals EF:	0.00862 kg/hr	
	0.019 lbs VOC/pump seal/hr	
Light Liquid Pump Seals EF:	0.0199 kg/hr	
	0.044 lbs VOC/pump seal/hr	
Sampling Connections EF:	0.015 kg/hr	
	0.033 lbs VOC/sampling connection/hr	
Gas Pressure Relief Valves EF ^[2] :	0.104 kg/hr	
	0.2293 lbs VOC/relief valve/hr	

Description of Streams and Number of Equipment Components

Stream ID	Vapor/ Liquid Service?	Number of Equipment Components not in Vacuum Service							Annual Max In-Service Hours/year
		Liquid Service Valves	Liquid Service Flanges	Vapor Service Valves	Vapor Service Flanges	Pump Seals	Sampling Connections	Safety Relief Valves	
T-30 & T-31 to K-20 Reactor	Liquid	31	60			4		2	8760
T-3 & T-9 to K-20 Reactor	Liquid	31	60			4		2	350
T-5 from K-4 Product	Liquid	14	40			1	2	1	350
K-20 Reactor to K-4	Liquid	18	35			2	3	1	350
K-20 Reactor to column	Vapor			5	11		1		2450
Primary condensor to secondary condensor	Vapor				2				2450
Secondary condensor to K-20 Receiver (R44)	Vapor			3	6				2450
K-20 Receiver (R44) to K-20 Charge Meter	Liquid	13	25			2	1		350
K-20 Receiver (R44) to Methanol drumming	Liquid	4	8				2		350
K-20 Receiver (R44) to KO Pot R116	Vapor			1	4				2450
KO Pot R116 to Water Jet	Vapor			5	12			1	4900
K-4 Filtration	Liquid	10	20			1			1400
Vacuum Pump to R-033	Vapor			7	19		2	1	4900
Vacuum Pump to R-039	Vapor			11	6	1			4900
Totals:		121	248	32	60	15	11	8	

Calculation

Streams	Emissions from Leaking Components not in Vacuum Service							
	Percent VOC in Stream	Valves Liquid (lbs/yr)	Flanges Liquid (lbs/yr)	Valves Gas (lbs/yr)	Flanges Gas (lbs/yr)	Pump Seals (lbs/yr)	Sampling Connections (lbs/yr)	Pressure Relief Valves (lbs/yr)
T-30 & T-31 to K-20 Reactor	100%	137.70	2,120.52	0.00	0.00	665.90	0.00	4,017.02
T-3 & T-9 to K-20 Reactor	100%	5.50	84.72	0.00	0.00	26.61	0.00	160.50
T-5 from K-4 Product	100%	2.48	56.48	0.00	0.00	6.65	23.15	80.25
K-20 Reactor to K-4	100%	3.19	49.42	0.00	0.00	13.30	34.72	80.25
K-20 Reactor to column	100%	0.00	0.00	161.23	108.73	0.00	81.02	0.00
Primary condensor to secondary condensor	100%	0.00	0.00	0.00	19.77	0.00	0.00	0.00
Secondary condensor to K-20 Receiver (R44)	100%	0.00	0.00	96.74	59.31	0.00	0.00	0.00
K-20 Receiver (R44) to K-20 Charge Meter	100%	2.31	35.30	0.00	0.00	13.30	11.57	0.00
K-20 Receiver (R44) to Methanol drumming	100%	12.44	11.30	0.00	0.00	0.00	23.15	0.00
K-20 Receiver (R44) to KO Pot R116	100%	0.00	0.00	4.61	5.65	0.00	0.00	0.00
KO Pot R116 to Water Jet	100%	0.00	0.00	322.46	237.23	0.00	0.00	1,123.48
K-4 Filtration	100%	7.10	112.97	0.00	0.00	26.61	0.00	0.00
Vacuum Pump to R-033	100%	0.00	0.00	451.45	375.61	0.00	324.08	1,123.48
Vacuum Pump to R-039	100%	0.00	0.00	709.41	118.61	93.12	0.00	0.00
Total		170.72	2,470.72	1,745.89	924.90	845.49	497.70	6,584.98

