

From: [Danko, Jeff](#)
To: [DuFresne, Kristin I - DNR](#)
Cc: [Neal, Conor](#); [Janeczek, Joseph](#); [Mator, Richard](#); [Suennen, Ryan](#); [Ziegelbauer, Heather/MKE](#); [Moen, Trevor J - DNR](#); [Killian, James - DNR](#); [Bougie, Cheryl - DNR](#); [Austin, Brian P - DNR](#)
Subject: Response to Dye Testing Comments - Tyco Fire Products LP site
Date: Tuesday, May 16, 2017 2:42:14 PM
Attachments: [image002.jpg](#)
[WDNR_2015_AdditiveReviewWorksheet_Dyes_\(SY151216\)_002.docx](#)
[D13800_CHROMATINT_RHODAMINE_WT_LIQUID_\(US\).pdf](#)
[D13800_Chromatint_Rhodamine_WT_20%_Liquid.pdf](#)
[D13800SPEC.DOC](#)
[DyeTestSDS.PDF](#)
[Worst_case_scenario_flow-DRAFT-20170515.xlsx](#)

Kristin:

Attached is the response to WDNR comments and additional information related to the dye test activities for your review. I am sure much of the information will be further discussed on our call next week. If you have questions please call.

Jeff Danko

Environmental Project Geologist
262-951-6888

From: DuFresne, Kristin I - DNR [<mailto:Kristin.DuFresne@wisconsin.gov>]
Sent: Monday, April 24, 2017 2:35 PM
To: Danko, Jeff
Cc: Neal, Conor (Neal.Conor@epa.gov); Janeczek, Joseph; Mator, Richard; Suennen, Ryan; Heather.Ziegelbauer@CH2M.com; Austin, Brian P - DNR; Moen, Trevor J - DNR; Killian, James - DNR; Bougie, Cheryl - DNR; DuFresne, Kristin I - DNR
Subject: RE: Response to Dye Testing Comments - Tyco Fire Products LP site

Jeff – The Department of Natural Resources (DNR) is in receipt of Tyco’s January 31, 2017 submittal titled *Responses to DNR Review of Tyco Contract Documents – Subsurface Injection of Tracer Dye Scope of Work, dated March 30, 2016 and Technical Memorandum, Response to DNR Questions Regarding Proposed Dye Testing, dated April 15, 2016, CH2M-Hill EPA RCRA Administrative Order Docket No. RCRA-05-2009-00007 Tyco Stanton Street Facility; EPA ID No. WID006 125 215*. The DNR has reviewed this submittal and offers the following comments:

To date, the DNR has not received a completed *Additive Review Worksheet* (attached) for the Rhodamine WT Liquid. The submittal of a completed worksheet is required in order for the DNR to review/approve of the dye test proposal. The DNR urges Tyco to actively communicate with the Rhodamine WT Liquid manufacturer and provide the requested information to the DNR.

The Additive Review Worksheet has been completed to the extent possible following extensive communication with suppliers of Rhodamine WT liquid. Attached is the Additive Review Worksheet and Safety Data Sheets from three potential suppliers of the material.

Limited data appears to be available to provide much of the information requested.

The submitted information does not provide enough information to assess the total mass of dye being injected into the groundwater and potentially released to the river (i.e. mass balance). Knowledge of the total mass to be injected, estimated groundwater travel rates, and estimates of dye lost to adsorption could provide a range of possible mass discharge rates to the river. Additionally, a thorough understanding of the river hydrology is necessary to assist with determining the amount of potential mixing. Factors to consider include Lake Michigan water levels, river flow and seiche-driven reversals, seasonal variations and relative temperature differences between the river and the groundwater. Upon knowing the mass range and river hydrology one can begin to evaluate the risks of dosing.

An excel spreadsheet was provided with the April 2016 Response to Comments that provides information on the assumptions made during design of the dye testing. From Worksheet 5 in that spreadsheet, the maximum mass injected would be 6.46 kg of Rhodamine WT per injection location if injected at 150 mg/L and 1.72 kg per injection location if injected at 40 mg/L. Because the injection will be conducted to displace 1 pore volume of groundwater within a radius of influence that intersects the wall, groundwater with dye would intersect the wall at the conclusion of the injection. An assumed combined aquifer dilution/adsorption factor of 5x was assumed, consistent with groundwater dye tracer studies (Payne et al, 2009) so that sufficient dye is present at the wall to detect potential seepage. However, for the worst-case scenario discussed below, additional calculations have been made in the attached spreadsheet with the conservative assumption of no aquifer dilution/adsorption.

With respect to the additional factors, low flows under higher than average water stage would provide the lowest dilution based on the lowest river velocity. However, the higher water column itself would provide some additional potential for dilution, reducing the influence of the higher water level. Seiche-driven reversals in river flow are transitory in nature and could actually improve mixing by increasing turbulence in the river. Although the dye plume entering the river could be carried back over itself in a current reversal, the impacts of this highly transitory event on potential dilution is likely immaterial considering the estimated initial dilution. Temperature differences are inconsequential at the estimated dilution ratios on the order of 10,000:1.

The DNR asks that Tyco provide estimates, for the worst case scenario, on the mass loading of the Rhodamine WT Liquid entering the river. This worst case scenario would assume no dye is lost to adsorption prior to discharge through the barrier wall. In addition, because the original calculated injection volumes were based on the concept of displacing the entire pore volume of groundwater in the space between the injection well and the barrier wall, no groundwater dilution should be assumed for a worst case scenario.

A worst case mass loading scenario has been calculated by making the following assumptions:

- The injection concentration (40 mg/L or 150 mg/L) would be subjected to no aquifer dilution, and would be present at the wall at the injected concentration (remove 5x aquifer dilution/adsorption factor).
- Calculating a worst-case groundwater seepage rate (10.6 gallons per minute) assuming the following:
 - Seepage from an 18 ft deep by 1 ft wide area as if the waterproof sealant had failed on a joint.
 - The maximum head difference observed between MW-108S (3.45 ft) and the

river during 2016 pressure transducer measurements.

- A hydraulic conductivity for main plant aquifer materials (66 ft/day) used in previous models.

