

**From:** Adamavich, Steven <Steven.Adamavich@tenneco.com>  
**Sent:** Wednesday, February 26, 2020 9:14 AM  
**To:** Beggs, Tauren R - DNR  
**Cc:** 'mhebert@ectinc.com'; Bauer2, MarkT; Adamavich, Steven  
**Subject:** Response to Closure Not Recommended Letter and PFAS Sample Requirements Letter for Federal-Mogul Powertrain, BRRTS # 02-36-580335  
**Attachments:** Tenneco\_Feb\_2020 Reponse.pdf

Tauren – Attached is the response to your letter dated January 7, 2020. Paper copies were mailed to your attention today. Please contact Mike Hebert or myself with any questions or clarifications that you may have. I look forward to your response.

Steven T. Adamavich  
EH&S Manager – Manitowoc  
H&S Coordinator Rings & Liners Product Line  
Tel: +1 920-686-2272  
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[steven.adamavich@tenneco.com](mailto:steven.adamavich@tenneco.com)



**Please note: Following the acquisition of Federal-Mogul by Tenneco Inc. my email address has changed to [first.lastname@tenneco.com](mailto:first.lastname@tenneco.com). Messages sent to me @federalmogul.com will continue to be delivered for a limited time. Please update my address in your system to ensure your messages will be delivered.**

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**From:** Beggs, Tauren R - DNR <[Tauren.Beggs@wisconsin.gov](mailto:Tauren.Beggs@wisconsin.gov)>  
**Sent:** Tuesday, January 7, 2020 1:30 PM  
**To:** Adamavich, Steven <[Steven.Adamavich@tenneco.com](mailto:Steven.Adamavich@tenneco.com)>  
**Cc:** 'mhebert@ectinc.com' <[mhebert@ectinc.com](mailto:mhebert@ectinc.com)>  
**Subject:** Closure Not Recommended Letter and PFAS Sample Requirements Letter for Federal-Mogul Powertrain, BRRTS # 02-36-580335

Hi Steven,

Attached are the Closure Not Recommended and PFAS Sample Requirements letters for the Federal-Mogul Powertrain site. Paper copies of these letters will be mailed to you. I notified Mike of this on December 20, 2019, who then followed up with you.

Mike, if you would like to further discuss anything in regards to what should be included in the work plan, please let me know.

If you have any questions in regards to these letters, please feel free to contact me.

Regards,

**We are committed to service excellence.**

Visit our survey at <http://dnr.wi.gov/customersurvey> to evaluate how I did.

**Tauren R. Beggs**

Hydrogeologist & Northeast Region Land Recycling Expert  
Remediation and Redevelopment Program  
Wisconsin Department of Natural Resources  
2984 Shawano Ave  
Green Bay, WI 54313  
Phone: (920) 662-5178  
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2318 Waldo Blvd.  
Manitowoc, WI 54220

February 26, 2020

Wisconsin Department of Natural Resources  
Remediation and Redevelopment Program  
Hydrogeologist & Northeast Region Land Recycling Expert  
Attn: Tauren R. Beggs  
2984 Shawano Ave.  
Green Bay, WI 54313

**RE: DNR BRRT Activity #02-36-580335 - Case Closure Request**

Dear Mr. Beggs:

Enclosed you will find our response to your letter dated January 7, 2020. Feel free to contact me with any questions at 920.686.2272. In addition, I would be more than happy to meet with you to discuss the closure request to clarify any concerns you may have.

Sincerely,

Steven T. Adamavich  
EHS Manager Manitowoc  
H&S Coordinator Rings and Liners

Encl: (1) Case Closure Response

February 19, 2020

Wisconsin Department of Natural Resources  
Remediation and Redevelopment Program  
Hydrogeologist & Northeast Region Land Recycling Expert  
Attn: Tauren R. Beggs  
2984 Shawano Ave  
Green Bay, WI 54313

Phone: (920) 662-5178  
Email: [Tauren.Beggs@wisconsin.gov](mailto:Tauren.Beggs@wisconsin.gov)

**Subject:** *January 7, 2020 Case Closure Response  
Federal Mogul Powertrain/Tenneco, 2318 Waldo Boulevard, Manitowoc, WI  
DNR BRRTS Activity # 02-36-580335  
FID # 436039010*