Total VOC Emissions from Equipment Leaks

13,240 lbs/yr
6.62 tpy

Streams	Emissions from Leaking Components not in Vacuum Service							
	Percent VOC in Stream	Valves Liquid (lbs/hr)	Flanges Liquid (lbs/hr)	Valves Gas (lbs/hr)	Flanges Gas (lbs/hr)	Pump Seals (lbs/hr)	Sampling Connections (lbs/hr)	Pressure Relief Valves (lbs/hr)
T-30 & T-31 to K-20 Reactor	100%	1.57E-02	2.42E-01	0.00E+00	0.00E+00	0.08	0.00E+00	4.59E-01
T-3 & T-9 to K-20 Reactor	100%	1.57E-02	2.42E-01	0.00E+00	0.00E+00	0.08	0.00E+00	4.59E-01
T-5 from K-4 Product	100%	7.10E-03	1.61E-01	0.00E+00	0.00E+00	0.02	6.61E-02	2.29E-01
K-20 Reactor to K-4	100%	9.13E-03	1.41E-01	0.00E+00	0.00E+00	0.04	9.92E-02	2.29E-01
K-20 Reactor to column	100%	0.00E+00	0.00E+00	6.58E-02	4.44E-02	0.00	3.31E-02	0.00E+00
Primary condensor to secondary condensor	100%	0.00E+00	0.00E+00	0.00E+00	8.07E-03	0.00	0.00E+00	0.00E+00
Secondary condensor to K-20 Receiver (R44)	100%	0.00E+00	0.00E+00	3.95E-02	2.42E-02	0.00	0.00E+00	0.00E+00
K-20 Receiver (R44) to K-20 Charge Meter	100%	6.59E-03	1.01E-01	0.00E+00	0.00E+00	0.04	3.31E-02	0.00E+00
K-20 Receiver (R44) to Methanol drumming	100%	3.55E-02	3.23E-02	0.00E+00	0.00E+00	0.00	6.61E-02	0.00E+00
K-20 Receiver (R44) to KO Pot R116	100%	0.00E+00	0.00E+00	1.32E-02	1.61E-02	0.00	0.00E+00	0.00E+00
KO Pot R116 to Water Jet	100%	0.00E+00	0.00E+00	6.58E-02	4.84E-02	0.00	0.00E+00	2.29E-01
K-4 Filtration	100%	5.07E-03	8.07E-02	0.00E+00	0.00E+00	0.02	0.00E+00	0.00E+00
Vacuum Pump to R-033	100%	0.00E+00	0.00E+00	9.21E-02	7.67E-02	0.00	6.61E-02	2.29E-01
Vacuum Pump to R-039	100%	0.00E+00	0.00E+00	1.45E-01	2.42E-02	0.02	0.00E+00	0.00E+00
Total		9.49E-02	1.00E+00	4.21E-01	2.42E-01	0.29	3.64E-01	1.83E+00

Total VOC Emissions from Equipment Leaks

4.24 lbs/hr

Addivant; Zero Phenol Process

Calculation Methodology

Emission factors are SOCFI factors - US EPA. Emissions are calculated using the number of components and the maximum operating hours in a year.

Methanol (HAP) Equipment Leaks

Input Data	Value	Basis
Light Liquid Valves EF:	0.00403 kg/hr	SOCMI Factors - US EPA. Protocol for Equipment Leak Emission Estimates, (EPA-453/R-95-017) November 1995, Table 2-1.
Gas Valves EF:	0.00888 lbs VOC/valve/hr 0.00597 kg/hr 0.01316 lbs VOC/valve/hr	
Light Liquid Flanges EF ⁽¹⁾ :	0.00183 kg/hr	
Gas Flanges EF ⁽¹⁾ :	0.00403 lbs VOC/flange/hr 0.00183 kg/hr 0.00403 lbs VOC/flange/hr	
Light Liquid Pump Seals EF:	0.0199 kg/hr	
Sampling Connections EF:	0.044 lbs VOC/pump seal/hr 0.015 kg/hr 0.033 lbs VOC/sampling connection/hr	
Gas Pressure Relief Valves EF ⁽²⁾ :	0.104 kg/hr 0.2293 lbs VOC/relief valve/hr	