Under this scenario, a 40 mg/L injection would have a mass discharge of 1,612 milligrams per minute and a 150 mg/L injection would have a mass discharge of 6,045 milligrams per minute at the joint. A copy of the calculation spreadsheet is attached. It should be noted that dye injections will occur sequentially (one location at a time) and if dye is observed in the river near a dye injection location, the remaining scheduled injections will not be conducted.

As discussed below, surface water dilution calculations and modeling could be completed to estimate the likely lateral and downstream extent of Rhodamine WT concentrations above relevant criteria (visible criteria, 10 ug/L; water entering drinking water plant criteria, 10 ug/L; drinking water criteria, 0.1 ug/L) under typical and worst-case scenarios.

Based on information provided by Tyco, the DNR does not have enough information to determine whether or not the Rhodamine WT Liquid will impact downstream sources. Most chemical inputs are rarely introduced uniformly and would not experience instantaneous complete mixing in the river. Typically, they must travel a certain distance before the chemical concentration becomes uniform and mixed across the channel.

Tyco should consider using a mixing zone model such as CORMIX to predict the movement of any dye plume by modeling it as a multi-port diffusor with a low exit velocity under unsteady flow conditions.

Tyco may also consider modeling the flow data and the plume using the Fickian Mixing Model. This model will provide Tyco with concentrations of the conservative tracer (i.e. chemical that does not undergo degradation in the river and is not absorbed to the river channel or suspended particles) at any time after injection and any distance downstream.

It is Tyco's opinion that there are too many assumptions and variables that exist to allow for accurate modeling to occur for the area; therefore, Tyco is not inclined to perform such extensive activities to allow for performance of an activity (dye testing) that Tyco has repeatedly expressed is not necessary to document site containment. In addition, use of a nearfield momentum-based mixing model (such as CORMIX) is not appropriate for the conditions at the site because these models are based on turbulent mixing due to momentum from discharges from a multiport diffuser, whereas discharges at this site would be low momentum groundwater discharges.

Alternatives to such extensive modeling could include simple excel spreadsheet modeling. Calculation of downstream tracer concentrations could be provided using standard techniques for farfield dilution such as those presented by the EPA (Yearsley, 1989. Diffusion in Near-shore and Riverine Environments.) The model could be applied using estimates for eddy diffusivity as provided by Fischer et al. 1979 (Mixing in Inland and Coastal Waters), which takes into account river depth and channel slope. A range of values governing longitudinal and lateral mixing would be investigated to provide bookend estimates on expected conditions to acknowledge the uncertainty in the controlling parameters.

In addition, it is possible that alternatives to modeling and implementation of the dye testing will be discussed during the upcoming May 23, 2017 conference call

Due to DNR concerns related to this large scale dye test, Tyco is advised to develop a

proposal for a pilot test. The DNR recommends implementing the pilot test upon completion of the outfall/storm water repair work. The DNR believes it may make more sense for Tyco to focus its efforts on a pilot dye test (i.e. collection of real data) rather than continued modeling (i.e. desktop) efforts. Note: The DNR envisions the potential to use one of the repaired outfalls to conduct the pilot dye test. Alternatively, a slug of dye could be injected directly into the river and its travel, dispersion, visibility and instrument detection characteristics could be observed and measured in real time. Realistic parameters for use in an acceptable mixing and dispersion model might also be developed with this pilot test.

Tyco is considering this request and may elect, with agency agreement, to perform a pilot test in the river in lieu of performance of modeling. If it is concluded following the May 23, 2017 conference call that the path forward will remain performance of a dye test, Tyco will commence preparation of a pilot test work plan with the intent of implementation of the plan following the planned August 2017 Walleye Fishing Tournament.

The DNR continues to believe that a proposal for sampling arsenic discharges at various horizontal and vertical locations along the barrier wall would provide useful information and should not be discounted. This sampling effort could be a stand-alone option or part of the dye test. Appropriate detection limits and background sampling would need to be a component of this proposal.

Tyco will discuss potential alternatives to the performance of the dye testing activities during the May 23, 2017 conference call. It is Tyco's position that any alternative selected must be in lieu of performance of the dye testing requirement and not in addition to dye testing.

The Cabela's National Walleye Tour Championship will be held in Marinette, Wisconsin August 16 - 18, 2017. The DNR recommends that the dye test take place after the championship.

USEPA has agreed, in a correspondence received on May 8, 2017, that dye testing implementation may be delayed until May 1, 2018 due to the ongoing performance of stormwater improvements at the site and the need to resolve agency comments associated with performance of the dye testing activities.

By May 19, 2017, please provide the DNR with a completed Additive Review Worksheet, estimates on mass loading of Rhodamine WT to the Menominee River, and either a mixing zone model analysis or a work plan for a pilot test to determine downstream concentrations of dye in the river.

The Additive Review Worksheet and mass loading information is attached. As presented above, mixing zone modeling, pilot testing, and alternative approaches will be discussed during the planned May 23, 2017 conference call, with the intent on determining a path forward for future work at the site.

Please feel free to contact the DNR or U.S. EPA if you have any questions.

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Kristin DuFresne

Phone: (920) 662-5443

Kristin.dufresne@wisconsin.gov

From: Danko, Jeff [<mailto:jdanko@tycoint.com>]

Sent: Tuesday, January 31, 2017 3:45 PM

To: Neal, Conor

Cc: DuFresne, Kristin I - DNR; Janeczek, Joseph; Mator, Richard; Suennen, Ryan;

Heather.Ziegelbauer@CH2M.com

Subject: Response to Dye Testing Comments - Tyco Fire Products LP site

Conor:

Attached, per your request, is the response to comments on the dye testing plan to be conducted at the Tyco Fire Products LP site. Should you have any questions, please call.

Jeff Danko

Environmental Project Geologist

262-951-6888



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Additive Review Worksheet

This worksheet summarizes the information to be submitted to the WDNR for review of additives including dyes. This information is required because additives are approved on a case-by-case basis.

The fields highlighted in orange are required for all additive reviews and are NOT typically found on a safety data sheet (SDS).

The fields highlighted in blue are required for all additive reviews and are typically found on a SDS.