Dear Mr. Beggs,

Pursuant to our review of the State of Wisconsin Department of Natural Resources (WI DNR) January 7, 2020 correspondence (**Attachment No. 1 – WI DNR Case Closure**), Federal Mogul Powertrain/Tenneco (FM/T) and Environmental Consulting & Technology, Inc. (ECT) herein are presenting additional information in response to the judgement rendered. As stated in the submitted Case Closure (former 4400-202 [R8/16]), FM/T removed the former Chromium Plating Line -1 (CR-1) from production during 2016 including the contents of the equipment. During September 2017, FM/T determined that CR-1 would not be put back into production and thereafter began the physical removal of CR-1. The year 2016, therefore, was the last time CR-1 was used in full manufacturing production. **As part of internal procedures, FM/T initiated a voluntary assessment of the area formerly supporting chromium plating operations to ensure/implement due care obligations to protect the environment.**

It is referenced that during the operation of CR-1, FM/T had no reportable losses of production chemicals or equipment failures which could have jeopardized the integrity of the system. Furthermore, as good industrial practices stipulate, FM/T prohibited the installation of equipment or supporting utilities below the primary containment barrier. These practices help ensure that hazardous materials have limited adverse effects to the environment. However, as with all industrial manufacturing, minor drippage can occur at the surface of the primary containment barrier while handling products. While these non-reportable surface losses are minor in nature and contained above the primary containment barrier, as with all production, it is well understood that over time a risk can occur from industrial production. This underlying potential risk is the primary justification for why industrial practices stipulate the following:

- The installation of a secondary barrier(s) to limit any dispersion of any non-reportable spillage, regardless of the volume of those releases. The use of these secondary barrier(s) is not intended to stop a release, but to control dispersion and limit impact potential, should production chemicals be found to exist beyond the primary containment barrier.
- Establishment of a life cycle of the equipment (chromium plating lines ~35 years), and removal of obsolete equipment.

### **Description of the Source of the Release**

During the 35 years of operation, minor drippage has occurred to the surface of the primary containment unit (concrete/metal surface) and the exterior surface of production equipment. General practices require daily water washing of these surfaces and the collecting/treatment/disposal of fluids. These fluids are collected by gravity drainage or recovery in the lower elevations of the surface of the primary containment unit. In the case of CR-1, it is suspected that during the past 35 years of operation, hexavalent chromium leached through the primary containment unit at the point of collection (East End of CR-1). When the equipment associated with CR-1 was removed, inspection of the surface of the primary containment barrier was conducted. While the primary containment barrier was still structurally sound, discoloration was observed. To determine if the chemicals had fully penetrated the concrete barrier, a core of the barrier material was extracted. Visual discoloration was observed through the barrier, and as such, provided the need to conduct a voluntary assessment to determine if hexavalent chromium had penetrated the 10 ft clay secondary barrier. FM/T and ECT accelerated the assessment and targeted in situ treatment methodologies to limit the exposure risk to the environment. Within 90 days of discovery of the release to the secondary containment barrier, aggressive reduction of hexavalent chromium was initiated. Within 270 days – post in situ treatment – a 98.44% reduction was measured, which exceeded the 95% reduction protocol. Furthermore, the treatment chemicals used were projected to remain active for an additional 95 days.

At the request of the WI DNR, groundwater sampling events for four quarters was implemented. No concentrations of hexavalent chromium were reported in the groundwater samples collected as close to the source as reasonably possible. Furthermore, total chromium analyses on the down gradient wells showed no reportable levels above the established method detection limit. Groundwater samples were also collected for pH to verify that surface release of chromic acid had not historically migrated into the non-potable groundwater regime.

A summary of the in-situ treatment and assessments conducted were presented in the submitted case closure documents.

The following sections are provided in direct response to the items listed in the referenced WI DNR January 7, 2020 correspondence concerning the status of the case closure review:

#### **Additional Requirements Needed for Case Closure Under Wis. Admin. Code ch. NR 726**

As noted above, additional work is necessary to meet the requirements for case closure because additional site investigation is needed for chromium, investigation is needed for other applicable metals, volatile organic compounds (VOCs), cyanide, and per- and polyfluoroalkyl substances (PFAS), and no site investigation report or remedial action documentation report was submitted.

#### **Response:**

Efforts were conducted/scheduled pursuant to the 10-12-17 WI DNR Request correspondence (Attachment No. 1) and the submitted Work Plan dated 10-19-17. Efforts defined under the approved Wisconsin Pollutant Discharge Elimination System (WPDES) Wastewater Discharge Permit (WI-0046566-06) for Contaminated Groundwater from Remedial Action Operations (10-19-17), and specifically, Section 6.6 Degradation By Products #7 General Description of Operations, where the post in-situ treatment parameter [hexavalent chromium (Cr VI)] was identified.

