VERMONT

Vermont Department of Environmental Conservation

EXECUTIVE SUMMARY

Per- and Polyfluoroalkyl Substances (PFAS) Pollution Prevention for Vermont Metal Finishers

In 2020, Vermont was awarded a two-year (FY 21-22) Pollution Prevention (P2) Grant from the US Environmental Protection Agency (EPA) to address source reduction of per- and polyfluoroalkyl substances (PFAS) in wastewater generated by aerospace product and part manufacturing and maintenance and metal manufacturing and fabrication industries in Vermont.

The goal of this project was to characterize and reduce, if possible, the environmental impact and human exposure of these persistent, bioaccumulative, toxic substances by improving the quality of wastewater effluent and biosolids produced at publicly owned treatment works (POTWs), or wastewater treatment facilities.

The Vermont Department of Environmental Conservation (DEC) Wastewater Pretreatment Program and Residuals & Emerging Contaminants Program collaborated with two consulting firms to conduct on site site assessments, testing and technical assistance, resulting in two reports that have been separated for easier access due to their length:

- "Poly- and Perfluoroalkyl Substances at Select Industrial Facilities", Weston & Sampson Engineers, Inc, March 19, 2023
- "Per- and Polyfluoroalkyl Substances (PFAS) Pollution Prevention at Vermont Metal Finishing Businesses", Sanborn Head & Associates, Inc., April 2023 **(attached)**

The project outcomes include:

- Characterization of PFAS contribution to POTWs from all of Vermont's active businesses engaged in metal finishing.
- Establishing a working cohort of five metal finishing businesses. The cohort researched, identified, developed, and promoted P2 practices and tools to reduce discharges of PFAS from metal finishing businesses.
- Estimating the impact of the P2 practices on POTW wastewater effluent and biosolids quality.
- Providing businesses and stakeholders training on source reduction techniques that can be replicated at businesses state and region wide.
- Ongoing technical assistance and P2 to reduce or eliminate PFAS use at the facility.

SANBORN HEAD

Mr. Nick Giannetti
Vermont Department of Environmental Conservation
1 National Life Drive, Davis 3
Montpelier, Vermont 05620-3522

April 6, 2023
File No. 5029.00

Re: PFAS Pollution Prevention at Vermont Metal Finishing Businesses
Various Facilities
Vermont

Dear Nick:

Sanborn, Head & Associates, Inc. (Sanborn Head) is pleased to provide the Per- and Polyfluoroalkyl Substances (PFAS) Pollution Prevention at Vermont Metal Finishing Businesses report for various facilities in Vermont.

Should you have any questions or require additional information, please contact the undersigned.

Very truly yours,
SANBORN, HEAD & ASSOCIATES, INC.

Matthew E. Estabrooks, PE
Senior Project Manager

Stephen G. Zemba, PhD
Project Director

MEE/SGZ: mee

Encl. PFAS Pollution Prevention at Vermont Metal Finishing Businesses Report

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SANBORN HEAD

Per- and Polyfluoroalkyl Substances (PFAS) Pollution Prevention at Vermont Metal Finishing Businesses

VARIOUS FACILITIES
Vermont

Prepared for Vermont Department of Environmental Conservation
File No. 5029.00
April 2023

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1.0 INTRODUCTION AND BACKGROUND

The Vermont Department of Environmental Conservation (DEC) received a U.S. Environmental Protection Agency (EPA) Pollution Prevention (P2) grant for a 2-year period (FY21-22) to collaborate with scientific experts and businesses in the metal finishing and aerospace industries to identify per- and polyfluoroalkyl substances (PFAS) in business operations and to reduce or eliminate PFAS entering wastewater and the environment. PFAS are a class of man-made chemicals that have been used extensively in manufacturing processes and products. P2 refers to any practice that reduces, eliminates, or prevents pollution at its source (source reduction) prior to and in preference to recycling, treatment, or disposal.[1]

As part of the grant, Sanborn, Head & Associates, Inc. (Sanborn Head) assisted the DEC with conducting a focused study on PFAS releases from metal finishing facilities in Vermont and assessing PFAS-related P2 applications for potential implementation at the subject facilities. The metal finishing industry is an important focus for the P2 project because: (1) there are numerous facilities engaged in metal finishing in Vermont, (2) many of these facilities discharge wastewater, and (3) some metal finishing operations are known to use products that contain PFAS for:

- Surfactants, dispersants, wetting agents, or fume/mist suppressing agents;
- Corrosion inhibitors or other products to reduce wear, enhance heat resistance, or aesthetic appearance;
- Leveling agents for zinc electrodeposition; and
- Electroless plating of nickel/copper and electroplating of copper, nickel, and/or tin.

PFAS are known to be used as mist suppressants to reduce emissions of hexavalent chromium, and hence lower worker exposure to the metal. In these operations, PFAS are added to plating baths to alter surface tension and lower the generation of aerosols. Historically, perfluorooctane sulfonic acid (PFOS) was used, but by 2002 and the voluntary phase-out of PFOS production, the industry transitioned to other PFAS such as 6:2 fluorotelomer sulfonate (6:2-FTS). However, these replacement PFAS can degrade and transform to stable PFAS. Studies have shown that 6:2-FTS can degrade into perfluoropentanoic acid (PFPeA) and perfluorohexanoic acid (PFHxA), but not PFOS. Continued detection of PFOS in the effluent of facilities that have discontinued its use is suspected to be related to residual presence in facility equipment.

Vermont has established a Maximum Contaminant Level (MCL) of 20 parts per trillion (ppt) for the combination of five PFAS including perfluorooctanoic acid (PFOA), PFOS, perfluorohexanesulfonic acid (PFHxS), perfluoroheptanoic acid (PFHpA), and perfluorononanoic acid (PFNA) that applies to drinking water systems. Vermont has also adopted a groundwater enforcement standard (GES) based on the health advisory level/MCL. A legislative mandate for DEC to establish surface water standards will likely broaden concerns over PFAS and focus attention and requirements on sources that discharge PFAS, and future regulations may encompass additional compounds.

[1] Examples of P2 practices include: equipment or technology modifications; process or procedure modifications; reformulation or redesign of products; substitution of raw materials; and improvements in housekeeping, maintenance, training, or inventory control.

The goal of this project is to reduce PFAS use through pollution prevention approaches, such as transitioning to products that are PFAS-free or contain less toxic PFAS compounds, and/or by changing operations or practices to minimize PFAS within wastewater. The scope of work included working with participating businesses to:

1. Characterize PFAS species, concentration, and mass in wastewater through on-site wastewater sampling and analysis;
2. Identify and quantify sources of PFAS contributing to wastewater based on sampling results;
3. Research and identify alternatives or practices to reduce PFAS-containing sources; and
4. Encourage adoption of P2 or source reduction practices.

Sanborn Head's project team included Robert Pojasek, PhD, a national leader in P2 practices who served as a P2 advisor and resource on the project. All wastewater sampling and analysis was conducted by Weston & Sampson Engineers, Inc. (Weston & Sampson) through a separate contract with the DEC. The course of the study involved frequent interaction and information exchange between Sanborn Head, DEC, Weston & Sampson, and the participating businesses through e-mail, phone conversations, and cohort meetings.

2.0 METHODOLOGY USED TO IDENTIFY PFAS AT METAL FINISHING FACILITIES

The DEC identified the following cohort of businesses that voluntarily committed to participating in the P2 evaluation project through a memorandum of understanding and collaboration agreement. Business names have been anonymized throughout this report:

- Vergennes Facility 1 (aerospace products and parts manufacturing facility located in Vergennes);
- Rutland Facility 1 and Rutland Facility 2 (aerospace products and parts manufacturing facilities located in Rutland and North Clarendon);
- Brattleboro Facility 1 (aerospace and metal products and parts manufacturing facility located in Brattleboro); and
- Swanton Facility 1 (metal medical products and parts manufacturing facility located in Swanton).

A phased approach was implemented for collecting information and data to identify and/or assess potential PFAS sources at each of the participating businesses including an initial survey to collect detailed process and product information, a site visit and walkthrough to observe process operations and identify sampling points, sample collection, and data analysis. The approaches and initial findings are further discussed in the following sections.

2.1 Survey and Information Gathering

In conjunction with the DEC, Sanborn Head developed a Metal Manufacturing and Finishing PFAS Assessment Questionnaire (provided in Appendix A) and distributed it to the businesses to collect information on processes at each facility that, on the basis of collective knowledge of PFAS, have the potential to use PFAS. The questionnaire provided a means for each facility to communicate information regarding processes conducted on site (e.g., hexavalent chrome

plating, chromic acid anodizing), the known use and application of any PFAS-containing products (e.g., as a fume suppressant), the amount used of any suspected PFAS-containing product, product Safety Data Sheets (SDSs) for any products known or suspected to contain PFAS, and process flow diagrams (PFDs) focusing on product inputs, wastewater outputs, and other effluent streams that could contain PFAS.

The collected information was reviewed by Sanborn Head and the DEC and discussed in detail during a follow up call with each business. A summary of the initial findings for each facility is provided below.

Rutland Facilities 1 and 2

- The facilities utilize an electrochemical machining process to remove material from parts. The process uses an electrolyte solution composed of salt and water. No fluorinated or suspected PFAS-containing materials are used in this process.
- The facilities utilize physical processes to produce final finish characteristics and hardnesses on the parts. These processes are physical in nature. No fluorinated or suspected PFAS-containing materials are used in this process.
- SDSs for several products including a finish coating that was formerly applied in-house and two additives used as a detergent / surface finish additive were reviewed, and PFAS were not listed as recognizable components.

Vergennes Facility 1

- The facility utilizes hexavalent conversion coating and nickel electroform plating processes. A variety of alkaline soak cleaners that may contain surfactants is utilized throughout the process lines, and surfactants are used to reduce surface tension on the nickel plating processes. Wastewater from both processes is discharged to the on-site pretreatment process.
- The facility utilizes Teflon wire stripping and Teflon surface etching processes, both of which are done infrequently and are performed on benches with very small volumes (several liters per month).
- SDSs for several products including cleaner, a proprietary anionic surfactant, and etching material were reviewed, and PFAS were not listed as components; however, some of the components were listed as “trade secret” and could not be identified.

Brattleboro Facility 1

- The facility utilizes a hexavalent and trivalent conversion coating process, an anodizer with a polytetrafluoroethylene (PTFE) seal process, a dry film lubricant coating process, and a nickel acetate seal process. Surfactants are present in the detergents and nickel acetate seal. Rinse water from some of these processes ends up in wastewater. Waste from the 1,000-liter PTFE seal process and dry film lubricant process is collected and shipped off-site for disposal. Parts treated in the PTFE tank are allowed to drip-dry over the tank, limiting potential drag-out from the process. The PTFE seal tank is changed out infrequently. The last changeout occurred in August 2017 and the next changeout is not expected in the foreseeable future.

- SDSs for several of the cleaners and the nickel acetate were reviewed, and PFAS were not listed as components; however, some of the components in the cleaners were listed as "proprietary ingredient" and could not be identified.
- The SDS for the PTFE paste stock indicated that the material contains 50 to 70% PTFE which is a fluoropolymer and 1 to 5% of a proprietary ingredient which could not be identified.

Swanton Facility 1

- The facility utilizes a hexavalent chrome plating process, black oxide conversion coating process, and an etching process.
- The chrome plating process utilizes a fume suppressant. The SDS dated 2006 (the older fume suppressant no longer in use) lists 6:2-FTS as an ingredient, and the SDS dated 2016 (the fume suppressant currently in use) lists one "proprietary component" under the chemical composition. Local ventilation from the chrome plating bath is vented to an air discharge unfiltered through the roof of the building. Solid and liquid waste generated from the chrome line is disposed of off-site.
- The facility utilizes various cleaning products that contain "proprietary surfactant."

Based on the results of the questionnaire and follow-up discussions with the businesses, several potential sources/sample collection points were identified at each facility for further evaluation during the facility walkthroughs. The sample points are discussed in the following section.

2.2 Site Walkthrough and Sample Point Selection

Following the initial information gathering work, representatives from Sanborn Head, the DEC, and Weston & Sampson visited each facility and participated in a site meeting and facility walkthrough led by representatives from each business on the following dates:

- October 6, 2021 – Rutland Facilities 1 and 2;
- October 15, 2021 – Vergennes Facility 1;
- October 18, 2021 – Brattleboro Facility 1; and
- November 2, 2021 – Swanton Facility 1.

The facility walkthroughs focused on observing process operations and potential PFAS-containing sources, and identifying/confirming wastewater, sludge, and other process-specific sample collection points. The sampling points for each facility are summarized below.

Sample Collection Points

- Rutland Facility 1 (Rutland):
  - Wastewater effluent from pretreatment process; and
  - Sludge from pretreatment process.
- Rutland Facility 2 (North Clarendon):
  - Wastewater effluent from pretreatment process; and
  - Sludge from pretreatment process.
- Vergennes Facility 1:
  - Wastewater effluent from pretreatment process:
  - Sludge from pretreatment process; and

  - Wastewater from Teflon Wire stripping process.
- Brattleboro Facility 1:
  - Wastewater effluent from pretreatment process;
  - Sludge from the nickel acetate process;
  - Sludge from pretreatment process; and
  - Liquid from the PTFE seal tank.
- Swanton Facility 1:
  - Wastewater effluent from the black oxide process;
  - Fume suppressant product; and
  - Facility stormwater representing runoff from the roof of the facility.

Wastewater effluent and sludge sampling points were selected for each facility (except for Swanton Facility 1 which did not have a sludge waste stream) to characterize the overall wastewater discharge and screen for potential PFAS sources not identified during the initial survey. Based on the results of the information gathering process, additional process-specific sampling points were selected for Vergennes Facility 1 and Brattleboro Facility 1 to evaluate potential PFAS use in the Teflon and PTFE products. The fume suppressant at Swanton Facility 1 was selected for sampling to confirm specific PFAS ingredients, as the SDS only listed a generic descriptor. In addition, facility stormwater at Swanton Facility 1 was selected for sampling to evaluate if the air vent from the chrome plating process is a potential transport path for PFAS.

2.3 Sampling and Analysis for PFAS

Weston & Sampson conducted PFAS sampling at the five facilities between October 2021 and June 2022. The sampling procedures and detailed results are included in a separate sampling and analysis report prepared by Weston & Sampson. The results are discussed below along with an evaluation of estimated PFAS mass discharges in wastewater from the facilities with comparison to PFAS mass loadings at wastewater treatment facilities (WWTFs) and concentrations in WWTF sludge samples.

2.3.1 Summary of Liquid Sample Results

Key summary points regarding the results for liquid samples (wastewater effluent, process baths, stormwater, and fume suppressant) are as follows:

- Concentrations of the five PFAS regulated by Vermont (PFAS VT 5) were not detected above laboratory reporting limits for the majority of results (73 non-detect results out of 100 sample results).
- Of the 27 reported detections of the PFAS VT 5, 24 of the reported detections were qualified (i.e., the results are estimated due to low levels of PFAS coupled with limitations on detection capabilities or matrix interference).
- Non-qualified, low-level detections of the PFAS VT 5 were reported once at three locations:
  - Vergennes Facility 1 Tank 033 (2.45 ng/L PFHpA on 3/8/2022);
  - Brattleboro Facility 1 wastewater effluent (2.62 ng/L PFOS on 11/10/2021); and
  - Swanton Facility 1 stormwater (2.42 ng/L PFOS on 6/13/2022).
- One qualified result for a PFAS VT 5 (21 ng/L PFOS on 1/21/2022) reported for the effluent at Brattleboro Facility 1 exceeded the VGES/MCL. We note that the reported concentration

was qualified as potentially biased high due to matrix interferences. We further note that the other two results for PFOS at this location were 2.62 ng/L and non-detect.

- A sample of diluted fume suppressant collected from Swanton Facility 1 on 12/10/2021 had a qualified detection of 6:2-FTS at a concentration of 22,800,000 ng/L, exceeding the instrument calibration range, and non-qualified detections of 4:2 fluorotelomer sulfonic acid (539,000 ng/L) and 8:2 fluorotelomer sulfonic acid (1,050,000 ng/L);
- Non-qualified detections of 6:2-FTS were reported at five locations:
    - Vergennes Facility 1 Tank 033 (3.64 ng/L on 3/8/2022),
    - Swanton Facility 1 Black Oxide Effluent (295 ng/L on 12/10/2021). We note that the detection at this location may be biased high due to potential cross-contamination issues related to analysis of the fume suppressant sample discussed above;
    - Swanton Facility 1 Stormwater (130 ng/L on 12/10/2021 and 7.84 ng/L on 6/13/2022). We note that the detection at this location on 12/10/2021 may be biased high due to potential cross-contamination issues related to analysis of the fume suppressant sample discussed above;
    - Rutland Plant 1 – Wastewater Effluent (2.62 ng/L on 10/6/2021); and
    - Rutland Plant 2 – Wastewater Effluent (2.45 ng/L on 10/6/2021).
- Low-level, non-qualified detections of PFAS other than the PFAS VT 5 were reported for one sampling round at the following locations:
    - Vergennes Facility 1 Tank 033 (2.75 ng/L perfluorobutanoic acid [PFBA] on 3/8/2022);
    - Swanton Facility 1 Black Oxide Effluent (3.62 ng/L PFBA and 2.26 ng/L PFPeA both on 3/1/2022); and
    - Swanton Facility 1 Stormwater (1.80 ng/L PFBA on 6/13/2022).