Parts D and E need to be completed **for each species** (e.g. Daphnia -water flea); Pimephales (fathead minnow), etc) for which a toxicity test is conducted.

The fields highlighted in green are NOT typically found on a SDS and are required for toxicity tests conducted when “Other” is selected for Test Method in Part D-1.

If all of the needed information is not provided on the SDS, It is recommended that you contact the chemical distributor and/or manufacturer to obtain the required information. You do not need to conduct the toxicity test if the toxicity information is available on SDS or from the supplier/manufacturer. If the required toxicity data is not provided to the Department, the additive product may not be approved for use.

Note: Toxicity test results must address the **commercial product formulation**. The commercial product formulation is all active ingredients and any and all carriers, buffering agents, binding agents, and additional materials – the entire product as used. Information related to active ingredient alone is not sufficient.

For more information on the additive review process, see the [“Water Quality Review Procedures for Additives”](#) guidance document.

A. General Production Information

Date of Request: 5/2/2017
 Permittee Facility Name: Chromatech Inc.
 Product Trade Name: INTRACID RHODAMINE WT LIQUID
 Product Manufacturer: SENSIENT COLORS
 Active Ingredients:

Ingredient Name*	CAS Number**	%wt or % vol
RHODAMINE WT	37299-86-8	25
TRIMELLITIC ACID	528-44-9	3
* Must be provided unless noted to be proprietary information		
** If available		

B. Toxicity Test Results

Test Species	Toxicity Value Type (e.g., LC50, EC50, NOAEL)	Toxicity Value	Toxicity Value Units (e.g., mg/L, µg/L, ppm)
FISH (species unknown)	LC50 96H	>320.0 mg/l	
Cladocera	LC50 48H	170.0 mg/l	
Green Algae	EC50 96H	20.0 mg/l	

Data shown above in
 public domain, test
 parameters unknown

Print one copy of this page for each species that has been tested.**C. Toxicity Test Parameters**1. Parameters needed for **ALL** reviews

Test species:	<input type="checkbox"/> Ceriodaphnia species (specify: _____)
	<input type="checkbox"/> Daphnia species (specify: _____)
	<input type="checkbox"/> Pimephales promelas (fathead minnow)
	<input type="checkbox"/> Lepomis macrochirus (bluegill)
	<input type="checkbox"/> Oncorhynchus mykiss (rainbow trout)
	<input type="checkbox"/> Salvelinus fontinalis (brook trout)
Test method:	<input type="checkbox"/> WI certified WET testing lab/method
	<input type="checkbox"/> EPA method (select from those listed below)
	<input type="checkbox"/> Acute-2002.0 <input type="checkbox"/> Chronic-1000.0
	<input type="checkbox"/> Acute-2021.0 <input type="checkbox"/> Chronic-1001.0
	<input type="checkbox"/> Acute-2000.0 <input type="checkbox"/> Chronic-1002.0
	<input type="checkbox"/> Acute-2019.0 <input type="checkbox"/> Chronic-1003.0
	<input type="checkbox"/> Other (additional information needed; see part D2)
Test type:	<input type="checkbox"/> Static non-renewal <input type="checkbox"/> Static-renewal <input type="checkbox"/> Flow-through
Control response:	<input type="checkbox"/> $\geq 90\%$ survival
	<input type="checkbox"/> Other (Note: if this is selected, this data cannot be used)

2. Parameters needed when using “**other**” test methods

Dilution water:	<input type="checkbox"/> Moderately hard synthetic water
	<input type="checkbox"/> Synthetic water
	<input type="checkbox"/> Receiving water
	<input type="checkbox"/> Ground water
	<input type="checkbox"/> Other (Specify: _____)
Number of test concentrations:	
Dilution series:	
Water chemistry analyses (check all that apply):	<input type="checkbox"/> pH
	<input type="checkbox"/> Conductivity
	<input type="checkbox"/> Hardness
	<input type="checkbox"/> Alkalinity
Temperature:	<input type="checkbox"/> 12 ± 1 °C
	<input type="checkbox"/> 20 ± 1 °C
	<input type="checkbox"/> 25 ± 1 °C
	<input type="checkbox"/> Other (Specify: _____)
Number of organisms per test chamber:	
Number of replicate chambers per concentration:	
Number of organisms per concentration:	
Method for calculating the response endpoint:	



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1 Company and Substance / Formulation Identification

- **Product identifier**

- **Product name:** D13800 CHROMATINT RHODAMINE WT LIQUID
- **Product Code** D13800
- **Application of the substance / preparation** Dyestuff/Colouring agent

- **Details of the supplier of the safety data sheet**

- **Manufacturer/Supplier:**
Chromatech, Inc.
7723 Market Dr.
Canton, MI 48187 USA
(734) 451-1230
- **Department:** Regulatory
- **Emergency Telephone:**
For Chemical / Medical Emergency, 24 hours:
INFOTRAC: (800) 535-5053 (US and CDN)
1-352-323-3500 (INTL)

2 Hazard(s) identification

- **Classification of the substance or mixture**

Eye Irrit. 2B H320 Causes eye irritation.

- **Label elements**

- **GHS label elements**

The product is classified and labeled according to the Globally Harmonized System (GHS).

- **Hazard pictograms** Void
- **Signal word** Warning
- **Hazard statements**
H320 Causes eye irritation.
- **Precautionary statements**
P264 Wash thoroughly after handling.
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.

3 Composition/information on ingredients

- **Chemical characterization: Mixtures**

- **Description:** Mixture of the substances listed below with nonhazardous additions.

- **Hazardous components:**

528-44-9	benzene-1,2,4-tricarboxylic acid	Eye Irrit. 2A, H319	≤ 2.5%
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4 First-aid measures

- **Description of first aid measures**

- **After inhalation:** Supply fresh air; consult doctor in case of complaints.
- **After skin contact:**
Immediately wash with water and soap and rinse thoroughly.
If skin irritation continues, consult a doctor.

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- **After eye contact:**
Rinse opened eye for several minutes under running water. If symptoms persist, consult a doctor.
- **After swallowing:**
Rinse out mouth and then drink plenty of water.
Induce vomiting, only if affected person is fully conscious.
Seek immediate medical advice.
- **Information for doctor:**
 - **Most important symptoms and effects, both acute and delayed** No further relevant information available.
 - **Indication of any immediate medical attention and special treatment needed**
No further relevant information available.