Cr VI was selected based upon WI Admin Code §NR716.07, Site Investigation Scoping – Field Investigation as appropriate to the complexity of the site or facility. As such, the following items were considered pursuant to the chemicals formerly used at CR-1:

- History of the site or facility, including industrial, commercial or other land uses that may have been associated with one or more hazardous substance discharges at the the site or facility.
- Knowledge of the type of contamination and the amount of the contaminate.
- History of previous substance discharges or environmental pollution.
- Environmental media potentially affected by the contamination.

#### **Applicable Metals & Cyanide**

Presented in **Attachment No. 2** is the chromic acid "Certification of Analysis" verifying the purity of the solution formerly used in the former CR-1 area, and therefore the lack of other metals present. Also presented in **Attachment No. 2** are copies of the analytical reports for the wastewater discharge prior to treatment. These analytical reports verify the purity of the chromic acid utilized and justification for other applicable metals not being associated with the products used in CR-1 operations.

These documents formally verify that total cyanide was not part of the process associated with CR-1 (cyanide was not used as a surface preparation additive).

**As such, the environment could not be adversely affected by cyanide or other metals from the operation of CR-1.**

#### **Volatile Organic Compounds (VOCs)**

FM/T followed the "*Heigh and Isle Way Plating Process*" at CR-1. The plating process from blasting to the finish of CR-1 plating is herein defined as described by FM/T:

1. Remove arbor from the blaster and place in the water rinse tank and rinse any grit off the rings and arbor.
2. Transfer arbor to the etch tank (preps/cleans the rings before plating)
3. Transfer the arbor to the plating cell to begin the plating process.
4. After plating is complete, transfer the arbor to the three-stage water rinse tanks.
5. After the liquid chrome is rinsed off the arbor, place the arbor in the sander.
6. Once sanding is complete, break down the arbor and place the rings on a work bar.
7. Dip the work bar and rings into a rust inhibitor.
8. Place rings on a transportation cart.

When the order was complete, it was moved out of the CR-1 plating area to the next operation, which included quality assurance/quality control procedures followed by packing.

**No VOCs were used in the operation at CR-1, and as such, the environment could not be adversely affected by VOCs from the operation of CR-1.**

#### **Per- and Polyfluoroalkyl Substances (PFAS)**

ECT and FM/T Plant and National/International Administration staff carefully evaluated this request for PFAS analysis and determined that the first course of action would be to determine if PFAS were ever used in the CR-1 process. FM/T staff retains a well-organized library/record(s) of current and historically utilized chemicals as part of the plant's operating procedures.

Presented in **Attachment No. 3** are the Safety Data Sheets (SDSs) for the following chemicals formerly used in the area which supported CR-1 plating operations:

- Chromic Acid Ultra
- Barium Carbonate
- Chromlift Liquid
- Hocut 797-E
- Econo-Chrome AA-70 Catalyst

The following statement is provided by those FM/T personnel who conducted the library/record(s) review:

*“After reviewing all the present and past SDSs of chemicals used in the CR-1 plating process, we determined we have not used chemicals that contain any PFAS per Section 7321 of the National Defense Authorization Act.”*

FM/T staff also reviewed library/record(s) with respect to the Chemical Added to the Toxics Release Inventory Pursuant to Section 7321 of the National Defense Authorization Act (reference Attachment No. 4) to ensure the review/assessment of the record(s) was complete and without error.

**No PFAS were used in the operation; as such, the environment could not be adversely affected by VOCs from the operation of CR-1.**

Need to Define the Degree and Extent of Contamination

Additional soil and groundwater sampling is needed to define the degree and extent of contamination per Wis. Admin. Code § NR 716.11.

- Soil and groundwater sampling is needed for chromium to define the horizontal and vertical degree and extent.
  - Soil sampling was primarily only done to a depth of six feet in the source area. There were still significant concentrations of chromium at six feet, so vertical extent was not delineated.
  - It is unknown at this time if contaminant migration is impeded by the foundation walls under the building.
  - It is also unknown if groundwater is impacted. A fairly shallow water table is expected at this site and based on the remaining chromium concentrations in soil, groundwater impacts are anticipated. If groundwater contamination is found in the source area, further delineation will be required. Vertical delineation with piezometers may be needed if significant contaminant concentrations in groundwater are detected.
- For appropriate scoping of the site investigation per Wis. Admin. Code § NR 716.07, soil and groundwater sampling also needs to be conducted for other applicable metals, cyanide, and VOCs that may have been used as part of the plating operation to determine if there has been a release of these contaminants. For PFAS sampling requirements, refer to the letter *PFAS Sampling Requirements*, dated January 7, 2019, being sent under separate cover.
  - Groundwater in the source area needs to be assessed to determine if it is impacted. This includes at a minimum installing a permanent monitoring well in the source area to a depth where groundwater is found. Vertical delineation with piezometers may be needed if significant contaminant concentrations in groundwater are detected.
  - A vapor investigation may be needed per Wis. Admin. Code § NR 716.11(5) if VOCs are found to determine whether vapor intrusion is a completed pathway at the site.
- A site investigation report per Wis. Admin. Code § NR 716.15 needs to be submitted when degree and extent of contamination has been fully defined.