2.3.2 Summary of Solid Sample Results

Key summary points regarding the results for sludge samples are as follows:

- Concentrations of the PFAS VT 5 were not detected above laboratory reporting limits for the majority of results (45 non-detect results out of 52 sample results).
- Qualified detections of the PFAS VT 5 were reported for two sampling rounds of the Vergennes Facility 1 Pretreatment Sludge including:
    - PFOS: 0.552 ng/g on 10/15/2021;
    - PFOA: 0.499 ng/g on 10/15/2021 and 0.318 ng/g on 1/15/2022; and
    - PFNA: 0.785 ng/g on 10/15/2021 and 0.553 ng/g on 1/15/2022.
- One non-qualified detection of a PFAS VT 5 (0.764 ng/g PFOS on 1/15/2022) was reported for one sampling round of the Vergennes Facility 1 Pretreatment Sludge.
- One qualified detection of a PFAS VT 5 (8.95 ng/g PFOS on 11/15/2021) was reported for one sampling round of Brattleboro Facility 1 Combined Filter Cake. We note this result is an estimated maximum.
- One non-qualified detection (0.881 ng/g on 3/8/2022) and two qualified detections (0.714 ng/g on 10/15/2021 and 0.737 ng/g on 1/15/2022) of 6:2-FTS were reported for three sampling rounds of the Vergennes Facility 1 Pretreatment Sludge.
- Qualified detections of PFAS other than PFAS VT 5 were reported for three sampling rounds of Pretreatment Sludge at Vergennes Facility 1 including:

- Perfluoropentanesulfonic acid (PFPeS): 0.245 ng/g on 1/15/2022;
- PFPeA: 0.229 ng/g on 1/15/2022;
- Perfluorotetradecanoic acid (PFTA): 0.293 ng/g on 1/15/2022;
- Perfluoroundecanoic acid (PFUnA): 0.279 ng/g on 10/15/2021 and 0.277 ng/g on 1/15/2022; and
- N-ethyl perfluorooctanesulfonamidoacetic acid (N-EtFOSAA): 0.308 ng/g on 10/15/2021 and 0.314 ng/g on 1/15/2022.

- One qualified detection of PFBA (0.064 ng/g) was reported for the Rutland Plant 1 sludge sample collected on 2/25/2022.

2.3.3 Comparison to Wastewater Treatment Facility PFAS Data

Exhibits 1a, 1b, and 2 are provided below to provide some context for understanding the significance of the PFAS results discussed above. Exhibits 1a and 1b present estimated average and maximum PFAS mass discharge from each facility compared to estimated PFAS influent load at the receiving WWTF, with the values in Exhibit 1a based on the sum of five VT-regulated PFAS and the values in Exhibit 1b based on Total PFAS. Exhibit 2 presents a comparison of average and maximum PFAS concentrations in sludge samples from the facilities and receiving WWTFs.

Exhibit 1a
Estimated PFAS Mass Discharge from Industrial Facilities and Influent Load at WWTFs
PFAS VT 5

Industrial Facility or Wastewater Treatment Facility	PFAS Concentration in Wastewater Samples		Average Daily Wastewater Flow	PFAS Discharge from Industrial Facilities and Influent Load at WWTFs		Percentage of PFAS Influent Load at Receiving WWTF	
	PFAS VT 5			PFAS VT 5		PFAS VT 5	
	Avg.	Max.		Avg.	Max.	Avg.	Max.
	ng/L	ng/L	MGD	mg/day	mg/day	%	%
Swanton Facility 1	2.73	3.03	0.000560	0.00579	0.00642	0.00541	0.00454
Swanton WWTF	54.7	72.3	0.517	107	141	--	--
Vergennes Facility 1	3.49	4.53	0.00536	0.0708	0.0919	0.184	0.0759
Vergennes WWTF	23.0	72.3	0.442	38.4	121	--	--
Rutland Facility 1	1.86	2.02	0.0229	0.161	0.174	0.0453	0.0188
Rutland Facility 2	0.592	0.608	0.104	0.234	0.240	0.0660	0.0260
Rutland WWTF	19.5	51.0	4.80	354	926	--	--
Brattleboro Facility 1	9.18	23.2	0.0161	0.558	1.41	4.24	6.45
Brattleboro WWTF	2.91	4.83	1.20	13.2	21.9	--	--

Exhibit 1b
Estimated PFAS Mass Discharge from Industrial Facilities and Influent Load at WWTFs
Total PFAS

Industrial Facility or Wastewater Treatment Facility	PFAS Concentration in Wastewater Samples		Average Daily Wastewater Flow	PFAS Discharge from Industrial Facilities and Influent Load at WWTFs		Percentage of PFAS Influent Load at Receiving WWTF	
	Total PFAS			Total PFAS		Total PFAS	
	Avg.	Max.		Avg.	Max.	Avg.	Max.
	ng/L	ng/L	MGD	mg/day	mg/day	%	%
Swanton Facility 1	7.16	8.84	0.000560	0.0152	0.0187	0.00735	0.00758
Swanton WWTF	106	127	0.517	206	247	--	--
Vergennes Facility 1	13.3	18.7	0.00536	0.270	0.379	0.213	0.178
Vergennes WWTF	75.6	127	0.442	127	213	--	--
Rutland Facility 1	4.07	5.39	0.0229	0.353	0.467	0.0212	0.0209
Rutland Facility 2	4.77	5.85	0.104	1.88	2.31	0.113	0.104
Rutland WWTF	91.5	123	4.80	1,661	2,233	--	--
Brattleboro Facility 1	10.3	23.2	0.0161	0.628	1.41	0.309	0.636
Brattleboro WWTF	44.9	49.0	1.20	203	222	--	--

Exhibit 1a and 1b Notes:

1. Average and maximum PFAS concentrations in wastewater samples are presented as "Total PFAS" (including the 24 compounds that were analyzed) and "PFAS VT 5" (the five PFAS included in Vermont's drinking water MCL: PFOA, PFOS, PFHxS, PFHpA, and PFNA).
2. PFAS concentrations for the industrial facilities are from wastewater sampling conducted by Weston & Sampson between October 2021 and March 2022. The results include estimated values that are less than the laboratory reporting limit, but greater than the method detection limit, and some estimated maximum values resulting from matrix interferences and/or laboratory QA/QC issues. Refer to the sampling and analysis report for more information.
3. PFAS concentrations for the WWTFs are from influent sampling conducted by Weston & Sampson in 2019 as summarized in the January 30, 2020 PFAS at WWTF and Landfill Leachate 2019 Summary Report. The PFAS concentrations for the Vergennes WWTF are assumed values based on average and maximum concentrations for samples collected from WWTFs that received industrial wastewater and no leachate.
4. The average daily industrial wastewater and WWTF effluent flows are based on the average of the daily total flows for the days that the PFAS samples were collected at the industrial facilities; therefore, the PFAS concentrations and the flow data for the WWTFs are not paired and were collected on different days.

The average concentration of PFAS in wastewater effluent samples ranged from 0.592 to 9.18 ng/l for the sum of five VT-regulated PFAS and 4.07 to 13.3 ng/l for Total PFAS. Results were generally well below (with the exception discussed below) the average influent concentrations at the receiving WWTFs which ranged from 2.91 to 54.7 ng/l for the sum of five VT-regulated PFAS and 44.9 to 106 ng/l for Total PFAS. Except for Brattleboro Facility 1, the estimated PFAS mass discharge rates in wastewater from each facility represent an insignificant fraction of the influent load at the receiving WWTF.

Regarding Brattleboro Facility 1, we note that there is some uncertainty with the PFAS discharge estimates because: 1) as noted in Exhibit 1a and 1b Note 2, the average and maximum PFAS concentrations shown for Brattleboro Facility 1 are based on some estimated maximum values resulting from matrix interferences and/or laboratory QA/QC issues and may

not reflect the actual concentrations in effluent wastewater; and 2) the effluent flow rates for Brattleboro Facility 1 are estimated values that were calculated based on pump capacity. In addition, we note that the estimated average five VT-regulated PFAS discharge rate for Brattleboro Facility 1 (0.558 milligrams per day [mg/day]) is similar to the average PFAS discharge rates for Rutland Facilities 1 and 2 (0.161 and 0.234 mg/day); however, the percentage of PFAS influent load at the Brattleboro WWTF is higher because it receives a relatively small PFAS influent load compared to the Rutland WWTF.

In addition to the wastewater effluent, samples were collected from wastewater generated from Teflon etching and wire stripping processes at Vergennes Facility 1 and from the liquid in the PTFE seal tank at Brattleboro Facility 1. PFAS were not detected in these samples. Given the non-detections, and taking the laboratory reporting limits into consideration, as well as the very limited volumes of wastewater generated, these processes are considered insignificant sources of PFAS.

Exhibit 2
PFAS Concentrations in Sludge Samples from the Facilities and WWTFs

Industrial Facility or Wastewater Treatment Facility	PFAS Concentration in Sludge Samples			
	PFAS VT 5		Total PFAS	
	Avg.	Max.	Avg.	Max.
	ng/g	ng/g	ng/g	ng/g
Swanton Facility 1	Not Sampled		Not Sampled	
Swanton WWTF	13.8	29.8	42.1	73.0
Vergennes Facility 1	1.74	1.84	2.58	3.73
Vergennes WWTF	Not Sampled		Not Sampled	
Rutland Facility 1	<0.804	<0.804	0.064	0.064
Rutland Facility 2	<0.904	<0.904	<1.81	<1.81
Rutland WWTF	Not Sampled		Not Sampled	
Brattleboro Facility 1	8.95	8.95	8.95	8.95
Brattleboro WWTF	3.94	4.12	19.6	24.3
WWTFs Receiving Industrial Wastewater and No Leachate	20.3	114	102	719

Exhibit 2 Notes:

1. Average and maximum PFAS concentrations in sludge samples are presented as "Total PFAS" (including the 24 compounds that were analyzed) and "PFAS VT 5" (the five PFAS included in Vermont's drinking water MCL: PFOA, PFOS, PFHxS, PFHpA, and PFNA).
2. PFAS concentrations for the industrial facilities are from sampling conducted by Weston & Sampson between October 2021 and March 2022. The results include estimated values that are less than the laboratory reporting limit, but greater than the method detection limit, and some estimated maximum values. Refer to the sampling and analysis report for more information.
3. PFAS concentrations for the WWTFs are from sampling conducted by Weston & Sampson in 2019 as summarized in the January 30, 2020 PFAS at WWTF and Landfill Leachate 2019 Summary Report. Average and maximum concentrations for sludge samples collected from WWTFs that received industrial wastewater and no leachate are included for comparison.

The average concentration of PFAS detected in sludge samples collected during this study ranged from not detected (<0.804) to 8.95 ng/g for the sum of five VT-regulated PFAS and 0.064 to 8.95 ng/g Total PFAS. Results were generally well below (except for Brattleboro Facility 1) the average concentrations in sludge samples from the receiving WWTFs (or other WWTFs that receive industrial wastewater and no leachate) which ranged from 3.94 to 20.3 ng/g for the sum of five VT-regulated PFAS and 2.58 to 102 ng/g Total PFAS. Regarding Brattleboro Facility 1, we note that there is some uncertainty with the PFAS concentration in sludge samples because as noted in Exhibit 2 Note 2, the average and maximum PFAS concentrations shown for Brattleboro Facility 1 are based on an estimated maximum value resulting from matrix interferences and/or laboratory QA/QC issues and may not reflect the actual concentrations in effluent wastewater.

The detected concentrations of PFAS in wastewater and sludge samples are generally low-level, with the few exceptions discussed above, per judgement/experience are consistent with trace levels of PFAS impurities found in many products. Therefore, the results suggest that PFAS is not being used in the metal finishing processes evaluated for the five facilities during this study, except for the use of a PFAS-containing fume suppressant at Swanton Facility 1 as noted in section 2.3.1.

The sampling results indicate that the fume suppressant in current use at Swanton Facility 1 contains 6:2-FTS at a concentration potentially in the millions of ppt. This result is not surprising given that 6:2-FTS is the PFAS that is a commonly used mist suppressant in the chrome plating industry, and is a listed compound in the 2006 SDS for the mist suppressant used by Swanton Facility 1. Results for the stormwater sample collected at Swanton Facility 1 on June 13, 2022 indicated low-level detections of three PFAS including PFBA (1.8 ng/l), PFOS (2.42 ng/l), and 6:2 FTS (7.84 ng/l). While detections of PFAS in surface water in the single ppt are generally considered reflective of background conditions, the concentration of 6:2-FTS is slightly elevated compared to the concentrations of PFBA and PFOS, and hence indicative of a potential environmental release to surface water. There could be similarities with a documented case study of PFOS contamination in a Minnesota Lake that was traced back to a metal plating facility. Quoting from the Minnesota Pollution Control Agency (MPCA) press release:[2]

> "MPCA tested numerous stormwater samples for PFOS in an attempt to find the source of PFOS to the lake. The testing eventually led to the discovery that Douglas Corporation, a metal plating facility in St. Louis Park, was the source of PFOS in stormwater going to Lake Calhoun. PFOS was used by the company in part of their manufacturing process. When fumes were vented to the roof both PFOS and chromium accumulated to high levels on the roof itself, which eventually contaminated stormwater during rain and snowmelt."

The use of a PFAS-containing fume suppressant is the only process identified during the study that warrants consideration of potential PFAS pollution prevention approaches and is therefore the focus of the next section of this report on identification of alternative (PFAS-free) products.

[2] https://content.govdelivery.com/accounts/MNPCA/bulletins/14f2450

3.0 ALTERNATIVE PRODUCT IDENTIFICATION METHODOLOGY

Vermont DEC identified source reduction as a preferential focus area for P2 implementation, with the goal of identifying alternative products that are PFAS-free, contain less PFAS, or contain less toxic PFAS as a potential pathway to reduce the source of PFAS at the participating metal finishing businesses. The following sections describe efforts made by Sanborn Head to research the availability of alternative products and potential limitations that may affect implementation.

3.1 Outreach to Government Agencies

In order to learn about other endeavors and potential progress with PFAS P2 initiatives, Sanborn Head contacted several state agencies that are active in PFAS investigation/pollution prevention to inquire of their willingness to share information in the form of a questionnaire pertaining to awareness of alternative metal finishing products, case studies involving alternative products, various P2 practices, and legislation (current or future) pertaining to the use of PFAS-containing products. A template of the questionnaire is provided in Appendix B. Relevant information conveyed by the state agencies via the questionnaire is summarized below.

California

- The California State Water Resources Control Board (SWRCB) issued Order WQ 2019-0045-DWQ (October 2019) requiring mandatory environmental assessment at 271 chrome plating facilities, and specifically requiring each facility to investigate "if fume suppressants or other substances potentially containing PFAS were disposed, discharged, spilled, or released in any way to land, drains, sewers, surface water, air, and/or groundwater." The due date for the first submission was 1/31/2020.
- Metal finishers engaged in chromic acid anodizing or chrome electroplating must comply with Rule 1469(f) which states that 1) a facility must use a certified fume suppressant and 2) fume suppressants containing PFOS shall not be added to any process tank after 9/21/2016. Initially, the rule was specific to facilities in the South Coast Air Quality Management District, but the California Air Resources Board (CARB) was considering expansion of the rule to all of CA.
- Fume suppressants that do not contain PFOS comply with the USEPA National Emission Standards for Hazardous Air Pollutants are included in the Approved Fume Suppressant List. These include: Fumetrol 21 LF2 Atotech, Dicolloy CRPF ProCom LLC, HCA-8.4 Hunter Chemical LLC, and Macuplex STR NPFX MacDermid Enthone Industrial Solutions. Many or all of these products likely contain 6:2-FTS, which has replaced PFOS as the industry standard surfactant in mist suppressants.
- California provided an example of a facility implementing an alternative to hexavalent chromium finishing in which the post-coating finishing of the aluminum anodizing process used hexafluorozirconic acid, which is neither hexavalent nor trivalent chrome-based.
- Metal finishers that have implemented P2 practices may be available as contacts; however, the relationship is of a regulator/regulated entity, and sharing of information is limited.