5 Fire-fighting measures

- **Extinguishing media**
 - **Suitable extinguishing agents:**
CO₂, extinguishing powder or water spray. Fight larger fires with water spray or alcohol resistant foam.
- **Special hazards arising from the substance or mixture**
Formation of toxic gases is possible during heating or in case of fire.
- **Advice for firefighters**
 - **Protective equipment:**
Wear self-contained respiratory protective device.
Wear fully protective suit.
- **Additional information**
Collect contaminated fire fighting water separately. It must not enter the sewage system.

6 Accidental release measures

- **Personal precautions, protective equipment and emergency procedures** Wear protective clothing.
- **Environmental precautions:**
Material is approved for controlled release for certain water tracing applications. Refer to any and all applicable state or municipal regulations to determine tracer study requirements.
Do not allow product to reach sewage system or any water course.
Dilute with plenty of water.
Do not allow to enter sewers/ surface or ground water.
- **Methods and material for containment and cleaning up:**
Absorb with liquid-binding material (sand, diatomite, acid binders, universal binders, sawdust).
- **Reference to other sections**
No dangerous substances are released.
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.

7 Handling and storage

- **Handling:**
 - **Precautions for safe handling** No special measures required.
 - **Protection against explosions and fires:** No special measures required.
- **Special Sensitivity:**
KEEP FROM FREEZING.
Keep container closed when not in use.

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- **Conditions for safe storage, including any incompatibilities**

- **Storage:**

- **Requirements for storerooms and containers:**

- Store only in the original receptacle.

- No special requirements.

- **Further information about storage conditions:** None.

- **Specific end use(s)** No further relevant information available.

8 Exposure controls/personal protection

- **Technical systems:**

Facilities using this material should be equipped with an eye wash station and a safety shower.

- **Control parameters**

- **Components with limit values that require monitoring at the workplace:**

The product does not contain any relevant quantities of materials with critical values that have to be monitored at the workplace.

- **Additional information:** The lists that were valid during the creation were used as basis.

- **Exposure controls**

- **Personal protective equipment:**

- **General protective and hygienic measures:**

Do not allow product to reach soil or surface water. Handle with care to minimize any exposure. The usual precautionary measures should be used when handling commercial/industrial chemicals.

Product is a concentrated colorant; general precautionary measures to avoid contact and spillage should be taken.

Wash hands before breaks and at the end of work.

- **Breathing equipment:** Not required under normal handling.

- **Protection of hands:**

Use of gloves suggested; concentrated dye/pigment products may stain skin if directly contacted.

- **Glove Material** No specified glove material; most liquid-impervious protective gloves will suffice.

- **Eye protection:** Goggles recommended during refilling.

- **Body protection:** Protective work clothing

9 Physical and chemical properties

- **Information on basic physical and chemical properties**

- **General Information**

- **Appearance:**

- **Form:** Liquid

- **Color:** Red

- **Odor:** Odorless

- **Odor threshold:** Not determined.

- **pH-value at 20 °C (68 °F):** 10.5

- **Change in condition**

- **Melting point/Melting range:** Undetermined.

- **Boiling point/Boiling range:** Undetermined.

- **Flash point:** Not applicable.

- **Flammability (solid, gaseous):** Not applicable.

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- **Ignition temperature:**
- **Decomposition temperature:** Not determined.
- **Auto igniting:** Product is not selfigniting.
- **Danger of explosion:** Product does not present an explosion hazard.
- **Vapor pressure at 20 °C (68 °F):** 23 hPa (17 mm Hg)
- **Density at 20 °C (68 °F):** 1.13 g/cm³ (9.43 lbs/gal)
- **Relative density:** Not determined.
- **Solubility in / Miscibility with**
- **Water:** Soluble.
- **Other information:** No further relevant information available.

10 Stability and reactivity

- **Reactivity:** No further relevant information available.
- **Chemical stability**
- **Thermal decomposition / conditions to be avoided:**
No decomposition if used according to specifications.
- **Possibility of hazardous reactions:** No dangerous reactions known.
- **Conditions to avoid:** No further relevant information available.
- **Incompatible materials:** No further relevant information available.
- **Hazardous decomposition products:**
In the case of a fire, oxides of carbon, fumes, and smoke may be produced.

11 Toxicological information

- **Information on toxicological effects**
- **Acute toxicity:**
- **LD/LC50 values that are relevant for classification:**
Based on the known information of the ingredients, product is expected to have a low level of acute oral toxicity. (Oral LD50 >2,000 mg/kg)
Product has not been tested.

528-44-9 benzene-1,2,4-tricarboxylic acid

Oral	LD50	2500 mg/kg (mouse)
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- **Primary irritant effect:**
- **on the skin:** May irritate skin.
- **on the eye:** No irritating effect.
- **Sensitization:** No sensitizing effects known.

- **Additional toxicological information:**

- **Carcinogenic categories**

- **IARC (International Agency for Research on Cancer)**

None of the ingredients is listed.

- **NTP (National Toxicology Program)**

None of the ingredients is listed.

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· **OSHA-Ca (Occupational Safety & Health Administration)**

None of the ingredients is listed.

12 Ecological information

- **Toxicity**
 - **Aquatic toxicity:** No further relevant information available.
- **Persistence and degradability** No further relevant information available.
- **Behavior in environmental systems:**
 - **Bioaccumulative potential** No further relevant information available.
 - **Mobility in soil** No further relevant information available.
 - **Other information:**
Rhodamine WT is an NSF approved colorant for tracer studies in drinking water applications. Controlled release of this material into the environment may be permitted by your local or state agencies for hydrological or other studies. Consult your state or local environmental authorities for any restrictions or requirements associated with release of this product.
- **Additional ecological information:**
 - **General notes:**
Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system.
- **Other adverse effects** No further relevant information available.