A complete remedial action documentation report is also required to be submitted per Wis. Admin. Code § NR 724.15.

**Response:**

On the behalf of FM/T, ECT submitted the following documents to the WI DNR.

- October 17, 2017 - Work Plan defining the initial investigation results
- February 8, 2018 - Post 30-Day In situ Treatment Summary

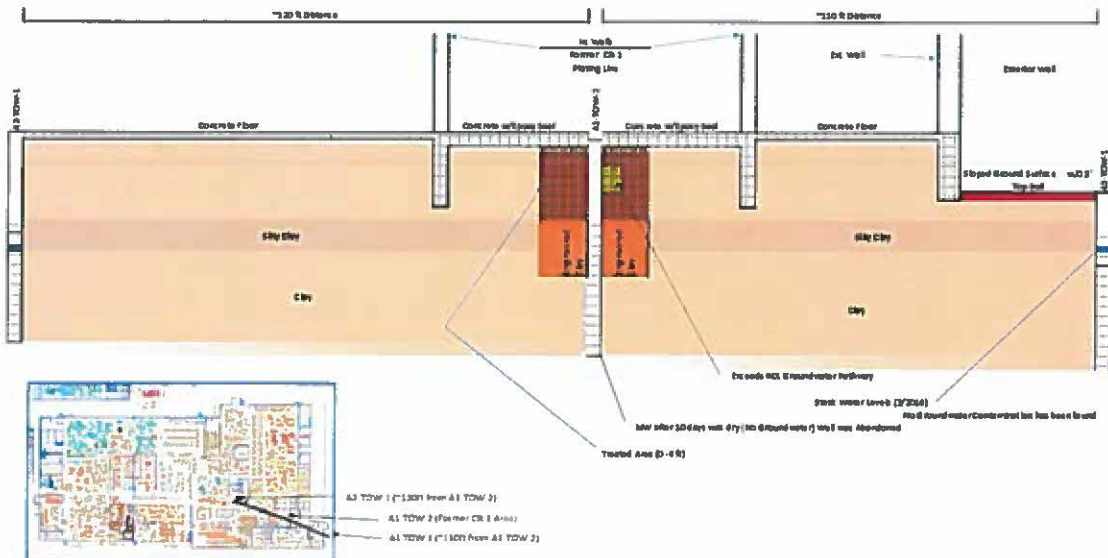
### Vertical Extent of Impact

The 10-19-17 Work Plan defined the vertical extent of impact in the source area at location A-1 TOW-2 @ 8-12 ft. Laboratory data reported hexavalent chromium to be below <2,500 ug/kg. The boring was extended to 16 ft, where the underlying clay could not be penetrated with a 540 MT Geoprobe®. The lithology directly under CR-1 is described herein:

- 100.73 - 100.24 Concrete Ground Cover
- 99.81 - ~99.31 Base Concrete Chromium Plating Line (0.5 ft concrete)
- 99.58 - ~98.74 Medium-grained Sand (0.5 ft sand leveling course)
- 98.74 - ~88.75 Engineered Clay (secondary containment unit)
- 88.24 - ~84.58 Native Silty Clay

During the advancement of A-1 TOW-2 (within the source area), saturation was not identified in the soil boring. A temporary well was still installed in the source area, with a 10 ft well screen set at 6-16 ft and allowed to set for 10 days. After 10 days, no groundwater was identified in the well. As part of the plant's preventative measures, after this 10-day period the well was extracted, and the bore hole was filled with bentonite and capped with concrete.

Shallow groundwater has been identified outside of CR-1 (saturated silty clay at ~6-8 ft below ground level). However, the lack of groundwater in the area formerly supporting CR-1 is related to the position of the engineered clay (0.5-10 ft below ground level), the location where the saturated deposit/seam was removed and replaced with engineered clay. The following detail presented in the case closure document shows the position of the engineered clay with respect to the saturated deposit/seam. As stated, boring A-1 TOW-2 was extended to 6 ft below the engineered clay unit, and as previously defined, the clay under CR-1 does not support groundwater. These clays under CR-1 are acting as an aquiclude. Aquiclude is defined as a formation/geological unit which is impermeable to the flow of water. While the formation/geological unit may contain water captured within its pore-spaces, water is not permitted to flow through them and will not yield water.