Minnesota

- The Minnesota Pollution Control Agency (MPCA) developed the "PFAS Monitoring Plan" (March 2022) to continue the state's effort to investigate and understand "the wide range of places where PFAS have been or are currently used and how these uses result in PFAS releases to the environment." Specifically, chrome plating facilities are proposed for inclusion in the monitoring of industrial stormwater for PFAS.
- Minnesota provided an example of a chrome plating facility that converted to using a 6:2-FTS-based fume suppressant as an alternative to a PFOS-based product, with one result being the release of considerable amounts of 6:2-FTS to the environment.
- PFOS residuals remain a concern after the use of an alternative product is implemented.

Michigan

- The Michigan Department of Environment, Great Lakes, and Energy (EGLE) study "Targeted and Nontargeted Analysis of PFAS in Fume Suppressant Products at Chrome Plating Facilities" (June 2020) provides an analysis of "PFOS-free" (replacement) fume suppressants and concludes that only 6:2-FTS was found in the currently used fume suppressants and that current discharges of PFOS are assumed to be associated with historical use of PFOS-containing products, possibly due to residual presence of PFOS in wastewater collection and treatment systems.
- Some metal finishers have eliminated use of PFAS-containing chemicals, although most have still needed to pretreat their wastewater due to residual PFOS in wastewater.
- Wastewater treatment plants have required indirect dischargers to comply with limits for PFOS since conventional wastewater treatment has not been found to reduce PFOS. Metal finishers that discharge PFOS have some incentive to reduce the use of PFAS-containing products since 6:2-FTS interferes with pretreatment systems for PFOS (e.g., granular activated carbon) and with the ability of laboratories to attain reporting levels low enough to show compliance with local limitations or requirements.
- The Executive Directive No. 2021-8 (October 2021) requires the State of Michigan to procure PFAS-free products whenever possible.
- Alternative products that reportedly do not contain PFAS include Haviland Havachrome Mist Eliminator 3 and Atotech.

New York

- The New York State Pollution Prevention Institute (NYSP2I) conducted a qualitative bench-top comparison of the performance of PFAS-based and PFAS-free/lower-PFAS fume suppressants and found that PFAS-free/lower-PFAS suppressants were able to reduce misting, but required additional dosing compared to the PFAS-based fume suppressants. (NYSDEC notes that this may have been due to the size of the container used for the evaluation and may not be reflective of full-size plating tanks.)
- NYSP2I worked with a NYS-based metal finisher to switch from their former PFAS-based fume suppressant to a PFAS-free/lower-PFAS alternative in one of the facility's plating lines. The report on the implementation of the alternative (including details on PFAS concentrations in the plating line over time) is still being finalized and will likely be made available through NYSP2I's website.

- Alternative process technologies include mesh pad and scrubber systems to eliminate the need for chemical fume suppressants, although these technologies are considered expensive and generally not feasible.
- Lower-PFAS fume suppressant chemicals are available through major plating chemical manufacturers including Atotech, TIB Chemicals, and Dynamix.
- NYSDEC (NYSP2I) is aware that there are a number of alternative plating technologies that do not generate hexavalent chromium emission (and would eliminate the need for fume suppressants), such as trivalent chromium, electroless nickel, high velocity oxyfuel, and physical vapor deposition.

Massachusetts

- The Massachusetts Toxics Use Reduction Institute (TURI) has research results with the defense aerospace industry substituting trivalent chromium in conversion coatings and bond primers to encourage movement away from hexavalent chromium.
- The Toxics Use Reduction Act (TURA) regulation 301 CMR 41 (toxic or hazardous substance list) was amended to include Certain PFAS Not Otherwise Listed (NOL) as a reportable category under TURA, such that companies covered under TURA are now required to track and report Certain PFAS NOL and an additional 172 PFAS that are reportable individually under TURA.
- The Final Report of the (Massachusetts) PFAS Interagency Task Force provides a comprehensive overview of PFAS, including an outline of legislative and regulatory options for addressing PFAS for protection of human health and the environment.
- The Massachusetts Office of Technical Assistance (OTA) provides various forms of support to help manufacturers reduce/eliminate use of PFAS, including a supplier notification template; an assessment tool for the metal finishing industry to evaluate/identify a facility's use of PFAS; assistance in using the Organization for Economic Cooperation and Development (OECD) database to check CAS numbers of chemicals in products; TURI industry grants for toxics use reduction; TURI small business grants for toxics use reduction; TURA off-ramp option through toxics use reduction; and collaboration opportunities with OTA and TURI to reduce/eliminate use of PFAS to comply with NPDES or MassDEP Surface Water Discharge testing requirements.

3.2 Outreach to Chemical Manufacturers

In an effort to learn more about the viability of fume suppressants classified as PFAS-free, Sanborn Head contacted several manufacturers of fume suppressants to inquire of their willingness to share information regarding the chemical composition and long-term stability of these products, as well as requesting SDSs. In addition, Sanborn Head inquired about the availability of case studies or supplemental data that could provide an indication of the efficacy of the PFAS-free fume suppressants.

Generally, the conversation with manufacturers included the following questions:

- Is your product PFAS-free?
- Do you have any data that you can share regarding the composition of the product?
- Can you provide the SDS for the product?

- Is there any data that you can share regarding the long-term stability of the product?

Key information conveyed by the manufacturers via telephone or email response is summarized below. SDSs and other product information provided by the manufacturer is included in Appendix C.

Atotech

- Atotech manufactures the Fumalock fume suppressant which (according to Atotech) is a process that comprises two additives (Part A and Part B), both of which are formulated without fluoride and do not contain any intentionally added PFAS.
- The manufacturer provided the SDS for Fumalock A3 which indicates only one hazardous ingredient: quaternary ammonium salt. However, the SDS states that the product may contain component(s) that are not listed under disclosure and that components not listed do not contain hazardous materials above deminimus disclosure limits as defined by OSHA, NIOSH, ACGIH, or Canadian WHMIS 2015 regulations and guidelines.
- The manufacturer provided the SDS for Fumalock B3 which indicates that the product contains no hazardous ingredients but may contain component(s) that are not listed under disclosure and that components not listed do not contain hazardous materials above deminimus disclosure limits as defined by OSHA, NIOSH, ACGIH, or Canadian WHMIS 2015 regulations and guidelines.

Dynamix, Inc.

- Dynamix, Inc. manufactures the Dynaplate Cr FSN 2 fume suppressant.
- The SDS and Technical Data Sheet (TDS) provided by the manufacturer indicate the product is coconut oil-based; is free of PFOA, PFOS, and PFAS; is non-fluorinated; and will reduce chrome misting by over 99 percent.
- The manufacturer indicated that the product is known to have a shorter useful life than more traditional PFAS-containing fume suppressants; however, the manufacturer did not provide long term usage/stability data. The TDS indicates that the product is consumed by drag-out and electrolysis, and that it is biologically degradable by chromic acid. The TDS also provides some information on usage and replenishment, indicating that the product should be added to the chrome solution on a continuous basis and that additional solution may be required after long idle periods.
- The manufacturer provided an example of an application in which a company in Virginia used the product for 5 months and reportedly received approval to continue using the product; however, the manufacturer could not share specific information or data.

Haviland Products Company

- Haviland Products Company manufactures the Havachrome Mist Eliminator III fume suppressant.
- The manufacturer stated that no PFAS/PFOS-based materials were intentionally added to the product.
- The manufacturer has no specific data on stability other than the product is biologically degradable by chromic acid during application of its intended use.

- The SDS provided by the manufacturer indicates the product is coconut oil-based and does not contain fluorinated compounds.

TIB Chemicals

- TIB Chemicals manufactures the TIB Suract CR-H fume suppressant.
- The manufacturer stated that the product is PFAS-free and free of any kind of fluorotensides.
- The manufacturer stated that the product is long-term stable under storage conditions but is not persistent.
- The manufacturer stated that the product must be added continuously to keep working efficiently as a chromic acid mist suppressant.
- The SDS provided by the manufacturer indicates the product is paraffin oil-based and does not contain fluorinated compounds.

4.0 FINDINGS OF SOURCE IDENTIFICATION AND ALTERNATIVES WORK

The findings of the source identification and alternative products identification work discussed above are summarized in the following sections.

4.1 Source Identification Findings

PFAS compounds were detected in wastewater and/or sludge samples collected from each of the five facilities at concentrations generally reflective of trace levels of PFAS impurities found in many products and generally well below concentrations in influent wastewater and sludge samples collected from receiving WWTFs, with the exception of some estimated higher-level concentrations that were qualified by limitations on laboratory analytical detection capabilities or matrix interference and were generally not repeated during follow up sampling and analysis.

The source identification process confirmed that the fume suppressant that is currently utilized in the chrome plating process at Swanton Facility 1 contains 6:2-FTS at a concentration potentially in the millions of ppt. Although the solid and liquid waste generated from the chrome line is disposed of off-site and there is no direct pathway for PFAS to enter the wastewater discharge from the facility, the chrome plating bath is vented to an air duct that has the potential to discharge PFAS to the outdoor environment, such as facility stormwater. Sampling results for the facility indicated the presence of 6:2-FTS in stormwater at levels that may be considered consistent with background concentrations, or slightly above background.

The use of a PFAS-containing fume suppressant is the only process identified during the study that warranted consideration of potential PFAS pollution prevention approaches and was the focus of the identification of alternative (PFAS-free) products. As previously discussed, the Teflon etching and wire stripping processes at Vergennes Facility 1 and the PTFE seal tank at Brattleboro Facility 1 were also evaluated, and these processes are considered insignificant sources of PFAS.

4.2 Alternative Product Findings

There are at least four chemical manufacturers that offer alternative fume suppressant products that are marketed as being PFAS-free. Some of the alternative ingredients indicated on the product SDSs include quaternary ammonium salt (Fumalock), coconut oil (Dynaplate and Havachrome), and paraffin oils (TIB Suract). Based on the information provided, the products are biologically degradable and should generally be added to the fume bath on a continuous basis during operation. Suggested dosage and replenishment rates are provided on some of the technical data sheets and are also summarized in Exhibit 3 below, along with information on dosage equipment and operating considerations. The estimated fume suppressant usage and cost information presented in Exhibit 3 was developed based on the assumption that the product would be used in the existing chrome plating bath at Swanton Facility 1.

Exhibit 3
Summary of Alternative Fume Suppressants

Alternative Fume Suppressant	Estimated Usage	Fume Suppressant Cost	Dosage Equipment	Operating Considerations
Atotech Fumalock	8 kg/year of "A" Component and 1.6 kg/year of "B" Component	Fumalock A3 = $22.25/kg in 20 kg pails, Fumalock B3 = $13.35/kg in 25 kg pails. Annual cost: $779	Continuous feed dosing tank is typically recommended, but manual additions based on surface tension and visual determination of foam height are acceptable for this scale.	Fume suppressant runs at 40 dynes/cm by tensiometer (or 45-50 dynes/cm by stalagmometer). Air Permit modification might be needed for higher surface tension condition.
Dynamix, Inc. Dynaplate Cr FSN2	2.5 L/year	$69.89/gal for 5-gal pail Annual cost: $349	Requires a 1:4 dilution with DI water. Diluted solution added to plating tank with a continuous feed pump.	A 1% concentration (v/v) is needed to achieve a 35 dynes/cm surface tension and 1.75% v/v to achieve 25 dynes/cm as measured with a tensiometer.
Haviland Havachrome Mist Eliminator III	1-2 gal/year	$85/gal for 5-gal pail or $21.50/gallon for 55-gal drum of pre-diluted Annual cost: $425-$1,183	Requires a 1:5 dilution with DI water. Product applied with a continuous feed pump attached to an ampere hour meter.	A 0.1% v/v is needed to achieve a 35 dynes/cm surface tension and 0.25% v/v to achieve 25 dynes/cm as measured with a tensiometer. Optimum operating temperature is 110°F and maximum is 130°F.
TIB Chemicals TIB Suract CR-H	1-2 L/year	$10/kg, assumes 375 kg order Annual cost: $3,750	Requires a 1:10 dilution with DI water. Optimum application includes mixing tank, circulating pump, and level measuring to determine the demand on fluid to be added. Simpler systems are possible.	Dosage should be adjusted to constantly cover the plating bath completely by a thin foam blanket and to maintain the surface tension of the electrolyte below 30 mN/m sein (ring method).

Notes:
1. The information summarized in Exhibit 3 was provided by the fume suppressant manufacturers as an example based on the specifications for the existing chrome plating bath at Swanton Facility 1 including:
   a. Plating tank volume: 8 gallons
   b. Operating temperature: 130-135 °F
   c. Annual permitted use limit: 60,000 amp-hours/yr
   d. Chromic acid concentration: 250 g/l
2. As a basis for comparison, Swanton Facility 1 manually adds approximately 25 ml of the existing fume suppressant to the plating bath approximately every six weeks to maintain the surface tension at 33-34 dynes/cm as measured by a stalagmometer.

Based on information collected during alternative product identification work, several of these alternative products have been pilot tested or are currently in use in New York and Virginia; however, data or information on their implementation is not available and has not been obtained as of the date of this report. Further assessment of the alternative products through laboratory bench scale testing could be beneficial for identifying a suitable alternative, followed by a full-scale pilot test. Recommendations and implementation guidance to assess the feasibility of potential replacement products are discussed in the next section.

5.0 CONCLUSIONS/NEXT STEPS

Each alternative fume suppressant identified in Section 4.2 warrants further consideration as a potential substitute for the PFAS-containing fume suppressant currently in use at Swanton Facility 1 and at other similar facilities that perform chrome plating. Given that these PFAS-free alternatives are relatively new technologies and have notably different characteristics and operating requirements than PFAS-containing fume suppressants, it appears prudent to conduct bench-scale and/or pilot testing prior to full-scale implementation of a PFAS-free fume suppressant. Testing and implementation guidance, considerations, and potential barriers to implementation of a PFAS-free alternative fume suppressant are discussed in the following sections.

5.1 Preliminary Guidance and Considerations for Testing a PFAS-Free Fume Suppressant

The guidance, considerations, and general methodology for testing a PFAS-free fume suppressant discussed herein is preliminary and should not be considered tried and proven. Development of a site-specific testing protocol is recommended.

The type of testing (e.g., bench-scale, pilot) and location (e.g., laboratory, facility) should be selected by the facility that is commissioning the testing and in consideration of the objective(s) of the study. Given that surface tension is a key metric for controlling emissions from chrome plating baths (and maintaining compliance with air permit conditions), a primary objective should be to evaluate the ability of the PFAS-free fume suppressant to achieve the specified surface tensions at the dosages recommended by the manufacturer. The following general methodology is provided for consideration during development of a site-specific testing protocol:

- Select a testing location that is equipped to implement the test and maintain appropriate health and safety controls (e.g., fume hood). Testing locations may include a university lab

or commercial lab, an on-site lab at the facility, or a room at the facility with existing plating operations equipment (e.g., chrome plating room).

- Select testing equipment to model the conditions of the chrome plating bath at the facility. A bench-scale set up may include a small (0.5-1 liter) beaker with electrode placed in a fume hood. A larger pilot test may include existing chrome-plating equipment that is not otherwise in use. Other testing setups may be possible.
- Set up the test bath (or beaker) to mimic the correct operating conditions of the plating bath including but not limited to chromic acid concentration, density, temperature, and pH. Additional consideration for the test bath design may be needed based on the recommended operating conditions for the selected fume suppressant. For example, some of the manufacturers recommend operating a well agitated bath equipped with a circulating pump.
- Based on the manufacturer recommendations for the PFAS-free fume suppressant(s), identify the initial dosage for the target concentration, and if multiple concentrations are to be evaluated. Consideration should be given for continuous feed dosing to maintain the desired target concentration.
- Develop a monitoring program to allow for quantitative comparison of the performance of the selected fume suppressant(s). The monitoring program should specify the duration of the test, monitoring parameters, and monitoring frequency. Key performance indicators may include surface tension and bath temperature. Industrial hygiene measurements may also be needed for assessing the 8-hour time-weighted average (TWA) concentration of chromium (VI) in air for evaluating employee exposure in accordance with Occupational Safety and Health Administration (OSHA) 29 CFR 1910.1026.
- Based on the results of the bench-scale/pilot comparison, select a PFAS-free fume suppressant and conduct a full-scale test (if appropriate). If conditions at the facility allow, consider continuing to operate a plating bath with PFAS-containing fume suppressant during the startup/initial implementation of the PFAS-free fume suppressant in a secondary bath and continue to monitor and record key parameters (e.g., surface tension, industrial hygiene measurements) simultaneously from both baths during the startup period.
- Compare performance of the PFAS-free fume suppressant to current PFAS-containing fume suppressant to further evaluate full scale implementation. As part of the evaluation, consider if additional equipment is needed to integrate the PFAS-free fume suppressant such as a mixing tank, circulating pump, level measuring or metering. Simpler systems may be possible such as a continuous feed pump attached to an ampere hour meter.