13 Disposal considerations

- **Waste treatment methods**
 - **Recommendation:**
Material may be considered non-hazardous waste. Consult waste contractor for disposal considerations of large amounts of unused product.
Must not be disposed of together with household garbage. Do not allow product to reach sewage system.
Must be specially treated adhering to official regulations.
- **Uncleaned packagings:**
 - **Recommendation:** Packaging can be reused or recycled after cleaning.
 - **Recommended cleansing agent:** Water, if necessary with cleansing agents.

14 Transport information

- **UN-Number**
 - DOT, ADR, ADN, IMDG, IATA Void
- **UN proper shipping name**
 - DOT, ADR, ADN, IMDG, IATA Void
- **Transport hazard class(es)**
 - DOT, ADR, ADN, IMDG, IATA
 - Class Void
- **Packing group**
 - DOT, ADR, IMDG, IATA Void
- **Environmental hazards:** Not applicable.
- **Special precautions for user** Not applicable.

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 · **UN "Model Regulation":** Void

15 Regulatory information

 · **Safety, health and environmental regulations/legislation specific for the substance or mixture**

 · **SARA**

 · **Section 355 (extremely hazardous substances):**

None of the ingredients is listed.

 · **Section 313 (Specific toxic chemical listings):**

None of the ingredients is listed.

 · **TSCA (Toxic Substances Control Act):**

All ingredients are listed.

 · **Proposition 65**

 · **Chemicals known to cause cancer:** No Proposition 65 carcinogens.

 · **Carcinogenic categories**

 · **EPA (Environmental Protection Agency)**

None of the ingredients is listed.

 · **TLV (Threshold Limit Value established by ACGIH)**

None of the ingredients is listed.

 · **NIOSH-Ca (National Institute for Occupational Safety and Health)**

None of the ingredients is listed.

 · **GHS label elements**

The product is classified and labeled according to the Globally Harmonized System (GHS).

 · **Hazard pictograms** Void

 · **Signal word** Warning

 · **Hazard statements**

H320 Causes eye irritation.

 · **Precautionary statements**

P264 Wash thoroughly after handling.

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.

 · **National regulations:**

 · **Other regulations, limitations and prohibitive regulations**

This product contains acute and/or chronic hazards under SARA 311 or 312.

 · **Other classification information**

 · **NFPA ratings (scale 0 - 4)**


Health = 1

Fire = 0

Reactivity = 0

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Printing date 06/07/2016

Reviewed on 06/07/2016

Product name: D13800 CHROMATINT RHODAMINE WT LIQUID

(Contd. from page 6)

· HMIS-ratings (scale 0 - 4)

HEALTH	1	Health = 1
FIRE	0	Fire = 0
REACTIVITY	0	Reactivity = 0

16 Other information

The information in this Safety Data Sheet relates only to the specific material designated herein. It does not relate to use in combination with any other material or in any process. This information is furnished without warranty, expressed or implied, except that it is accurate to the best knowledge of the manufacturer/supplier. The data on this sheet are related only to the specific material designated herein, and the information available for all ingredients at the time of creation. Manufacturer/supplier assumes no responsibility for use or reliance upon these data. Any information that is withheld herein (such as exact chemical identity or exact concentration) has been reserved as a trade secret as per applicable regulations.

· Contact: ABH**· Date of preparation / last revision** 06/07/2016 / 3**· Abbreviations and acronyms:**

Eye Irrit. 2A: Serious eye damage/eye irritation, Hazard Category 2A

Eye Irrit. 2B: Serious eye damage/eye irritation, Hazard Category 2B

US

D13800 CHROMATINT® RHODAMINE WT 20% LIQUID

DESCRIPTION:

Chromatint® Rhodamine WT 20% Liquid is an intense red dye used in antifreeze, leak detection, as a tracing agent in hydrogeological and water pollution studies, and as a marker in aerial spraying. It is particularly suitable for water tracing work by fluorometry or by visual methods.

PROPERTIES:

Physical Form:	Dark red liquid
pH Stability:	5.5 to 11
Solubility:	Complete solubility in fresh and sea water
Staining:	Low staining of silt, dirt and other suspended matter in shallow and inland waters.
Fluorescence:	Optimum excitation wavelength is about 556 nm Optimum analyzing wavelength is about 580 nm
Freezing Point:	Approximately -10°C
Applicable Inventories:	DSL, TSCA

STORAGE AND HANDLING:

Storage above 5° C is recommended.

AVAILABILITY:

Chromatint® Rhodamine WT 20% Liquid is available in 475 lb. drums, 250 lb. drums, and 40 lb. pails.

Chromatech Inc.
7723 Market Drive
Canton, Michigan 48187 USA
1-800-545-5075 www.chromatechcolors.com

Revision: May/2013

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CHROMATECH INCORPORATED

7723 Market Street – CANTON, MI 48187 – (734)451-1230
fax: (734) 451-8552

PRODUCT SPECIFICATION SHEET

PRODUCT NAME: CHROMATINT RHODAMINE WT LIQUID

PRODUCT CODE: D13800

	<u>SPECIFICATION</u>	<u>METHOD</u>
SHADE:	Absorbance Max @ 556 nm +/- 2 nm	Beckman
SRTENGTH:	Absorptivity 42.98 – 47.50	Beckman

PROPERTIES

APPEARANCE:	Red Liquid
SOLUBILITY IN WATER:	Soluble

July 31, 2012

CHROMATECH, INC.

7723 MARKET STREET CANTON, MI 48187

1-800-545-5075

The information and recommendations in this publication are reliable to the best of our knowledge. Users should perform their own tests to determine the suitability of a product for their own purposes. Chromatech, Inc. makes no other warranty, expressed or implied, and specifically excludes implied warranties of merchantability and fitness for a particular use. Chromatech, Inc. shall not be liable for incidental or consequential damages.