Description of Streams and Number of Equipment Components

Stream ID	Vapor/ Liquid Service?	Number of Equipment Components not in Vacuum Service							Annual Max In-Service Hours/year
		Liquid Service Valves	Liquid Service Flanges	Vapor Service Valves	Vapor Service Flanges	Pump Seals	Sampling Connections	Safety Relief Valves	
K-20 Reactor to column	Vapor			5	11		1		2450
Primary condensor to secondary condensor	Vapor				2				2450
Secondary condensor to K-20 Receiver (R44)	Vapor			3	6				2450
K-20 Receiver (R44) to Methanol drumming	Liquid	4	8				2		350
K-20 Receiver (R44) to KO Pot R116	Vapor			1	4				2450
KO Pot R116 to Water Jet	Vapor			5	12			1	4900
Vacuum Pump to R-033	Vapor			7	19		2	1	4900
Vacuum Pump to R-039	Vapor			11	6	1			4900
Totals:		4	8	32	60	1	5	2	

Calculation

Streams	Emissions from Leaking Components not in Vacuum Service							
	Percent VOC in Stream	Valves Liquid (lbs/yr)	Flanges Liquid (lbs/yr)	Valves Gas (lbs/yr)	Flanges Gas (lbs/yr)	Pump Seals (lbs/yr)	Sampling Connections (lbs/yr)	Pressure Relief Valves (lbs/yr)
K-20 Reactor to column	50%	0.00	0.00	80.62	54.36	0.00	40.51	0.00
Primary condensor to secondary condensor	50%	0.00	0.00	0.00	9.88	0.00	0.00	0.00
Secondary condensor to K-20 Receiver (R44)	50%	0.00	0.00	48.37	29.65	0.00	0.00	0.00
K-20 Receiver (R44) to Methanol drumming	100%	12.44	11.30	0.00	0.00	0.00	23.15	0.00
K-20 Receiver (R44) to KO Pot R116	100%	0.00	0.00	32.25	39.54	0.00	0.00	0.00
KO Pot R116 to Water Jet	100%	0.00	0.00	322.46	237.23	0.00	0.00	1,123.48
Vacuum Pump to R-033	100%	0.00	0.00	451.45	375.61	0.00	324.08	1,123.48
Vacuum Pump to R-039	50%	0.00	0.00	354.71	59.31	107.49	0.00	0.00
Total		12.44	11.30	1,289.84	805.58	107.49	387.74	2,246.96

Total Methanol Emissions from Equipment Leaks
4,861 lbs/yr
2.43 tpy

Streams	Emissions from Leaking Components not in Vacuum Service							
	Percent VOC in Stream	Valves Liquid (lbs/hr)	Flanges Liquid (lbs/hr)	Valves Gas (lbs/hr)	Flanges Gas (lbs/hr)	Pump Seals (lbs/hr)	Sampling Connections (lbs/hr)	Pressure Relief Valves (lbs/hr)
K-20 Reactor to column	50%	0.00E+00	0.00E+00	3.29E-02	2.22E-02	0.00	1.65E-02	0.00E+00
Primary condensor to secondary condensor	50%	0.00E+00	0.00E+00	0.00E+00	4.03E-03	0.00	0.00E+00	0.00E+00
Secondary condensor to K-20 Receiver (R44)	50%	0.00E+00	0.00E+00	1.97E-02	1.21E-02	0.00	0.00E+00	0.00E+00
K-20 Receiver (R44) to Methanol drumming	100%	3.55E-02	3.23E-02	0.00E+00	0.00E+00	0.00	6.61E-02	0.00E+00
K-20 Receiver (R44) to KO Pot R116	100%	0.00E+00	0.00E+00	1.32E-02	1.61E-02	0.00	0.00E+00	0.00E+00
KO Pot R116 to Water Jet	100%	0.00E+00	0.00E+00	6.58E-02	4.84E-02	0.00	0.00E+00	2.29E-01
Vacuum Pump to R-033	100%	0.00E+00	0.00E+00	9.21E-02	7.67E-02	0.00	6.61E-02	2.29E-01
Vacuum Pump to R-039	50%	0.00E+00	0.00E+00	7.24E-02	1.21E-02	0.02	0.00E+00	0.00E+00
Total		3.55E-02	3.23E-02	2.96E-01	1.92E-01	0.02	1.49E-01	4.59E-01

Total Methanol Emissions from Equipment Leaks
1.18 lbs/hr