Potential limitations or barriers to testing and implementation of a PFAS-free alternative fume suppressant are discussed in the following section.

5.2 Potential Barriers to Implementation of a PFAS-Free Fume Suppressant

There are some potential limitations or barriers that need to be evaluated prior to moving forward with testing and implementation of a PFAS-free fume suppressant for controlling chromium emissions from a plating bath. Areas that may require additional consideration include air permitting, industrial hygiene/worker health and safety, worker availability, and cost.

Minimum air permitting requirements are likely to include a limit on the maximum allowable surface tension of the chromium electroplating bath and a minimum frequency for testing the surface tension. As an example, the Title V Air Permit for Swanton Facility 1 (and EPA 40 CFR 63.342) specifies that the surface tension in the electroplating tank bath is not to exceed 40 dynes per centimeter (dynes/cm), as measured with a stalagmometer or 33 dynes/cm, as measured with a tensiometer, at any time during operation of the tank. Testing is required at least once during every 40 hours of operation of the tank. As summarized in Exhibit 3 of section 4.2, it may not be feasible for some of the PFAS-free fume suppressants to meet this limit.

In addition to the air permitting considerations, OSHA 29 CFR 1910.1026 specifies a permissible exposure limit (PEL) of 5 micrograms per cubic meter of air (5 $\mu g/m^3$) chromium (VI) in air, calculated as an 8-hour TWA. The action level is set at 2.5 $\mu g/m^3$ calculated as an 8-hour TWA. As well as meeting the surface tension requirements, testing would likely be needed to demonstrate that the PFAS-free fume suppressant can control chromium emissions as well as the PFAS-containing fume suppressant.

In addition, switching to a PFAS-free fume suppressant will require some up-front effort by the facility to develop and implement a testing program including working through the applicable permitting and health and safety requirements. Full implementation may also require procurement and installing additional equipment (e.g., mixing tank, circulating pump, metering) and adjustments to operations and monitoring to allow for a continuous feed of PFAS-free fume suppressant to the plating bath. Dedicating additional resources to this effort may be a barrier for some facilities.

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Appendix A

Metal Manufacturing and Finishing
PFAS Assessment Questionnaire

Metal Manufacturing and Finishing PFAS Assessment Questionnaire

For Confidential Business Information (CBI) management procedures, please refer to the VTDEC letter regarding Addressing Potential Trade Secret Information.

1) Does your facility conduct any of the following activities (please respond "Yes", "No", or "Don't Know")?

    - □ Hexavalent Chrome plating
    - □ Chromating
    - □ Chromic acid anodizing
    - □ Chromic acid etching
    - □ Electroless copper and electroless nickel-boron baths
    - □ Electroplating of copper, nickel, and tin
    - □ Zinc electrodeposition
    - □ Nickel, cadmium, or lead plating
    - □ Metal plating on plastics
    - □ Alkaline zinc plating
    - □ Other types of chemical and electrochemical finishing of parts
    - □ Other treatments to improve heat or corrosion resistance, reduce mechanical wear or enhance aesthetic appearance
    - □ Any processes that utilize polytetrafluoroethylene (PTFE) products
    - □ Any other processes that may utilize surfactants for purposes such as reducing friction/drag, changing surface tension in liquids, etc., through the use of additives

2) If "Yes" to any activities in Question #1, please list any fluorinated compounds or PFAS-containing products your facility uses in these processes that you are aware of. Please also provide Safety Data Sheets. Be mindful that PFAS may not be explicitly called out by name for reasons of confidential business information, and so be on the lookout for chemicals that contain "fluor" as part of their names or list descriptions such as "proprietary surfactant."

3) If "Yes" to activities in Question 1 and a list of fluorinated compounds or PFAS-containing products your facility uses can be generate (under #2), please estimate amounts of such products purchased/used per year.

Metal Manufacturing and Finishing PFAS Assessment Questionnaire

4) Perfluorooctane Sulfonate (PFOS) was commonly used as a mist suppressant or wetting agent until just a few years ago. Please indicate any current or previous use of products containing PFOS (please refer to the attached list of PFAS-Containing Products). Please indicate if the product is currently in use at the facility or was used within the last 10 years.

5) Does your facility use any of the PFOS replacement products (i.e., products potentially containing 6:2-FTS) included on the attached list of PFAS-Containing Products?

6) If "Yes" to #5, please estimate amounts of such products purchased/used per year.

7) What other, if any, fluorocarbons are used at the facility? Any products you use with "perfluoro-" in the name? Please provide Safety Data Sheets.

8) Does your facility have a fire suppression system that includes the use of foam, in particular a system that utilizes aqueous film forming foam (AFFF)? If so, what types of AFFF are used (or have been used in the past), and are there SDSs available for these products?

9) For any processes or activities performed at the facility that use products known or suspected to contain PFAS, please provide a process flow diagram (PFD) showing the process inputs (e.g., chemicals, water, parts, etc.) and outputs (e.g., spent baths, wastewater, evaporation loss, parts to additional production step, etc.). Please see attached Metal Finishing "Process Unit" as an example. If you do not have a PFD available, please prepare a simple sketch in the space provided below or provide additional sheets as needed.

Attachments List of PFAS-Containing Products
Metal Finishing "Process Unit" Flow Diagram

PFAS-Containing Products (Mist Suppressants)

Products containing PFOS

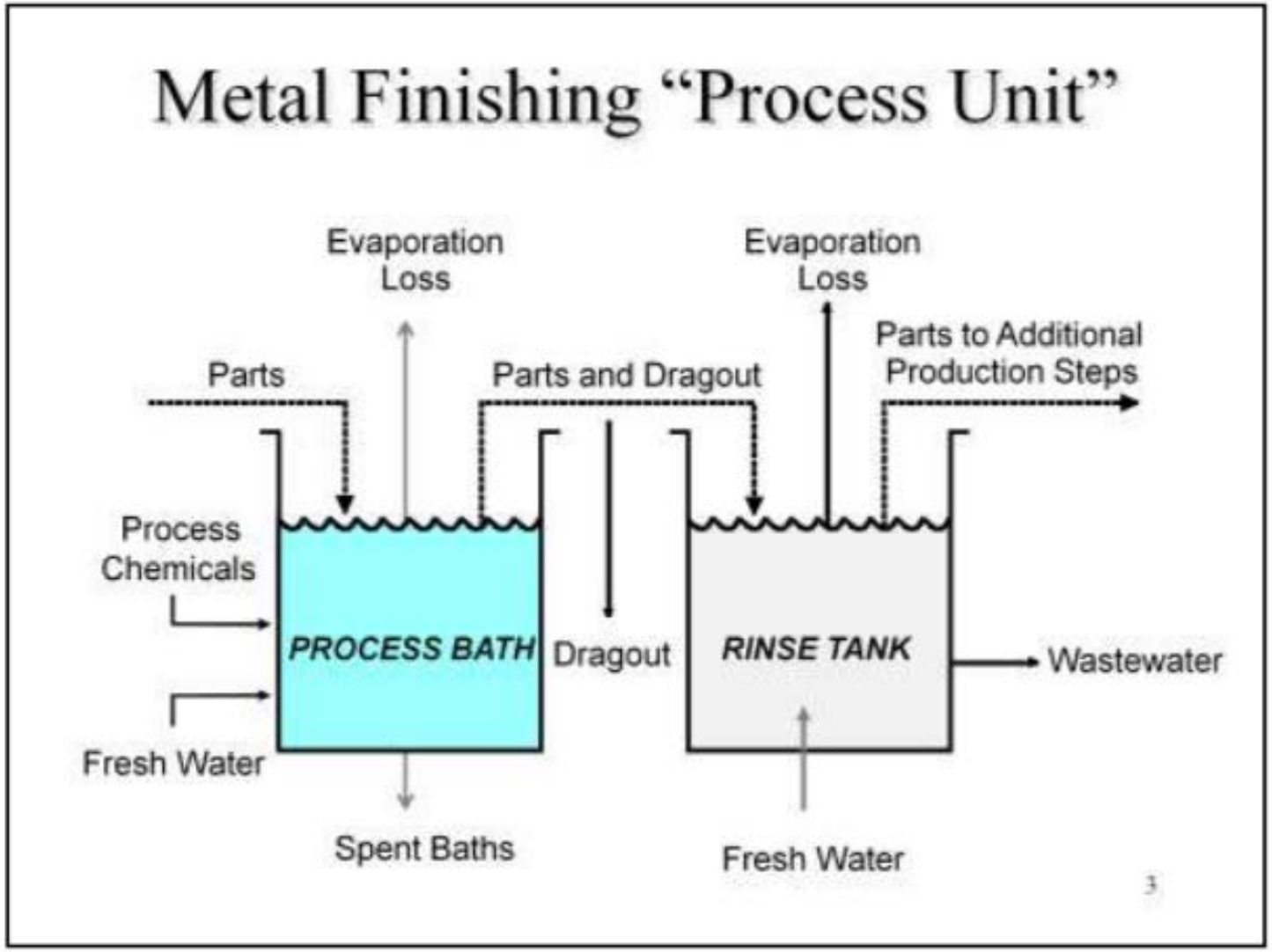
- Ankor Wetting Agent F
- Clepo Chrome Mist Control
- Fumetrol 140
- Fluorotenside-248, Sur Tec 960, Fumetrol (Atotech)
- Benchmark Benchbrite STX
- Benchmark CFS
- Benchbrite CR 1800
- MacDermid Clepo Chrome
- MacDermid Proquel B
- MacDermid Macuplex STR
- Plating Process Systems PMS-R
- Brite Guard AF-1
- Hunter Chemical 6.2
- Hunter Chemical HCA-4

Products potentially containing 6:2-FTS

- Fumetrol 21 LF2
- Dicolloy CRPF
- Hunter Chemical HCA – 8.4
- Macuplex STR NPFX

From Mass Toxics Use Reduction Institute and
https://ww2.arb.ca.gov/sites/default/files/classic/toxics/chrome/fumesuppresslistfinal9.6.16.pdf

Process Flow Diagram for Metal Finishing Process Unit



SANBORN HEAD

https://epa.ohio.gov/Portals/41/training/Metal%20Finishing%20Training%20Web.pdf

Appendix B

Questionnaire for State Agencies, Chemical Manufacturers/Suppliers and/or Industry

Questionnaire for State Agencies, Chemical Manufacturers/Suppliers, and/or Industry

1. What alternative products that are PFAS-free or are made with reduced-PFAS formulations are you aware of for use in the metal finishing industry (e.g., PFAS-free fume suppressants for chrome plating)? Metal finishing operations are known to use PFAS for:
    a. Surfactants, dispersants, wetting agents, or fume/mist suppressing agents;
    b. Corrosion inhibitors or other products to reduce wear, enhance heat resistance, or aesthetic appearance;
    c. Leveling agents for zinc electrodeposition;
    d. Electroless plating of nickel/copper and electroplating of copper, nickel, and/or tin.

2. Do you maintain SDS sheets or manufacturer information on any of the alternative products identified in Question No. 1?

3. Do you have access to studies investigating the use and performance of any alternative products in the metal finishing industry that are PFAS-free or are made with reduced-PFAS formulations? For example, are you aware of or do you have access to studies (industry or research based) evaluating the functionality of the product in the industrial process and whether PFAS concentrations in effluent streams (e.g., air, wastewater) decreased subsequent to use of the product?

4. Do you have record of the implementation of any alternative products that are PFAS-free or are made with reduced-PFAS formulations at an operational metal finishing facility, including comparative data (i.e., PFAS sampling results before and after implementation)? Do you have contacts at these facilities that you can share/recommend for further discussion/information?

5. (For state agency) What practices are you aware of that are being implemented at metal finishing facilities to reduce, eliminate, or prevent PFAS loading at the source. The practices may include:
    a. Equipment or technology modifications;
    b. Process or procedure modifications;
    c. Reformulation or redesign of products;
    d. Substitution of raw materials; and
    e. Improvements in housekeeping, maintenance, training, or inventory control.

6. (For state agency) Do you offer education (or incentive) to metal finishing facilities regarding the use of alternative products that are PFAS-free or are made with reduced-PFAS formulations?

7. (For state agency) What state legislation currently exists regarding the use of products that contain PFAS? Is new legislation expected? Are there specific requirements for metal finishing facilities?

Appendix C

Safety and Technical Data Sheets for Alternative Fume Suppressants

Atotech

Fumalock®

Atotech's legacy for the future generations

General metal finishing | Functional chrome | atotech.com

A new generation of sustainable fume suppressants for Cr(VI) hard chrome plating

FLUORINE-free

non-PFAS

The first non-PFOS, non-PFAS and fluorine-free fume suppressant for hard chrome plating

Fumalock® is the first non-PFOS, non-PFAS and fluorine-free fume suppressant for hexavalent hard chrome plating on the global market. The Fumalock® process is fully compliant with non-PFOS and non-PFAS legislation and directives.

Fumalock® is a highly effective fume-suppressing process based on surface-active components. It is designed to form a dense foam barrier layer that prevents the exhaust of hazardous aerosols. The standard emissions for this new fume suppressant are compliant with local regulations.

Fumalock® provides an excellent balance between a controlled foam blanket and the reduction of surface tension to values below 40 (30 - 38) mN/m. Fumalock® has a wide working window and consists of two products which allow for a more thorough control of the foam blanket. The process is strongly resistant to hard water and tolerates metal impurities excellently. It is also easy to control, handle and operate.

ATOTECH

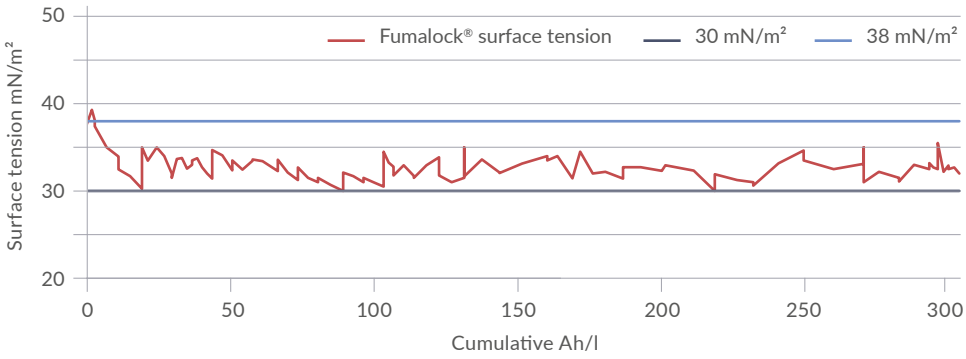
Maximum flexibility and protection

Image 1:
Fumalock® foam blanket on bath surface of chrome plating bath

Two components offering maximum operational flexibility

Fumalock® consists of two surface-active agents, both of which are free of fluorine-based compounds. Fumalock® A acts as a foam generator and Fumalock® B acts as a foam controller, which ensures a dense layer of foam is formed on the bath surface to achieve full coverage and eliminate mist.

Fumalock® surface tension vs. Ah/l



The above graph shows the surface tension behavior of Fumalock® in a 170l bath that was operated over a three-month period. The surface tension created by Fumalock® varied between 30 and 38 mN/m² throughout the period.

Protecting the plating peripherals and reducing chemistry consumption

Effectively reducing the surface tension and covering the bath surface with the foam barrier ensures aerosols are not emitted into the air and reduces Cr(VI) contamination into the air extraction system. Lower Cr(VI) emissions result in reduced chemical drag-out into the rinses and reduced chemical consumption.