Issuing Date 26-Mar-2015

Revision Date 05-May-2014

Version 5

1. Identification of the Substance/Preparation and of the Company/Undertaking

Product Identifier

Product Code 70301027
Product name KEYACID™ RHODAMINE WT LIQUID

Recommended use of the chemical and restrictions on use

Synonyms N/A

Supplier's details

Recommended use Industrial Use Only.
Uses advised against No information available

Details of the Supplier of the Safety Data Sheet

Keystone Corporate Office	Keystone Liquid Manufacturing and Technical Facility
2501 W Fulton Street	2165 Highway 292
Chicago, IL 60612	Inman, SC 29349
	Ph 864 473-1601

Ph 312-666-2015
Ph 1-800-522-4393

Emergency Telephone Number

USA: 1-800-255-3924
China: (400-1)-400-120-0751
Other: Collect 1-813-248-0585

2. Hazards Identification

Classification

Not a dangerous substance or mixture according to the Globally Harmonized System (GHS)

EMERGENCY OVERVIEW

signal word

Not Hazardous

The product contains no substances which at their given concentration, are considered to be hazardous to health

appearance Red

Physical State Liquid

Odor No information available

precautionary statements

P281 - Use personal protective equipment as required
P262 - Do not get in eyes, on skin, or on clothing
P261 - Avoid breathing dust/fume/gas/mist/vapors/spray
P264 - Wash face, hands and any exposed skin thoroughly after handling
P270 - Do not eat, drink or smoke when using this product
P501 - Dispose of contents/ container to an approved waste disposal plant

Hazards Not Otherwise Classified (HNOC)

OTHER INFORMATION**Unknown Acute Toxicity**

98.2 percent of the mixture consists of ingredient(s) of unknown acute toxicity

3. Composition/information on Ingredients

This chemical is not considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200).

4. First aid measures**First aid measures for different exposure routes**

Eye Contact	Rinse thoroughly with plenty of water for at least 15 minutes, lifting lower and upper eyelids. Consult a physician.
Skin Contact	Wash skin with soap and water.
INHALATION	Move to fresh air.
INGESTION	Rinse mouth.

Most important symptoms/effects, acute and delayed**Main Symptoms** No information available.**Indication of immediate medical attention and special treatment needed, if necessary****Notes to physician** Treat symptomatically.**5. Fire-fighting measures****Suitable extinguishing media**

Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable extinguishing media Keep away from heat and sources of ignition.**Specific Hazards Arising from the Chemical**

No information available.

Explosion Data**Sensitivity to Mechanical Impact** None.**Sensitivity to Static Discharge** None.**Protective Equipment and Precautions for Firefighters**

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. Accidental release measures**Personal precautions, protective equipment and emergency procedures****Personal Precautions** Avoid contact with the skin and the eyes. Use personal protective equipment. For personal protection see section 8. Ensure adequate ventilation.**Environmental Precautions****Environmental Precautions** Prevent further leakage or spillage if safe to do so.**Methods and materials for containment and cleaning up****Methods for containment** Prevent further leakage or spillage if safe to do so.

Methods for Cleaning Up Use personal protective equipment. Dam up. Cover liquid spill with sand, earth or other noncombustible absorbent material. Take up mechanically, placing in appropriate containers for disposal. Clean contaminated surface thoroughly.

7. Handling and Storage

Precautions for Safe Handling

Advice on safe handling Avoid contact with skin, eyes and clothing. Do not breathe vapors/dust. In case of insufficient ventilation, wear suitable respiratory equipment. Wear personal protective equipment. Handle in accordance with good industrial hygiene and safety practice. Remove and wash contaminated clothing before re-use. Provide appropriate exhaust ventilation at places where dust is formed. Do not eat, drink or smoke when using this product. Use personal protection recommended in Section 8.

Conditions for safe storage, including any incompatibilities

Technical measures/Storage conditions Store locked up. Keep containers tightly closed in a dry, cool and well-ventilated place. Keep in properly labeled containers. Store in accordance with the particular national regulations. Store in accordance with local regulations.

Incompatible Products None known based on information supplied.

8. Exposure Controls/Personal Protection

Control Parameters

Exposure guidelines This product, as supplied, does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies

Exposure Controls

Engineering Measures Showers
Eyewash stations
Ventilation systems. Apply technical measures to comply with the occupational exposure limits. Process enclosure and/or ventilation systems.

Individual protection measures, such as personal protective equipment

Eye/Face Protection Face-shield. Chemical resistant goggles must be worn. Eyewash fountains should be provided in areas where there is any possibility that workers could be exposed to the substances; this is irrespective of the recommendation involving the wearing of eye protection. If splashes are likely to occur, wear.. Goggles.

Skin and Body Protection Skin and Body Protection. Wear protective gloves and protective clothing. Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Respiratory Protection If exposure limits are exceeded or irritation is experienced, NIOSH/MSHA approved respiratory protection should be worn.

Hygiene Measures Do not eat, drink or smoke when using this product.

9. Physical and Chemical Properties

Physical and Chemical Properties

Physical State	Liquid	Odor	No information available
appearance	Red		
odor threshold	No information available		

<u>Property</u>	<u>VALUES</u>	<u>Remarks • Method</u>
pH	10.00	
melting point		N/A
Boiling point/boiling range	< 110 °C / 230.00 °F °F	
Flash Point	< 121 °C / < 250.00 °F °F	
Evaporation Rate	no data available	
flammability (solid, gas)	no data available	no data available
Flammability Limits in Air		
Upper Flammability Limit	No information available	
Lower Flammability Limit	No information available	
vapor pressure	No information available	
Vapor Density	No information available	
Specific gravity	No information available	N/A
Solubility in Other Solvents	No information available	
Partition coefficient: n-octanol/water	No information available	
Autoignition Temperature	No Data Available	N/A
decomposition temperature	No information available	
Kinematic viscosity	No Data Available	
Dynamic viscosity	No information available	
Explosive Properties	No information available	
Oxidizing properties	No information available	

OTHER INFORMATION

softening point	No information available
Molecular Weight	
VOC Content(%)	No information available.
density	No information available

10. Stability and Reactivity**Reactivity**

no data available

Chemical Stability

Stable under recommended storage conditions.

Hazardous Reactions

None under normal processing

Conditions to avoid

Extremes of temperature and direct sunlight.

Incompatible materials

None known based on information supplied.

Hazardous decomposition products

May emit toxic fumes under fire conditions.

11. Toxicological Information**Information on Likely Routes of Exposure****Product information**

INHALATION	Avoid breathing vapors or mists.
Eye Contact	Avoid contact with eyes.
Skin Contact	Avoid contact with skin.
INGESTION	Not an expected route of exposure.

Information on Toxicological Effects

Symptoms No information available.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

sensitization No information available.
 Germ cell mutagenicity No information available.
 carcinogenicity No information available.
 Reproductive Toxicity No information available.
 Specific target organ systemic toxicity (single exposure) No information available.
 Specific target organ systemic toxicity (repeated exposure) No information available.
 Aspiration Hazard No information available.

Numerical Measures of Toxicity - Product information

Unknown Acute Toxicity 98.2 percent of the mixture consists of ingredient(s) of unknown acute toxicity
 The following values are calculated based on chapter 3.1 of the GHS document .
 ATEmix (oral) 39333 mg/kg

12. Ecological Information

ecotoxicity

98.2% of the mixture consists of components(s) of unknown hazards to the aquatic environment

Persistence and Degradability

No information available.

Bioaccumulation

No information available.

Other Adverse Effects

No information available

13. Disposal Considerations

Waste treatment

Waste Disposal Methods Should not be released into the environment. Dispose of in accordance with local regulations. This material, as supplied, is not a hazardous waste according to state and federal regulations (40 CFR 261).

Contaminated Packaging Do not re-use empty containers. Dispose of in accordance with local regulations.

14. TRANSPORT INFORMATION

DOT
 Description NOT REGULATED

MEX NOT REGULATED

IATA

Description NOT REGULATED

IMDG

Description NOT REGULATED

RID**ADN****15. Regulatory Information****International Inventories**

TSCA	Listed
EINECS/ELINCS	Listed
DSL	Not Determined
NDSL	Not Determined
PICCS	Not Determined
ENCS	Not Determined
IECSC	Not Determined
AICS	Not Determined
KECL	Not Determined
NZIoC	Not Determined

Legend

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
 EINECS/ELINCS - European Inventory of Existing Commercial Chemical Substances/EU List of Notified Chemical Substances
 DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List
 PICCS - Philippines Inventory of Chemicals and Chemical Substances
 ENCS - Japan Existing and New Chemical Substances
 IECSC - China Inventory of Existing Chemical Substances
 AICS - Australian Inventory of Chemical Substances
 KECL - Korean Existing and Evaluated Chemical Substances
 NZIoC - New Zealand Inventory of Chemicals

REACH registration number Keystone has taken all relative steps to ensure REACH-Compliance. Please contact us with any REACH-Related questions at REACH@Keystone-Europe.CO.UK

RESTRICTIONS - REACH TITLE VIII No information available

US Federal Regulations**SARA 313**

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372

SARA 311/312 Hazard Categories

Acute health hazard	NO.
Chronic health hazard	NO.
Fire hazard	NO.
Sudden Release of Pressure Hazard	NO.
Reactive Hazard	NO.

Clean Water Act

This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42).

CERCLA

This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material

US State Regulations**California Proposition 65**

This product does not contain any Proposition 65 chemicals

U.S. State Right-to-Know Regulations

This product does not contain any substances regulated by state right-to-know regulations

International regulations

Mexico - Grade

Slight risk, Grade 1.

CANADA**WHMIS Note**

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

WHMIS Hazard Class

Non-controlled

HMIS	Health Hazard 1	flammability 1	Physical hazard 0	PERSONAL PROTECTION H
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16. Other Information

Revision Date	05-May-2014
Revision note	No information available.
Restrictions on use	No information available.
Contact Information Website	WWW.DYES.COM.

Disclaimer

The information provided on this MSDS 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 guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as 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 material or in any process, unless specified in the text

End of Material Safety Data Sheet

Material Safety Data Sheet

Complies with EC no. 1907/2006
Issue Date: 11/15/2013

Page 1 of 3

Section 1: Chemical Product and Company Identification

Cat#: 19922

Part Name: RHODAMINE WT WATER TRACING DYE

Supplier: Polysciences, Inc.
400 Valley Road
Warrington, PA 18976 USA
MSDS Telephone #215-343-6484 Emergency only #215-378-4526

Identified uses: Laboratory use, manufacture of substances

Section 2: Hazards Identification

Hazard Overview

Causes eye irritation.

GHS Classification

Eye Irritation Category 2A

Signal word: Warning



Hazard and Precautionary Statements

- H319 Causes serious eye irritation.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P301A IF SWALLOWED do not induce vomiting. Do not give anything to drink. Obtain medical attention without delay.
P301D IF SWALLOWED, induce vomiting as directed by medical personnel.
P302+P352 IF ON SKIN: Wash with plenty of soap and water.
P340 Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P351 Rinse cautiously with water for several minutes.
P361 Remove/Take off immediately all contaminated clothing.
P501 Dispose of contents/container to proper waste area in accordance with institutional practices and local, state or federal regulations.

NFPA Rating

Hazard Ratings:

These ratings are Polysciences' Inc. own assessments of the properties of the material using the ANSI/NFPA 704 Standard. Additional information can be found by consulting in the NFPA published ratings lists (List 325 and List 49).

If no data is listed the information is not available.

Health	Flammability	Reactivity
2	0	1

Section 3: Composition/ Information on Ingredients

Note: Items listed with a CASRN... number have no CAS# available.

Item#	Name	EINECS	CAS#	% in product
1	Rhodamine WT	Unknown	CASRNHX199	6 - 10
2	Water	231-791-2	0007732185	91 - 100

Section 4: First Aid Measures

- Flush eyes with flowing water for at least 15 minutes.
If breathing is difficult, contact emergency personnel.
If swallowed, induce vomiting as directed by medical personnel.
Remove contaminated clothing.
Remove to fresh air.
Wash skin with deluge of water for at least 15 minutes.

Section 5: Fire Fighting Measures

- Flash point, deg F.: no data Method: no data
UEL: no data LEL: no data Autoignition temperature, deg. F.: no data
Flammability Classification: no data Flame Propagation Rate: no data
Hazardous Combustion Products: no data

Section 6: Accidental Release Measures

Any information listed below is to be considered in addition to internal guidelines for isolation of spill, containment of spill, removal of ignition sources from immediate area, and collection for disposal of spill by trained, properly protected clean up personnel.