Features and benefits

- Non-PFOS, non-PFAS and non-fluorine-based process
- Complies with EPA, CEPA and REACH regulations
- Greatly reduces chromic acid misting during operation
- Controllable dense foam blanket thickness and surface tension
- Passes the NESHAP stack test
- Lowers the chance of contamination of adjacent plating solutions by chromic acid fumes
- Increases the lifespan of ventilation systems and other plating line equipment
- Possesses strong resistance to hard water

Atotech Group
+49 30 349850
info@atotech.com

FUMALOCK® A3

Version 1.0
SDS_US_GHS SDS Number: 1692905 Revision Date: 04/19/2021

SECTION 1. IDENTIFICATION

Product name	:	FUMALOCK® A3
Product code	:	1692905

Manufacturer or supplier's details

Company name of supplier	:	Atotech Deutschland GmbH
Address	:	Erasmusstrasse 20 Berlin 10553 Germany
Telephone	:	+4930349850
Company name of supplier	:	Atotech USA
Address	:	1750 OVERVIEW DRIVE ROCK HILL, SC, USA 29730
Telephone	:	+18038173500
Company name of supplier	:	Atotech Canada
Address	:	1180 Corporate Drive BURLINGTON L7L 5R6 Canada
Telephone	:	+19053320111

Prepared by
Product Safety Department (PSD): product-safety@atotech.com

Inquiries
E-mail address for a competent person responsible for the safety data sheet: product-safety@atotech.com

Emergency telephone number	:	CHEMTREC +18004249300
Transport Medical	:	Rocky Mountain Poison Control Center: 303-623-5716

Recommended use of the chemical and restrictions on use

Recommended use	:	Plating agents and metal surface treating agents Surface treatment

Restrictions on use : For industrial use only.

SECTION 2. HAZARDS IDENTIFICATION

GHS classification in accordance with 29 CFR 1910.1200

Not a hazardous substance or mixture.

GHS label elements

Not a hazardous substance or mixture.

Other hazards

None known.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance / Mixture : Mixture

Chemical nature : Aqueous solution

Hazardous ingredients

Chemical name	CAS-No.	Concentration (% w/w)
Quaternary Ammonium Salt	Proprietary	>= 2.5 - < 5

Actual concentration is withheld as a trade secret

This product may contain component(s) that are not listed under disclosure. All components not listed, do not contain hazardous materials above deminimus disclosure limits as defined by OSHA, NIOSH, ACGIH or Canadian WHMIS 2015 regulations and or guidelines. Please refer to other sections of the SDS for information on safety, health and environmental guidelines and precautions.

SECTION 4. FIRST AID MEASURES

General advice : If you feel unwell, seek medical advice (show the label where possible).

If inhaled : Move to fresh air.

In case of skin contact : Wash off immediately with plenty of water for at least 15 minutes.
Take off contaminated clothing and shoes immediately.
Wash contaminated clothing before re-use.
Get medical attention if irritation develops and persists.

In case of eye contact : Rinse immediately with plenty of water, also under the eyelids, for at least 5 minutes.

If swallowed	:	If swallowed, call a poison control centre or doctor immediately. Never give anything by mouth to an unconscious person. Do not induce vomiting without medical advice.
Most important symptoms and effects, both acute and delayed	:	None known.
Protection of first aid responders	:	First Aid responders should pay attention to self-protection and use the recommended protective clothing
Notes to physician	:	No information available.

SECTION 5. FIRE-FIGHTING MEASURES

Suitable extinguishing media	:	Water spray Alcohol-resistant foam Carbon dioxide (CO2) Dry chemical
Unsuitable extinguishing media	:	None known.
Specific hazards during fire fighting	:	Hazardous decomposition products formed under fire conditions.
Hazardous combustion products	:	Carbon oxides Nitrogen oxides (NOx)
Specific extinguishing methods	:	Use a water spray to cool fully closed containers. Collect contaminated fire extinguishing water separately. This must not be discharged into drains. Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations.
Special protective equipment for fire-fighters	:	As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures	:	Use personal protective equipment. Evacuate personnel to safe areas. Keep people away from and upwind of spill/leak.
Environmental precautions	:	Should not be released into the environment.
Methods and materials for containment and cleaning up	:	Avoid formation of aerosol. Dam up. Soak up with inert absorbent material. Keep in suitable, closed containers for disposal. Clean contaminated floors and objects thoroughly while

observing environmental regulations.

SECTION 7. HANDLING AND STORAGE

Advice on safe handling	:	For personal protection see section 8. Smoking, eating and drinking should be prohibited in the application area. Handle in accordance with good industrial hygiene and safety practice. Avoid breathing mist or vapours.
Conditions for safe storage	:	Keep containers tightly closed in a dry, cool and well-ventilated place. Do not freeze.
Recommended storage temperature	:	5 - 40 °C

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Ingredients with workplace control parameters

Contains no substances with occupational exposure limit values.

Engineering measures	:	Ensure adequate ventilation, especially in confined areas.

Personal protective equipment

Respiratory protection	:	Use NIOSH approved respiratory protection. In case of insufficient ventilation, wear suitable respiratory equipment. When workers are facing concentrations above the exposure limit they must use appropriate certified respirators. No personal respiratory protective equipment normally required.
Hand protection		
Remarks	:	Impervious gloves
Eye protection	:	Tightly fitting safety goggles Ensure that eyewash stations and safety showers are close to the workstation location.
Skin and body protection	:	Impervious clothing Boots
Hygiene measures	:	Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product. When using do not eat, drink or smoke.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	liquid
Color	:	colorless, white
Odor	:	odorless
Odor Threshold	:	Not relevant
pH	:	3.5 - 6.5 (20 °C)
Melting point/freezing point	:	not determined, mixture of various components
Initial boiling point and boiling range	:	> 100 °C
Flash point	:	does not flash
Evaporation rate	:	not determined, mixture of various components
Flammability (solid, gas)	:	not applicable for liquids
Upper explosion limit	:	not determined, mixture of various components
Lower explosion limit	:	not determined, mixture of various components
Vapor pressure	:	ca. 23 hPa (20 °C)
Relative vapor density	:	not determined, mixture of various components
Density	:	1.00 - 1.10 g/cm3 (20 °C)
Solubility(ies)		
Water solubility	:	completely miscible
Partition coefficient: n-octanol/water	:	not determined, mixture of various components
Autoignition temperature	:	not determined, stable under normal process conditions
Decomposition temperature	:	not determined, stable under normal process conditions
Viscosity		
Viscosity, kinematic	:	similar to water
Oxidizing properties	:	The substance or mixture is not classified as oxidizing.

SECTION 10. STABILITY AND REACTIVITY

Reactivity	:	None under normal processing.

Chemical stability	:	Stable under recommended storage conditions.
Possibility of hazardous reactions	:	No dangerous reaction known under conditions of normal use.
Conditions to avoid	:	To avoid thermal decomposition, do not overheat.
Incompatible materials	:	No data available
Hazardous decomposition products	:	No hazardous decomposition products are known.

SECTION 11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

No information available.

Acute toxicity

Based on available data, the classification criteria are not met.

Remark: The acute toxicity estimate (ATE) of the ingredients are derived using the LD50/LC50 values where available.

Skin corrosion/irritation

Based on available data, the classification criteria are not met.

Components:

Quaternary Ammonium Salt:

Result: irritating
Remarks: information from raw material supplier

Serious eye damage/eye irritation

Based on available data, the classification criteria are not met.

Components:

Quaternary Ammonium Salt:

Result: irritating
Remarks: information from raw material supplier

Respiratory or skin sensitization

Skin sensitisation

Based on available data, the classification criteria are not met.

Respiratory sensitisation

Based on available data, the classification criteria are not met.

Germ cell mutagenicity

Based on available data, the classification criteria are not met.

Carcinogenicity

Based on available data, the classification criteria are not met.

IARC	No ingredient of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
OSHA specified	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.
NTP	No ingredient of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

Reproductive toxicity

Based on available data, the classification criteria are not met.

STOT - single exposure

Based on available data, the classification criteria are not met.

Components:

Quaternary Ammonium Salt:

Assessment: May cause respiratory irritation.

STOT - repeated exposure

Based on available data, the classification criteria are not met.

Aspiration toxicity

Based on available data, the classification criteria are not met.

Further information

Product:

Remarks: No data available

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity

No data available

Persistence and degradability

No data available

Bioaccumulative potential

No data available

Mobility in soil

No data available

Other adverse effects

No data available

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal methods

Waste from residues	:	Dispose of in accordance with local regulations. Dispose of wastes in an approved waste disposal facility.
Contaminated packaging	:	Empty containers should be taken to an approved waste handling site for recycling or disposal.

SECTION 14. TRANSPORT INFORMATION

International Regulations

IATA-DGR
Not regulated as a dangerous good

IMDG-Code
Not regulated as a dangerous good

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code
Not applicable for product as supplied.

Domestic regulation

DOT / 49 CFR
Not regulated as a dangerous good

SECTION 15. REGULATORY INFORMATION

TSCA 5a : No substances are subject to a Significant New Use Rule.

TSCA_12b : No substances are subject to TSCA 12(b) export notification requirements.

DEA : Not applicable

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 : No SARA Hazards

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.

US State Regulations

Massachusetts Right To Know

No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know

No components are subject to Pennsylvania Right to Know Act.

New Jersey Right To Know

No components are subject to New Jersey Right to Know Act.

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.

Remarks: Components which are only displayed in Section 15 are being reported for local regulatory purposes. These components are not displayed in Section 3 due to one or more of the following conditions being met: being present in the product at concentration(s) below threshold limit values for reporting, not considered hazardous materials, health hazards or because they do not contribute to the overall GHS Classification of the final product as required by OSHA HazCom 2012 final rule (29 CFR 1910.1200).

Substances currently restricted by WEEE/RoHS (European Directives 2015/863/EU, 2012/19/EU and 2011/65/EU) or ELV (European Directive 2000/53/EC):

PBDE	PBB	CrVI	Hg	Pb	Cd
-	-	-	-	-	-

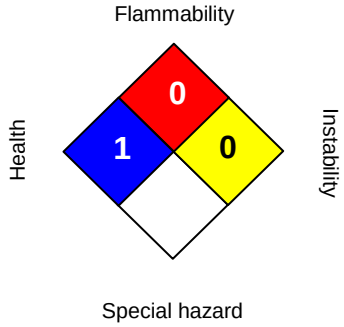
	DEHP	BBP	DBP	DIBP
Phthalates:	-	-	-	-

Please note: Current legislation according to WEEE/RoHS or ELV restricting the use of certain substances applies to "homogeneous material" in finished articles being supplied to the market. Substances deposited during surface finishing may have a composition (weight percent) higher than the weight percent of the substance in the operating solution from which the deposit is made. Atotech encourages its customers to implement systems to ensure their finished products comply with the regulations in force.

SECTION 16. OTHER INFORMATION

Further information

NFPA:



Full text of other abbreviations

(Q)SAR - (Quantitative) Structure Activity Relationship; ASTM - American Society for the Testing of Materials; bw - Body weight; DIN - Standard of the German Institute for Standardisation; ECx - Concentration associated with x% response; ELx - Loading rate associated with x% response; EmS - Emergency Schedule; ErCx - Concentration associated with x% growth rate response; GHS - Globally Harmonized System; IARC - International Agency for Research on Cancer; IATA - International Air Transport Association; IBC - International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk; IC50 - Half maximal inhibitory concentration; ICAO - International Civil Aviation Organization; IMDG - International Maritime Dangerous Goods; IMO - International Maritime Organization; ISO - International Organisation for Standardization; LC50 - Lethal Concentration to 50 % of a test population; LD50 - Lethal Dose to 50% of a test population (Median Lethal Dose); MARPOL - International Convention for the Prevention of Pollution from Ships; n.o.s. - Not Otherwise Specified; NO(A)EC - No Observed (Adverse) Effect Concentration; NO(A)EL - No Observed (Adverse) Effect Level; NOELR - No Observable Effect Loading Rate; OECD - Organization for Economic Co-operation and Development; OPPTS - Office of Chemical Safety and Pollution Prevention; PBT - Persistent, Bioaccumulative and Toxic substance; REACH - Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals; SADT - Self-Accelerating Decomposition Temperature; SDS - Safety Data Sheet; UN - United Nations; vPvB - Very Persistent and Very Bioaccumulative; CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act; DOT - Department of Transportation; EHS - Extremely Hazardous Substance; HMIS - Hazardous Materials Identification System; MSHA - Mine Safety and Health Administration; NFPA - National Fire Protection Association; RCRA - Resource Conservation and Recovery Act; RQ - Reportable Quantity; SARA - Superfund Amendments and Reauthorization Act; CMR - Carcinogen, Mutagen or Reproductive Toxicant; GLP - Good Laboratory Practice; ERG - Emergency Response Guide; NTP - National Toxicology Program; UNRTDG - United Nations Recommendations on the Transport of Dangerous Goods

Revision Date : 04/19/2021

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.

US / EN

FUMALOCK® B3

Version 1.0
SDS_US_GHS SDS Number: 1692990 Revision Date: 03/19/2021

SECTION 1. IDENTIFICATION

Product name	:	FUMALOCK® B3
Product code	:	1692990

Manufacturer or supplier's details

Company name of supplier	:	Atotech Deutschland GmbH
Address	:	Erasmusstrasse 20 Berlin 10553 Germany
Telephone	:	+4930349850
Company name of supplier	:	Atotech USA
Address	:	1750 OVERVIEW DRIVE ROCK HILL, SC, USA 29730
Telephone	:	+18038173500
Company name of supplier	:	Atotech Canada
Address	:	1180 Corporate Drive BURLINGTON L7L 5R6 Canada
Telephone	:	+19053320111

Prepared by
Product Safety Department (PSD): product-safety@atotech.com

Inquiries
E-mail address for a competent person responsible for the safety data sheet: product-safety@atotech.com

Emergency telephone number	:	CHEMTREC +18004249300
Transport Medical	:	Rocky Mountain Poison Control Center: 303-623-5716

Recommended use of the chemical and restrictions on use

Recommended use	:	Plating agents and metal surface treating agents Surface treatment

Restrictions on use	:	For industrial use only.

SECTION 2. HAZARDS IDENTIFICATION

GHS classification in accordance with 29 CFR 1910.1200

Not a hazardous substance or mixture.

GHS label elements

Not a hazardous substance or mixture.

Other hazards

None known.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance / Mixture	:	Mixture
Chemical nature	:	Aqueous solution

Hazardous ingredients

No hazardous ingredients

This product may contain component(s) that are not listed under disclosure. All components not listed, do not contain hazardous materials above deminimus disclosure limits as defined by OSHA, NIOSH, ACGIH or Canadian WHMIS 2015 regulations and or guidelines. Please refer to other sections of the SDS for information on safety, health and environmental guidelines and precautions.

SECTION 4. FIRST AID MEASURES

General advice	:	If you feel unwell, seek medical advice (show the label where possible).
If inhaled	:	Move to fresh air.
In case of skin contact	:	In case of contact, immediately flush skin with plenty of water. Take off contaminated clothing and shoes immediately. Wash contaminated clothing before re-use.
In case of eye contact	:	Rinse immediately with plenty of water, also under the eyelids, for at least 5 minutes.
If swallowed	:	If swallowed, call a poison control centre or doctor immediately. Never give anything by mouth to an unconscious person. Do not induce vomiting without medical advice.

Most important symptoms and effects, both acute and delayed	:	None known.
Protection of first aid responders	:	First Aid responders should pay attention to self-protection and use the recommended protective clothing
Notes to physician	:	No information available.

SECTION 5. FIRE-FIGHTING MEASURES

Suitable extinguishing media	:	Water spray Alcohol-resistant foam Carbon dioxide (CO2) Dry chemical
Unsuitable extinguishing media	:	None known.
Specific hazards during fire fighting	:	Hazardous decomposition products formed under fire conditions.
Hazardous combustion products	:	Silicon oxides
Specific extinguishing methods	:	Use a water spray to cool fully closed containers. Collect contaminated fire extinguishing water separately. This must not be discharged into drains. Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations.
Special protective equipment for fire-fighters	:	As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures	:	Use personal protective equipment. Evacuate personnel to safe areas. Keep people away from and upwind of spill/leak.
Environmental precautions	:	Should not be released into the environment.
Methods and materials for containment and cleaning up	:	Avoid formation of aerosol. Dam up. Soak up with inert absorbent material. Keep in suitable, closed containers for disposal. Clean contaminated floors and objects thoroughly while observing environmental regulations.

SECTION 7. HANDLING AND STORAGE

Advice on safe handling	:	For personal protection see section 8. Smoking, eating and drinking should be prohibited in the application area. Handle in accordance with good industrial hygiene and safety practice. Avoid breathing mist or vapours.
Conditions for safe storage	:	Keep containers tightly closed in a dry, cool and well-ventilated place. Do not freeze.
Recommended storage temperature	:	5 - 40 °C

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Ingredients with workplace control parameters

Contains no substances with occupational exposure limit values.

Engineering measures : Ensure adequate ventilation, especially in confined areas.