Absorb liquids on absorbent material.

Contain spilled liquids.

Section 7: Handling and Storage

Store at room temp

Section 8: Exposure Controls/ Personal Protection**OSHA (ACGIH) Exposure Limits**

		TWA		STEL		CEILING	
		ppm	mg/	ppm	mg/m3	ppm	mg/m3
CAS#: 0007732185	IDLH: NE						
OSHA		NE	NE	NE	NE	NE	NE
ACGIH		NE	NE	NE	NE	NE	NE
CAS#: CASRNHX1992	IDLH: NE						
OSHA		NE	NE	NE	NE	NE	NE
ACGIH		NE	NE	NE	NE	NE	NE

The use of eye protection in the form of safety glasses with side shields and the use of skin protection for hands in the form of gloves are considered minimum and non-discretionary in work places and laboratories. Any recommended personal protection equipment or environmental equipment is to be considered as additional to safety glasses and gloves.

Use chemical splash goggles and face shield.

Chemical-resistant gloves should be worn whenever this material is handled. The glove material has to be impermeable and resistant to the product. Gloves should be removed and replaced immediately if there is any indication of degradation or chemical breakthrough.

Rinse and remove gloves immediately after use. Wash hands with soap and water. All glove recommendations presume that the risk of exposure is through splash and not intentional immersion of the hands into the product.

Since glove permeation data does not exist for this material, no recommendation for the glove material can be given for the product.

Permeation data must be obtained from the glove manufacturer to determine if the glove is suitable for the task.

Section 9: Physical and Chemical Properties

Formula:	no data	vapor pressure:	no data
Formula Weight:	no data	vapor density:	heavier than air
boiling point:	no data	Specific gravity:	1.01
melting point:	no data	ph:	10.5 @1.0 %
solubility:	miscible	appearance:	fluorescing red liquid

Section 10: Stability and Reactivity

Chemical Stabilit no data

Conditions to Avoid: no data

Incompatibility with other materials: no data

Hazardous Decomposition Products: no data

Hazardous Polymerization: will not occur

Section 11: Toxicological Information

Acute Data: no data

Subchronic data: no data

Section 12: Ecological Information

LC50: >320 mg/l rainbow trout (96 hour)

LC50: 170 mg/l daphnia magna

No developmental abnormalities or toxicity to oyster larvae at 100 mg/L.

Section 13: Disposal Considerations

The following chart lists the status of the chemical and its components in reference to 40 CFR Part 261.33. If the product is listed by code number the substance may be subject to special federal and state disposal regulations. If no codes are listed the material must be disposed in compliance with all Federal, State and Local Regulations.

CAS#	Waste Code	Regulated Name
0007732185	not listed	not listed
CASRNHX19922	not listed	not listed

Section 14: Transportation Data

Proper Shipping Name NOT REGULATED

Chemical Name

UN

Class

PG

Section 15: Regulatory Information

All components of this product are on the TSCA public inventory.

All components of this product are on the TSCA public inventory.

Prop 65 - Column A identifies those items which are known to the State of California to cause cancer. Column B identified items which are known to the State of California to cause reproductive toxicity.

CAS#	Column A	Column B
0007732185	no	no
CASRNHX19922	no	no

State Regulatory Information :If a CAS# is listed below this material is subject to the listed state right-to-know requirements.

CAS#	
0007732185	not listed
CASRNHX199	not listed

SARA Toxic Release Chemicals(as defined in Section 313 of SARA Title III)

This list identifies the toxic chemicals, including their de minimis concentrations for which reporting is required under Section 313 of the Emergency Planning and Community Right-to-Know Act (EPCRA). The list is also referred to as the Toxics Release Inventory (TRI) List.

CAS#	Regulated name	de minimis conc. %	Rep. Thres.
0007732185	not listed	not listed	not listed
CASRNHX19922	not listed	not listed	not listed

SARA Extremely Hazardous Substances and TPQs

This list includes hazardous chemicals as defined in 29 CFR 1910.1200(c); and extremely hazardous substances regulated under Section 302 of SARA Title III with their TPQs (in pounds), as listed in 40 CFR 355, Appendices A and B.

CAS#	Regulated name	TPQ (pounds)	EHS-RQ(pounds)
0007732185	not listed	not listed	not listed
CASRNHX19922	not listed	not listed	not listed

CERCLA

The hazardous substances, and their reportable quantities (RQs) are listed in the federal regulations at 40 CFR Part 302, Table 302.4. Release of a CERCLA hazardous substance in an amount equal to or greater than its RQ, in any 24-hour period, must be reported to the National Response Center at (800) 424-8802.

CAS#	Regulated name	RQ (pounds)
0007732185	Not listed	Not listed
CASRNHX19922	Not listed	Not listed

Section 16: Other Information

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END OF MSDS

Attachment 1

Expected Worst-Case Groundwater Discharge, Assuming a Leak Along a Joint

Tyco Fire Products LP, Marinette, WI

WORST-CASE SCENARIO (Joint Failure)-Flow

	Value	unit	Note/Rationale
from 18 ft by 1 ft area			
Head Difference	3.45	ft	Head difference between river and MW-108S in main plant on 8/20/16
Distance	2	ft	Wall thickness used in previous models
Gradient	1.725	unitless	
Area	18	ft ²	18 ft by 1 ft hole in wall along joint
Hydraulic Conductivity	66	ft/day	K value used for main plant in 2014 Model update
Discharge	2049.3	ft ³ /day	
Discharge	10.6	gpm	18 ft by 1 ft hole in wall along joint
Injection Concentration	40	mg/L	Low-end proposed injection concentration
Concentration at Wall	40	mg/L	Assumes no dilution/adsorption in groundwater system
Wall Seepage Rate	40.3	Lpm	Worst case discharge from row 12
Mass dye Seepage per minute	1612	mg/minute	Dye loading at single joint
Injection Concentration	150	mg/L	Low-end proposed injection concentration
Concentration at Wall	150	mg/L	Assumes no dilution/adsorption in groundwater system
Wall Seepage Rate	40.3	Lpm	Worst case discharge from row 12
Mass dye Seepage per minute	6045	mg/minute	Dye loading at single joint