Personal protective equipment

Respiratory protection	:	No personal respiratory protective equipment normally required. Use NIOSH approved respiratory protection. In case of insufficient ventilation, wear suitable respiratory equipment. When workers are facing concentrations above the exposure limit they must use appropriate certified respirators.
Hand protection		
Remarks	:	Impervious gloves
Eye protection	:	Tightly fitting safety goggles Ensure that eyewash stations and safety showers are close to the workstation location.
Skin and body protection	:	Impervious clothing Boots
Hygiene measures	:	Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product. When using do not eat, drink or smoke.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	liquid

Color	:	colorless, white
Odor	:	slight
Odor Threshold	:	Not classified due to lack of data.
pH	:	6.5 - 8.5 (20 °C)
Melting point/freezing point	:	not determined, mixture of various components
Initial boiling point and boiling range	:	> 100 °C
Flash point	:	does not flash
Evaporation rate	:	not determined, mixture of various components
Flammability (solid, gas)	:	not applicable for liquids
Upper explosion limit	:	not determined, mixture of various components
Lower explosion limit	:	not determined, mixture of various components
Vapor pressure	:	ca. 23 hPa (20 °C)
Relative vapor density	:	not determined, mixture of various components
Density	:	0.95 - 1.05 g/cm3 (20 °C)
Solubility(ies)		
Water solubility	:	completely miscible
Partition coefficient: n-octanol/water	:	not determined, mixture of various components
Autoignition temperature	:	not determined, stable under normal process conditions
Decomposition temperature	:	not determined, stable under normal process conditions
Viscosity		
Viscosity, kinematic	:	similar to water
Oxidizing properties	:	The substance or mixture is not classified as oxidizing.

SECTION 10. STABILITY AND REACTIVITY

Reactivity	:	None under normal processing.
Chemical stability	:	Stable under recommended storage conditions.
Possibility of hazardous reactions	:	No dangerous reaction known under conditions of normal use.

Conditions to avoid	:	To avoid thermal decomposition, do not overheat.
Incompatible materials	:	No data available
Hazardous decomposition products	:	No hazardous decomposition products are known.

SECTION 11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure
No information available.

Acute toxicity
Based on available data, the classification criteria are not met.

Remark: The acute toxicity estimate (ATE) of the ingredients are derived using the LD50/LC50 values where available.

Skin corrosion/irritation
Based on available data, the classification criteria are not met.

Serious eye damage/eye irritation
Based on available data, the classification criteria are not met.

Respiratory or skin sensitization

Skin sensitisation
Based on available data, the classification criteria are not met.

Respiratory sensitisation
Based on available data, the classification criteria are not met.

Germ cell mutagenicity
Based on available data, the classification criteria are not met.

Carcinogenicity
Based on available data, the classification criteria are not met.

IARC	No ingredient of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
OSHA specified	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.
NTP	No ingredient of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

Reproductive toxicity
Based on available data, the classification criteria are not met.

STOT - single exposure
Based on available data, the classification criteria are not met.

STOT - repeated exposure
Based on available data, the classification criteria are not met.

Aspiration toxicity
Based on available data, the classification criteria are not met.

Further information

Product:
Remarks: No data available

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity
No data available

Persistence and degradability
No data available

Bioaccumulative potential
No data available

Mobility in soil
No data available

Other adverse effects
No data available

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal methods

Waste from residues	:	Dispose of in accordance with local regulations. Dispose of wastes in an approved waste disposal facility.
Contaminated packaging	:	Empty containers should be taken to an approved waste handling site for recycling or disposal.

SECTION 14. TRANSPORT INFORMATION

International Regulations

IATA-DGR
Not regulated as a dangerous good

IMDG-Code
Not regulated as a dangerous good

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code
Not applicable for product as supplied.

Domestic regulation

DOT / 49 CFR
Not regulated as a dangerous good

SECTION 15. REGULATORY INFORMATION

TSCA 5a : No substances are subject to a Significant New Use Rule.

TSCA_12b : No substances are subject to TSCA 12(b) export notification requirements.

DEA : Not applicable

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 : No SARA Hazards

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.

US State Regulations

Massachusetts Right To Know
No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know
No components are subject to Pennsylvania Right to Know Act.

New Jersey Right To Know
No components are subject to New Jersey Right to Know Act.

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.

Remarks: Components which are only displayed in Section 15 are being reported for local regulatory purposes. These components are not displayed in Section 3 due to one or more of the following conditions being met: being present in the product at concentration(s) below threshold limit values for reporting, not considered hazardous materials, health hazards or because they do not contribute to the overall GHS Classification of the final product as required by OSHA HazCom 2012 final rule (29 CFR 1910.1200).

Substances currently restricted by WEEE/RoHS (European Directives 2015/863/EU, 2012/19/EU and 2011/65/EU) or ELV (European Directive 2000/53/EC):

PBDE	PBB	CrVI	Hg	Pb	Cd
-	-	-	-	-	-

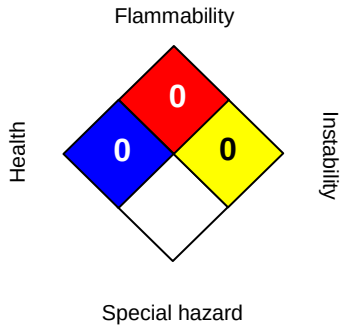
	DEHP	BBP	DBP	DIBP
Phthalates:	-	-	-	-

Please note: Current legislation according to WEEE/RoHS or ELV restricting the use of certain substances applies to "homogeneous material" in finished articles being supplied to the market. Substances deposited during surface finishing may have a composition (weight percent) higher than the weight percent of the substance in the operating solution from which the deposit is made. Atotech encourages its customers to implement systems to ensure their finished products comply with the regulations in force.

SECTION 16. OTHER INFORMATION

Further information

NFPA:



Full text of other abbreviations

(Q)SAR - (Quantitative) Structure Activity Relationship; ASTM - American Society for the Testing of Materials; bw - Body weight; DIN - Standard of the German Institute for Standardisation; ECx - Concentration associated with x% response; ELx - Loading rate associated with x% response; EmS - Emergency Schedule; ErCx - Concentration associated with x% growth rate response; GHS - Globally Harmonized System; IARC - International Agency for Research on Cancer; IATA -

International Air Transport Association; IBC - International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk; IC50 - Half maximal inhibitory concentration; ICAO - International Civil Aviation Organization; IMDG - International Maritime Dangerous Goods; IMO - International Maritime Organization; ISO - International Organisation for Standardization; LC50 - Lethal Concentration to 50 % of a test population; LD50 - Lethal Dose to 50% of a test population (Median Lethal Dose); MARPOL - International Convention for the Prevention of Pollution from Ships; n.o.s. - Not Otherwise Specified; NO(A)EC - No Observed (Adverse) Effect Concentration; NO(A)EL - No Observed (Adverse) Effect Level; NOELR - No Observable Effect Loading Rate; OECD - Organization for Economic Co-operation and Development; OPPTS - Office of Chemical Safety and Pollution Prevention; PBT - Persistent, Bioaccumulative and Toxic substance; REACH - Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals; SADT - Self-Accelerating Decomposition Temperature; SDS - Safety Data Sheet; UN - United Nations; vPvB - Very Persistent and Very Bioaccumulative; CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act; DOT - Department of Transportation; EHS - Extremely Hazardous Substance; HMIS - Hazardous Materials Identification System; MSHA - Mine Safety and Health Administration; NFPA - National Fire Protection Association; RCRA - Resource Conservation and Recovery Act; RQ - Reportable Quantity; SARA - Superfund Amendments and Reauthorization Act; CMR - Carcinogen, Mutagen or Reproductive Toxicant; GLP - Good Laboratory Practice; ERG - Emergency Response Guide; NTP - National Toxicology Program; UNRTDG - United Nations Recommendations on the Transport of Dangerous Goods

Revision Date : 03/19/2021

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.

US / EN

Dynamix

DYNAPLATE Cr FSN2

Fume Suppressant for Hexavalent Chromium Plating Solutions.

Dynaplate Cr FSN2 is a PFOS, PFAS and fluoride free fume suppressant used in hexavalent chromium plating solutions to control misting and reduce ventilation requirement.

Meets the United States, European and Canadian regulations prohibiting the manufacture, use, sale, and import of perfluoroctane sulfonate (PFOS) and its salts.

FEATURES

- Perfluoroctane sulfonate (PFOS, PFAS, PFOA) free.
- Does not contain halogenated ingredients and is biologically degradable.
- Non-fluorinated.
- Produces very stable foam blanket on hexavalent chrome electrolytes.
- Will reduce chrome misting by over 99%.
- Lowers the surface tension to 35 dynes/cm or less, thus substantially lowering drag-out losses as well as reducing the size of escaping bubbles.
- Stable in strong oxidizing solutions (chrome plating solutions).
- Does not have a detrimental effect on chrome deposit.
- Less danger of contamination of adjacent plating solutions by chromic acid mist.
- Increased life of ventilating and other plating room equipment.

91 Esna Park Drive, Unit #7, Markham, Ontario, Canada, L3R 2S2

Tel: 905. 477.0900 Fax: 905. 477.0600 www.dynamix-inc.com

OPERATING CONDITIONS

CONCENTRATION: 1.0% v/v for 35 dyne/cm

Dynaplate Cr FSN2 should be diluted 4 times with water and added to the chrome solution with good mixing. (25% by volume)

REPLENISHMENT

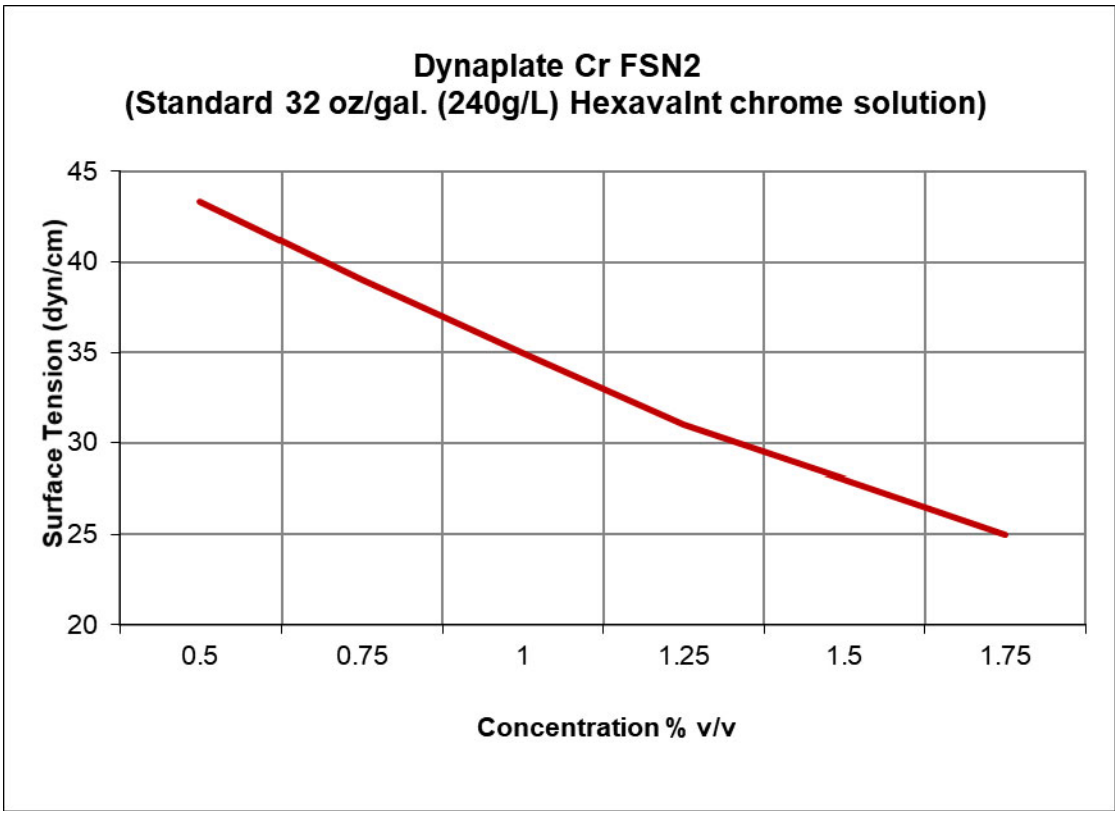
Dynaplate Cr FSN2 is consumed by drag-out, electrolysis and is biologically degradable by chromic acid. Control should be by measuring the surface tension using a tensiometer or a stalagmometer. A stalagmometer will give different surface tension values that can be up to 10 – 20 dyne/cm higher than the actual values.

Additions of the 4x diluted solution should be made on a continuous basis using a feeding pump at the approximate rate of 25000 amp-hrs./L.

An addition of 0.3 – 0.5% of the 4x diluted solution may be required after long idle periods.

SURFACE TENSION RANGES: as per SOR/2009-162 June 4, 2009

Two ranges depending on instrument used to measure:
Tensiometer < 35 dyne/cm
Stalagmometer <45 dyne/cm



READ THE MSDS BEFORE USING THIS PRODUCT.

91 Esna Park Drive, Unit #7, Markham, Ontario, Canada, L3R 2S2
Tel: 905. 477.0900 Fax: 905. 477.0600 www.dynamix-inc.com

Safety Data Sheet

1. CHEMICAL AND COMPANY IDENTIFICATION

Product Name: DYNAPLATE Cr FSN 2
Chemical Family: Not available.
Product Use: Surface finishing chemistry.
Restrictions on Use: Take notice of labels and safety data sheets before working.

Supplier: Dynamix Inc.
91 Esna Park Drive, Unit #7
Markham, Ontario, Canada
L3R 2S2
(905) 477-0900

24-Hour Emergency Telephone Number (CANUTEC): (613) 996-6666

2. HAZARDS IDENTIFICATION

Hazard Classification:
Serious eye damage/eye irritation (Category 2A)

Signal Word:
WARNING

Hazard Statements:
H319 Causes serious eye irritation.

Target Organs:
None.

Precautionary Statements:
P264 Wash exposed skin thoroughly after handling.
P280 Wear eye protection, face protection, protective clothing, protective gloves.
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

Ingredients (synonyms)	C.A.S. #	Percent (w/w)	GHS Classification
Polyethyleneglycol cocamine ((Coconut oil alkyl)amine, ethoxylated; Cocoamine, ethoxylated; Polyoxyethylene cocoamine; Primary coco amine, ethylene oxide adduct)	61791-14-8	10 – 30	Serious eye damage/eye irritation (Category 1) Acute toxicity, oral (Category 4)

4. FIRST AID MEASURES

Eye: Immediately flush eye with water while lifting the upper and lower lids. Remove contact lenses if present, then continue flushing. Seek medical attention if irritation develops.
Skin: Remove contaminated clothing immediately. Rinse thoroughly with plenty of water. Wash contaminated clothing before reuse. Seek medical attention if irritation occurs.
Inhalation: If breathed in, move person into fresh air. If not breathing, give artificial respiration.
Ingestion: Never give anything by mouth to an unconscious person. Rinse mouth with water. Seek medical attention is irritation develops.
Note to Physician: None.

5. FIRE FIGHTING MEASURES

Extinguishing Media: Product is not flammable. Use fire-fighting measures that suit the surrounding fire.
Unsuitable Extinguishing Media: High volume water jet.
Special Exposure Hazards: Not available.
Special Protective Equipment: Wear protective clothing and self-contained breathing apparatus.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions: See Section 8 of SDS for recommendations on the use of personal protective equipment.
Protective Equipment: Wear protective clothing. Local ventilation.
Emergency Procedures: Not available.
Environmental Precautionary Measures: Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.
Spill Clean Up: Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container.

7. HANDLING AND STORAGE

Handling Procedures and Equipment: Keep container closed when not in use.
Storage: Store in a dry, well-ventilated area. Keep container closed when not in use. Store away from incompatible materials (See Section 10 of SDS).

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate ventilation to keep airborne concentrations low.
Exposure Limit of Material: Not applicable.
Respiratory Protection: Use an appropriate NIOSH-approved respirator, only if mist is generated.
Skin Protection: Impervious clothing. Impervious gloves.
Eyes: Chemical goggles.
Other: Not applicable.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State: Liquid
Odour: Slight
Odour Threshold: Not available
pH: 7.0 - 9.0
Specific Gravity: 0.97 - 1.07
Solubility: Not available
Viscosity: Not available
Partition Coefficient: Not available
Autoignition Temperature: Not available
Decomposition Temperature: Not available
Colour: Light amber
Boiling Point (Range): Not available
Freezing/Melting Point: Not available
Flash Point: Not available
Vapour Pressure: Not available
Vapour Density: Not available
Evaporation Rate: Not available
Flammability: Not available
Lower Flammable Limits (%): Not available
Upper Flammable Limits (%): Not available

10. STABILITY AND REACTIVITY

Reactivity: Not available.
Stability: Stable.
Possibility of Hazardous Reactions: Hazardous polymerization will not occur.
Conditions to avoid: Temperatures above 70ºC.
Incompatible Materials: Strong acids. Strong bases. Strong oxidizers.
Hazardous Decomposition Products: No hazardous decomposition if stored and handled correctly.

11. TOXICOLOGICAL INFORMATION

Routes of Exposure: Inhalation, ingestion and absorption.
Eye Contact: May cause irritation/damage.
Skin Contact: May cause irritation.
Inhalation: Not available.
Ingestion: Ingestion of large quantities may cause irritation.
Effects of Chronic Exposure: Not available.
Carcinogenicity of Material: Not listed as an IARC or ACGIH carcinogen.
Reproductive Toxicity/Teratogenicity/Embryotoxicity/Mutagenicity: Not available.
Acute Toxicity Estimates
LC_{50} of Material, Route & Species: Not available.
LD_{50} of Material, Route & Species: For Polyethyleneglycol cocamine >4,000 mg/kg (oral, rat).

12. ECOLOGICAL INFORMATION

Ecotoxicity: Not available.
Persistence and Degradability: Not available.
Bioaccumulative Potential: An accumulation in aquatic organisms is not to be expected.
Mobility in Soil: Not available.
Other Adverse Effects: Not available.

13. DISPOSAL CONSIDERATIONS

Disposal Waste Method: Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Waste generators must consult local hazardous waste regulations to ensure complete and accurate classification.

14. TRANSPORTATION INFORMATION

UN Number: Not applicable.
Shipping Name: Not TDG Regulated.
Hazard Class: Not applicable.
Packing Group: Not applicable.
Marine Pollutant: Not applicable.
Bulk Transport: Not applicable.
Special Precautions: Not applicable.
Note: Protect from freezing. Ship at temperatures above 0ºC.
DOT (U.S.): Not regulated.

15. REGULATORY INFORMATION

Canadian DSL Inventory Status: CAS # 61791-14-8 is listed on Canadian DSL.

Note: None

16. OTHER INFORMATION

Prepared By: Technical Department
Preparation Date of SDS: May 12, 2017

The information on this safety data sheet is based upon data obtained from the manufacturer and technical data. While the information is believed to be accurate, Dynamix Inc. makes no representations as to its accuracy or sufficiency. The information relates to the product as identified, and does not relate to its use in combination with any other material or in any process. Users and handlers of this product should make sure their own investigations to determine the suitability of the information provided herein for their own purposes.

Haviland Products Company

SANBORN HEAD

HAVILAND PRODUCTS COMPANY
SAFETY DATA SHEET

Section 1: Identification

Product Name: Havachrome Mist Eliminator III Product Code:H005797

Haviland Products Company

421 Ann Street NW
Grand Rapids, MI 49504 (616)
361-6691

Emergency Phone
CHEMTREC (800) 424-9300
CHEMTREC International (703) 527-3887

Product Use: NA
Not recommended for: NA

Section 2: Hazard(s) Identification

GHS Ratings:

GHS Hazards

There are no GHS ratings that apply to this product at this time.

GHS Precautions

Section 3: Composition/Information on Ingredients

Chemical Name / CAS No.	OSHA Exposure Limits	ACGIH Exposure Limits	Other Exposure Limits
Ethoxylated coconut oil alkyl amine 61791-14-8 20 to 30%			

Section 4: First-aid Measures

Inhalation
Rescuers should put on appropriate protective gear. Remove from area of exposure. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Keep victim warm. Get immediate medical attention. To prevent aspiration, keep head below knees.

Eye Contact
Immediately flush eyes with water. Flush eyes with water for a minimum of 15 minutes, occasionally lifting and lowering upper lids. Get medical attention promptly.

Skin Contact
Remove contaminated clothing. Wash skin with soap and water. Get medical attention. Wash clothing separately and clean shoes before reuse.

Ingestion
If swallowed, do NOT induce vomiting. Give victim a glass of water. Call a physician or poison control center immediately. Never give anything by mouth to an unconscious person.

Section 5: Fire-fighting Measures

Extinguishing Media
Use mediat suitable for the surrounding fire.

Specific Hazards Arising from the Chemical
None known.

Special Protective Equipment and Precautions for Firefighters
Special Information: As in any fire, wear self-contained breathing apparatus pressure-demand (MSHA/NIOSH approved or equivalent) and full protective gear.

Section 6: Accidental Release Measures

Spill and Leak Procedures
Contain with adsorbent material and dispose. Avoid generation of fumes, aerosols and dust.

Do not allow to enter drains, sewerage system. Cover drains. Collect, bind and pump of spills.

Section 7: Handling and Storage

Handling Procedures
Use with adequate ventilation. Avoid breathing dusts, mists, and vapors. Do not get in eyes, on skin, or on clothing. Wear eye protection and protective clothing. Wash thoroughly after handling.

Storage Requirements
Store containers in a cool, dry, well ventilated place. Keep container closed when not in use.

Section 8: Exposure Control/Personal Protection

Chemical Name / CAS No.	OSHA Exposure Limits	ACGIH Exposure Limits	Other Exposure Limits
Ethoxylated coconut oil alkyl amine 61791-14-8			

ENGINEERING CONTROLS: Provide ventilation sufficient to maintain exposure below the recommended limits.

RESPIRATORY PROTECTION: A respiratory protection program that meets OSHA 1910.134 and ANSI Z88.2 requirements must be followed whenever workplace conditions warrant the use of a respirator.

SKIN PROTECTION: Wear impervious protective gloves. Wear protective gear as needed - apron, suit, boots.

EYE PROTECTION: Wear safety glasses with side shields (or goggles) and a face shield.

OTHER PROTECTIVE EQUIPMENT: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower.

HYGENIC PRACTICES: Do not eat, drink, or smoke in areas where this material is used. Avoid breathing vapors. Remove contaminated clothing and wash before reuse. Wash thoroughly after handling. Wash hands before eating.

Section 9: Physical and Chemical Properties

Appearance: Clear, light yellow solution	**Odor:** Not Available
Vapor Pressure: Not Avaliable	**Odor threshold:** Not Avaliable

Vapor Density: Not Avaliable	**pH:** NA
Density: Not Available	**Melting point:** Not Avaliable
Freezing point: Not Avaliable	**Solubility:** Complete
Boiling range: Not Avaliable	**Flash point:** Not Avaliable
Evaporation rate: Not Avaliable	**Flammability:** Not Avaliable
Explosive Limits: Not Avaliable	**Specific Gravity** 1.018
Autoignition temperature: Not Avaliable	**Decomposition temperature:** Not Avaliable
Viscosity: Not Avaliable	**Grams VOC less water:** Not Avaliable

Section 10: Stability and Reactivity

Chemical Stability:

STABLE

Incompatible Materials

Oxidising agents. Reaction with alkaline or acid.

Conditions to Avoid

None if handled according to information. Protect against temperature of more than 70 °C.

Hazardous Decomposition Products

None if handled according to information. Reaction with alkaline or acid. Not corrosive against steel and iron.

Hazardous Polymerization

Hazardous polymerization will not occur.

Section 11: Toxicology Information

Mixture Toxicity

Routes of Entry:

Inhalation
Ingestion
Skin contact
Eye contact

Target Organs

Effects of Overexposure

CAS Number	Description	% Weight	Carcinogen Rating

Section 12: Ecological Information

Component Ecotoxicity

Section 13: Disposal Considerations

Dispose of in accordance with local, state and federal regulations.

Section 14: Transportation Information

This product is non-regulated for land transport.

Section 15: Regulatory Information

Country	Regulation	All Components Listed

Section 16: Other Information

Date Prepared: 2/15/2019

Disclaimer

The information herein is believed to be correct, but does not claim to be all inclusive and should be used only as a guide. Neither the above named supplier nor any of its affiliates or subsidiaries assumes any liability whatsoever for the accuracy or completeness of the information contained herein. Final determination of suitability of any material is the sole responsibility of the user. All chemical reagents must be handled with the recognition that their chemical, physiological, toxicological, and hazardous properties have not been fully investigated or determined. All chemical reagents should be handled only by individuals who are familiar with their potential hazards and who have been fully trained in proper safety, laboratory, and chemical handling procedures. Although certain hazards are described herein, we can not guarantee that these are the only hazards which exist. Our SDS are based only on data available at the time of shipping and are subject to change without notice as new information is obtained. Avoid long storage periods since the product is subject to degradation with age and may become more dangerous or hazardous. It is the responsibility of the user to request updated SDS for products that are stored for extended periods. Disposal of unused product must be undertaken by qualified personnel who are knowledgeable in all applicable regulations and follow all pertinent safety precautions including the use of appropriate protective equipment (e.g. protective goggles, protective clothing, breathing equipment, face mask, fume hood). For proper handling and disposal, always comply with federal, state and local regulations.

October 4, 2022

Dear Jishnu,

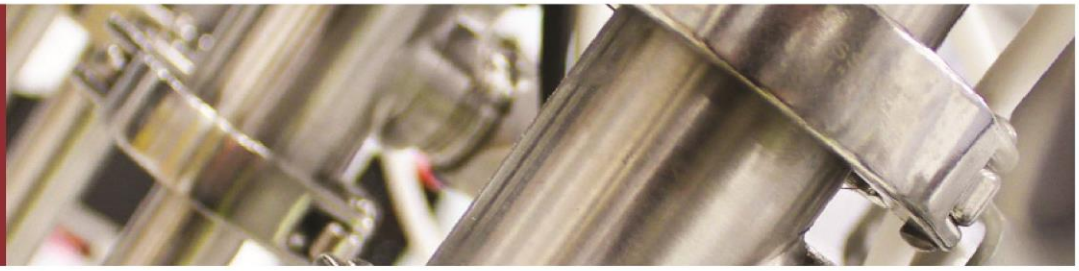
No PFAS/PFOS based materials were intentionally added to the following product(s):

Havachrome Mist Eliminator III (Haviland Product #H005797)

We have no specific data on stability other than it's biologically degradable by chromic acid during application of its intended use.

Sincerely,

Steve Alkema/*Lab Manager*
Haviland Products Company
421 Ann St. N.W. | Grand Rapids, MI 49504
C | 616.293.6621 **W**| 616.365.6533
W| stevea@havilandusa.com



HAVACHROME MIST ELIMINATOR III | Chrome Plating Mist Suppressant

HAVACHROME MIST ELIMINATOR III is a biodegradable fume suppressant used in hexavalent chromium plating solutions to control misting and reduce ventilation requirements. **HAVACHROME MIST ELIMINATOR III** lowers the surface tension to 35 dynes/cm or less, thus substantially lowering drag-out losses as well as reducing the size of escaping bubbles.

FEATURES AND BENEFITS:

- No PFAS/PFOA/PFOS (fluorine-free)
- Biodegradable.
- Does not have a detrimental effect on chrome deposits.
- Reduces danger of contamination of adjacent plating solutions by chromic acid mist.

OPERATING PARAMETERS:

IMPORTANT: This product is a concentrate and requires a 1:5 dilution with water before adding to tank in amounts listed!

Surface Tension (Tensiometer)	Concentration of diluted product
35 dynes/cm	0.1% v/v
25 dynes/cm	0.25% v/v

PROCESS CONTROL:

Parameter	Optimum	Maximum
Temperature	110°F 43°C	130°F 54°C
Surface Tension (Tensiometer)	< 35 dynes/cm	
Surface Tension (Stalagmometer)	< 45 dynes/cm	

Concentration of **HAVACHROME MIST ELIMINATOR III** should be controlled by measurement of the surface tension using a tensiometer or a stalagmometer. A stalagmometer will give different surface tension values that can be up to 10-20 dynes/cm higher than the actual value. Additions should be made based on amp-hours of work processed through the bath. The approximate consumption is 30,000-60,000 amp-hrs/gallon. **HAVACHROME MIST ELIMINATOR III** is best applied with a continuous feed pump attached to an ampere hour meter.

PRODUCTS IN THIS TECHNICAL DATA SHEET:

Product	Product Number
HAVACHROME MIST ELIMINATOR III	H005797

SAFETY INFORMATION:

Follow SDS information for products used in this process.

WASTE DISPOSAL:

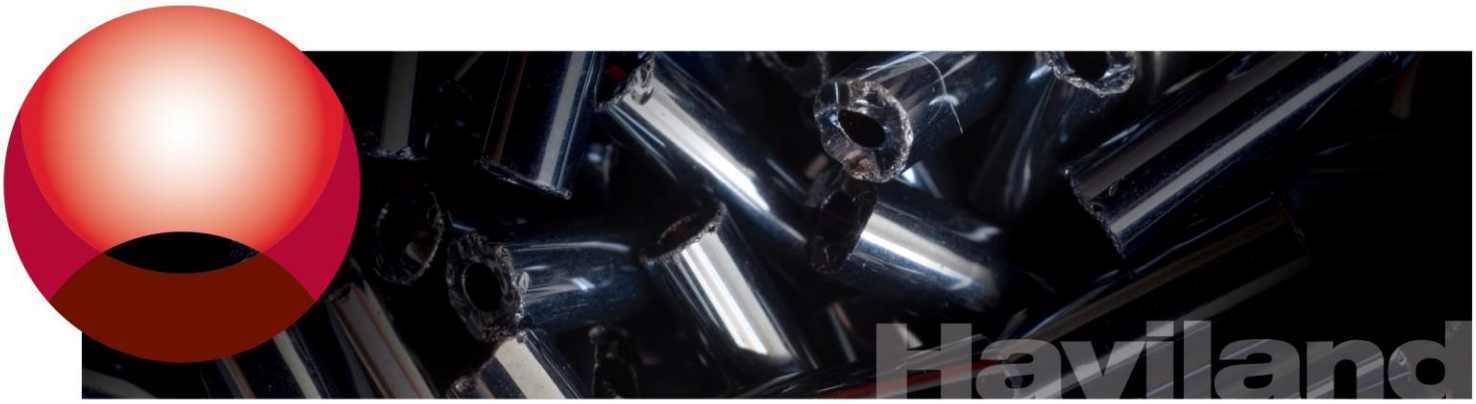
This product is biodegradable.

NON-WARRANTY:

The data contained in this bulletin is believed by HAVILAND PRODUCTS COMPANY to be accurate and complete. Since however, final methods of use of these products are in the hands of the customer beyond our control, we cannot guarantee that the customer will obtain the results described in this bulletin nor can we assume any responsibility for the use of this product by the customer in any process which may infringe the patents of third parties. Follow all federal, state and local requirements.

Haviland Products Company
421 Ann St. N.W. Grand Rapids, MI 49504
800.456.1134 | HavilandUSA.com | chemicalexperts@havilandusa.com

Revision Date: June 08, 2020
Revision: 2
Approval: Rich Held/Ron Kinne



Havachrome Mist Eliminator III - RTU | Chrome plating | H006268

Havachrome Mist Eliminator III is a biodegradable fume suppressant used in hexavalent chromium plating solutions to control misting and reduce ventilation requirements. **Havachrome Mist Eliminator III** lowers the surface tension to 35 dynes/cm or less, thus substantially lowering drag-out losses as well as reducing the size of escaping bubbles.

FEATURES AND BENEFITS

- Fluorine (including PFOS) free.
- Biodegradable.
- Stable in strong oxidizing solutions.
- Does not have a detrimental effect on chrome deposits.
- Reduces danger of contamination of adjacent plating solutions by chromic acid mist.
- Increased life of ventilating and other plating room equipment.

OPERATING PARAMETERS

Surface Tension (Tensiometer)	Concentration
35 dynes/cm	0.1% v/v
25 dynes/cm	0.25% v/v

Parameter	Optimum	Maximum
Temperature (°F)	110	130

REPLENISHMENT

Bath should be controlled by measurement of the surface tension using a tensiometer or a stalagmometer. A stalagmometer will give different surface tension values that can be up to 10-20 dynes/cm higher than the actual value. Additions should be made based on amp-hours of work processed through the bath.

The approximate consumption is 30,000-60,000 amp-hrs/gallon. **Havachrome Mist Eliminator III** is best applied with a continuous feed pump attached to an ampere hour meter.

Tensiometer	<35 dynes/cm
Stalagmometer	<45 dynes/cm

SAFETY INFORMATION

- Follow SDS information for products used in this process.

WASTE DISPOSAL

This product is biodegradable.

NON-WARRANTY

The data contained in this bulletin is believed by HAVILAND PRODUCTS COMPANY to be accurate and complete. Since however, final methods of use of these products are in the hands of the customer beyond our control, we cannot guarantee that the customer will obtain the results described in this bulletin nor can we assume any responsibility for the use of this product by the customer in any process which may infringe the patents of third parties. Follow all federal, state and local requirements.

Haviland Products Company
421 Ann St. N.W. Grand Rapids, MI 49504
800.456.1134 | HavilandUSA.com | chemicalexperts@havilandusa.com
Rev 1.0 Rev Date: 1/11/2019

TIB Chemicals

TIBCHEMICALS

TIB Suract CR-H

Wetting Agent for Chrome Plating baths free of Fluorotensides

Product data

Chemical composition	aqueous formulation, contains surfactants
Delivery form	fluid
Odor	typical
Solubility	easily miscible with water
Color	clear blue-green solution
pH value	3 approx.
Density (20°C = 293 K)	1.0 kg/l approx.

Application

TIB Suract CR-H allows the processing of chrome plating baths without adding any fluorinated compounds e.g. PFOS.

TIB Suract CR-H prevents the build-up of chromic acid fume spray and minimizes the carry-over losses.

TIB Suract CR-H is completely bio-degradable.

TIB Suract CR-H neither contains nor replaces any catalyst.
It is compatible with all usual chrome plating catalyst systems based on either silicofluoride or methanedisulfonate.

Storage

TIB Suract CR-H has a shelf life of min. 12 months, if stored correctly in dry areas and in its original closed packaging at room temperature.

Packaging

Plastic can (25 kg net weight)
IBC (1000 kg net weight)
Special packaging upon request

Special advices for security

Information concerning

- classification and labelling according to the regulations governing transport and hazardous chemicals.
- protective measures for storage and handling
- safety measures in case of accident and fire
- toxicity and ecological effects

is given in our material safety data sheets.

Customs Tariff Number

3824 9950 00

TIB Chemicals AG Mulheimer Strasse 16-22 68219 Mannheim Germany
Telefon +49 621 8901-800 | Moc@tib-chemicals.com | Fax +49 621 8901-1800 | www.tib-chemicals.com

TIB Suract CR-H

Wetting Agent for Chrome Plating baths free of Fluorotensides

TIBCHEMICALS

Directions for Use

TIB Suract CR-H should be added continuously to the chrome plating bath. A proper way is to combine the dosage of the additive with the compensation of the evaporation loss by linking the feed with the automatic leveling of the electrolyte. Furthermore, the electrolyte should be agitated continuously, e.g. by a stirrer. As an alternative, we recommend the use of a pump to circulate the complete electrolyte volume at least once per hour. This way the prediluted **TIB Suract CR-H** can be added advantageously via the pump line.
It is important to avoid any direct dosage of the wetting agent into the anode compartment.

Recommended Working Concentrations

The dosage of **TIB Suract CR-H** is dependent upon the chromic acid concentration of the plating bath as well as its working temperature and the current density. The larger the absolute quantity of the wetting agent employed, the higher the quantity of water required.
Generally, **TIB Suract CR-H** should be diluted the more

- the larger the leeway for replenishment due to evaporation loss,
- the less the chrome plating bath agitated,
- the lower the remaining concentration of fluorotensides in the bath

The dosage of **TIB Suract CR-H** should be adjusted to constantly meet the following criteria:

- The Surface of the chrome plating bath shall be covered completely by a thin foam blanket.
- The surface tension of the electrolyte shall be lower than 30 mN/m sein (ring method).

Examples

(electrolyte volume: 5 m^3, bath surface area: 5 m^2, evaporation loss rate: 75 l/h approx.)

Bathtype:	Bright chrome	Bright chrome	Hard chrome	Black chrome
Bath temperature:	45°C	60°C	60°C	40°C
Chromic acid content:	375 g/l	375 g/l	250 g/l	250 g/l
Consumption of **TIB Suract CR-H**:	65 ml/h	65 ml/h	65 ml/h	65 ml/h

Initial dosage to establish a basic concentration level of the wetting agent:

Content per liter of the dilution:	205.4 ml	81.1 ml	112.5 ml	255.6 ml
Dosage of the dilution:	0.32 l/h	0.80 l/h	0.58 l/h	0.25 l/h
Time to level out:	1.5 h	6.3 h	4.0 h	1.0 h

Further bath control:

Content per liter of the dilution:	32.6 ml	9.5 ml	14.1 ml	47.3 ml
Dosage of the dilution:	2.0 l/h	6.8 l/h	4.6 l/h	1.4 l/h

These figures represent recommendations for operating a well agitated bath equipped with a circulating pump.

TIB Chemicals AG Mulheimer Strasse 16-22 68219 Mannheim Germany
Telefon +49 621 8901-800 | Moc@tib-chemicals.com | Fax +49 621 8901-1800 | www.tib-chemicals.com

TIBCHEMICALS

Safety Data Sheet

Globally Harmonized System (GHS) Rev.6

Printing date 04.10.2022 Version number 18 Revision: 27.09.2022

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

· **1.1 Product identifier**

· **Trade name: TIB SURACT CR-H**

· **Article number:** 206378
· **1.2 Relevant identified uses of the substance or mixture and uses advised against**
No further relevant information available.
· **Application of the substance / the mixture** Electroplating auxiliary

· **1.3 Details of the supplier of the safety data sheet**
· **Manufacturer/Supplier:**
TIB Chemicals AG
Muelheimer Str. 16-22
D-68219 Mannheim/Germany

· **Informing department:**
PRODUKTSERVICE
e-mail: Produktservice@tib-chemicals.com
Mo−Fr 9−15 h: Tel.: +49(0)621 8901 710
· **1.4 Emergency telephone number:** 24 h Tel.: +49 (0) 621 / 8901 - 700

SECTION 2: Hazards identification

· **2.1 Classification of the substance or mixture**
· **Classification according to Regulation (EC) No 1272/2008**
Skin Corr. 3 H316 Causes mild skin irritation.

· **2.2 Label elements**
· **Labelling according to Regulation (EC) No 1272/2008**
The product is classified and labelled according to the CLP regulation.
· **Hazard pictograms** Void
· **Signal word** Warning
· **Hazard statements**
H316 Causes mild skin irritation.
· **Precautionary statements**
P332+P313 If skin irritation occurs: Get medical advice/attention.
· **2.3 Other hazards**
· **Results of PBT and vPvB assessment**
· **PBT:** Not applicable.
· **vPvB:** Not applicable.

SECTION 3: Composition/information on ingredients

· **3.2 Chemical characterisation: Mixtures**
· **Description:** Mixture of the substances listed below and harmless substances.

· **Dangerous components:**		
CAS: 68188-18-1 EINECS: 269-144-1	Paraffin oils, sulfochlorinated, saponified Acute Tox. 4, H302; Skin Irrit. 2, H315; Eye Irritation 2A, H319; Acute Tox. 5, H313; Aquatic Chronic 3, H412	<2.5%

· **Additional information** For the wording of the listed hazard phrases refer to section 16.

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SECTION 4: First aid measures

· **4.1 Description of first aid measures**
· **General information** No special measures required.
· **After inhalation** Supply fresh air; consult doctor in case of symptoms.
· **After skin contact**
Immediately wash with water and soap and rinse thoroughly.
If skin irritation continues, consult a doctor.
· **After eye contact** Rinse opened eye for several minutes under running water.
· **After swallowing** In case of persistent symptoms consult doctor.
· **4.2 Most important symptoms and effects, both acute and delayed**
No further relevant information available.
· **4.3 Indication of any immediate medical attention and special treatment needed**
No further relevant information available.

SECTION 5: Firefighting measures

· **5.1 Extinguishing media**
· **Suitable extinguishing agents**
CO2, extinguishing powder or water spray. Fight larger fires with water spray or alcohol resistant foam.
· **5.2 Special hazards arising from the substance or mixture**
Formation of toxic gases is possible during heating or in case of fire.
- carbon dioxide, carbon monoxide
Sulphur dioxide (SO2)
· **5.3 Advice for firefighters**
· **Protective equipment:** No special measures required.

SECTION 6: Accidental release measures

· **6.1 Personal precautions, protective equipment and emergency procedures** Not required.
· **6.2 Environmental precautions:** Dilute with much water.
· **6.3 Methods and material for containment and cleaning up:**
Absorb with liquid-binding material (sand, diatomite, acid binders, universal binders, sawdust).
Dispose of contaminated material as waste according to item 13.
· **6.4 Reference to other sections** No dangerous materials are released.

SECTION 7: Handling and storage

· **7.1 Precautions for safe handling** No special measures required.
· **Information about protection against explosions and fires:** No special measures required.

· **7.2 Conditions for safe storage, including any incompatibilities**
· **Storage**
· **Requirements to be met by storerooms and containers:** No special requirements.
· **Information about storage in one common storage facility:** Not required.
· **Further information about storage conditions:** None.
· **7.3 Specific end use(s)** No further relevant information available.

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SECTION 8: Exposure controls/personal protection

· **8.1 Control parameters**
· **Additional information about design of technical systems:** No further data; see item 7.
· **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 compilation were used as basis.

· **8.2 Exposure controls**
· **Personal protective equipment**
· **General protective and hygienic measures**
The usual precautionary measures should be adhered to general rules for handling chemicals.
· **Breathing equipment:** Not required.
· **Protection of hands:**
The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation
· **Material of gloves**
The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer. As the product is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application.
· **Penetration time of glove material**
The exact break trough time has to be found out by the manufacturer of the protective gloves and has to be observed.
· **Eye protection:** Safety glasses recommended during refilling.
· **Body protection:** suitable clothing

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SECTION 9: Physical and chemical properties

· **9.1 Information on basic physical and chemical properties**	
· **General Information**	
· **Appearance:**	
Form:	Fluid
Colour:	Clear blue-green solution
· **Odour:**	Characteristic
· **pH-value at 20 °C:**	2.5
· **Change in condition**	
Melting point/freezing point:	0 °C <0 °C
Initial boiling point and boiling range:	>100 °C
· **Flash point:**	Not applicable
· **Decomposition temperature:**	>150 °C
· **Self-inflammability:**	Product is not selfigniting.
· **Explosive properties:**	Product is not explosive.

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· **Explosion limits:**	
Upper:	15.0 Vol %
· **Vapour pressure at 20 °C:**	23 hPa
· **Density at 20 °C:**	1 g/cm³
· **Solubility in / Miscibility with**	
Water:	Fully miscible
· **Partition coefficient: n-octanol/water:**	Not determined.
· **Viscosity:**	
dynamic:	Not determined.
kinematic:	Not determined.
· **Solvent content:**	
Organic solvents:	0.2000 %
Water:	97.8650 %
Solids content:	1.0 %
· **9.2 Other information**	No further relevant information available.

SECTION 10: Stability and reactivity

· **10.1 Reactivity** No further relevant information available.
· **10.2 Chemical stability**
· **Thermal decomposition / conditions to be avoided:**
No decomposition if used according to specifications.
Temperatures > 150 ° C
· **10.3 Possibility of hazardous reactions** No dangerous reactions known
· **10.4 Conditions to avoid** No further relevant information available.
· **10.5 Incompatible materials:** No further relevant information available.
· **10.6 Hazardous decomposition products:**
Carbon monoxide and carbon dioxide
Sulphur oxides (SOx)

SECTION 11: Toxicological information

· **11.1 Information on toxicological effects**
· **Acute toxicity** Based on available data, the classification criteria are not met.

· **LD/LC50 values that are relevant for classification:**		
68188-18-1 Paraffin oils, sulfochlorinated, saponified		
Oral	LD50	1,271 mg/kg (rat) (Acute Oral Toxicity)
Dermal	LD50	>2,000 mg/kg (rat)

· **Primary irritant effect:**
· **Skin corrosion/irritation**
Causes mild skin irritation.
· **Serious eye damage/irritation** Based on available data, the classification criteria are not met.
· **Respiratory or skin sensitisation** Based on available data, the classification criteria are not met.

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· **Additional toxicological information:**
· **CMR effects (carcinogenity, mutagenicity and toxicity for reproduction):**
· **Germ cell mutagenicity** Based on available data, the classification criteria are not met.
· **Carcinogenicity** Based on available data, the classification criteria are not met.
· **Reproductive toxicity** Based on available data, the classification criteria are not met.
· **STOT-single exposure** Based on available data, the classification criteria are not met.
· **STOT-repeated exposure** Based on available data, the classification criteria are not met.

SECTION 12: Ecological information

· **12.1 Toxicity**

· **Aquatic toxicity:**	
68188-18-1 Paraffin oils, sulfochlorinated, saponified	
EC50/24 h	9.48 mg/l (Daphnia magna (water flea)) (Daphnia sp. Acute Immobilisation Test)
EC50/48 h	4.72 mg/l (Daphnia magna (water flea)) (Daphnia sp. Acute Immobilisation Test)
LC50/96 h	4.16 mg/l (Brachydanio rerio (zebrafish)) (Fish, Acute Toxicity Test)
NOEC	96 mg/l (Brachydanio rerio (zebrafish)) (Fish, Acute Toxicity Test)
	48 mg/l (Daphnia magna (water flea)) (Daphnia sp. Acute Immobilisation Test)
EC50 (static)	94 mg/l (Scenedesmus subspicatus (algae)) (Alga, Growth Inhibition Test)

· **12.2 Persistence and degradability** No further relevant information available.
· **12.3 Bioaccumulative potential** No further relevant information available.
· **12.4 Mobility in soil** No further relevant information available.
· **Additional ecological information:**
· **General notes:**
Do not allow undiluted product or large quantities of it to reach ground water, water bodies or sewage system.
· **12.5 Results of PBT and vPvB assessment**
· **PBT:** Not applicable.
· **vPvB:** Not applicable.
· **12.6 Other adverse effects** No further relevant information available.

SECTION 13: Disposal considerations

· **13.1 Waste treatment methods**
· **Recommendation**
Must not be disposed of together with household garbage. Do not allow product to reach sewage system.

· **Uncleaned packagings:**
· **Recommendation:** Disposal must be made according to official regulations.
· **Recommended cleaning agent:** Water, if necessary with cleaning agent.

SECTION 14: Transport information

· **14.1 UN-Number**
· **ADR, ADN, IMDG, IATA** Void

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· **14.2 UN proper shipping name** · **ADR, ADN, IMDG, IATA**	Void
· **14.3 Transport hazard class(es)** · **ADR, ADN, IMDG, IATA** · **Class**	Void
· **14.4 Packing group** · **ADR, IMDG, IATA**	Void
· **14.5 Environmental hazards:** · **Marine pollutant:**	No
· **14.6 Special precautions for user**	Not applicable.
· **14.7 Transport in bulk according to Annex II of Marpol and the IBC Code**	Not applicable.
· **Transport/Additional information:**	Not dangerous according to the above specifications.
· **UN "Model Regulation":**	Void

SECTION 15: Regulatory information

· **15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture**
· **EU regulations/legislation**
· **Regulation (EC) No 1907/2006 (REACH), Annex XIV** not applicable
· **Regulation (EC) No 1907/2006 (REACH), Annex XVII** not applicable

· **Directive 2012/18/EU**
· **Named dangerous substances - ANNEX I** None of the ingredients is listed.

· **National regulations**

· **Decree to be applied in case of technical fault:**

Class	Share in %
NK	0.2

· **Water hazard class:**
Water hazard class 1 (German Regulation) (Self-classification) : slightly hazardous for water
· **Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

SECTION 16: Other information

The information contained herein is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

· **Abbreviations and acronyms:**
RID: Règlement international concernant le transport des marchandises dangereuses par chemin de fer (Regulations Concerning the International Transport of Dangerous Goods by Rail)
ICAO: International Civil Aviation Organisation
ADR: Accord relatif au transport international des marchandises dangereuses par route (European Agreement Concerning the International Carriage of Dangerous Goods by Road)
IMDG: International Maritime Code for Dangerous Goods

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IATA: International Air Transport Association
GHS: Globally Harmonised System of Classification and Labelling of Chemicals
EINECS: European Inventory of Existing Commercial Chemical Substances
ELINCS: European List of Notified Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
LC50: Lethal concentration, 50 percent
LD50: Lethal dose, 50 percent
PBT: Persistent, Bioaccumulative and Toxic
vPvB: very Persistent and very Bioaccumulative
Acute Tox. 4: Acute toxicity – Category 4
Acute Tox. 5: Acute toxicity – Category 5
Skin Irrit. 2: Skin corrosion/irritation – Category 2
Skin Corr. 3: Skin corrosion/irritation – Category 3
Eye Irritation 2A: Serious eye damage/eye irritation – Category 2A
Aquatic Chronic 3: Hazardous to the aquatic environment - long-term aquatic hazard – Category 3

· *** Data compared to the previous version altered.**