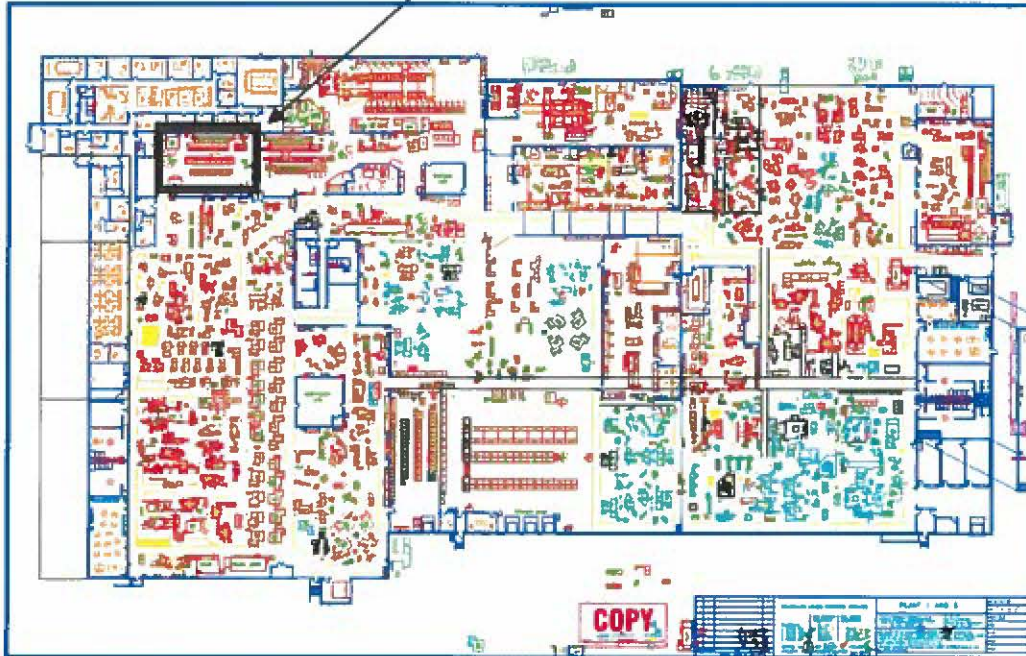




Advancing a boring deeper (below 16 ft) within the source to a potentially lower saturated zone (aquifer) under CR-1 was respectfully considered, but the following constraints prohibit such activities:

- The former CR-1 area is within the manufacturing portion of the plant and access to the area is restricted by exterior and interior building structures.

**Former CR-1 Plant Line Location**



- Floor to truss/roof supporting beams are positioned 11.5 ft above the concrete floor.
- Electrical buss bars/plugs are positioned at ~10 ft above the concrete floor.
- Aisleway access doors measure only 3.25 ft wide.
- The aisleway into the former CR-1 area ranges in width from 3.25 to 5.83 ft.



CR-1 (truss/roof supports) & electrical buss bars/plugs



Exterior doorway/aisleway (exterior to CR-1)

As previously stated, in addition to the physical access constraints, the former CR-1 is positioned in the manufacturing portion of the plant where combustion engines are not permitted to prevent ambient air contamination (workers and product manufacturing QA/QC controls). As such, only the use of electrically powered equipment is permitted. Based upon these constraints, during the site activities ECT used a 540 MT Geoprobe® (largest drilling equipment that could be positioned through the doors/aisleways and still comply with the ambient air quality requirements). The 540 MT Geoprobe® could not be advanced below 16 ft under the controls of an operator with over 20 years of experience. (It should also be noted that the 540 MT Geoprobe® does not have the ability to utilize a 4.25-inch hollow stem auger to install a larger 2-inch monitoring well. This limitation is based upon the hydraulic conditions supporting the 540 MT Geoprobe®.)

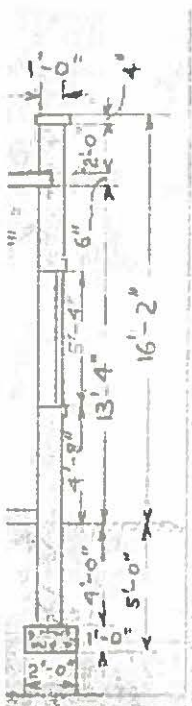
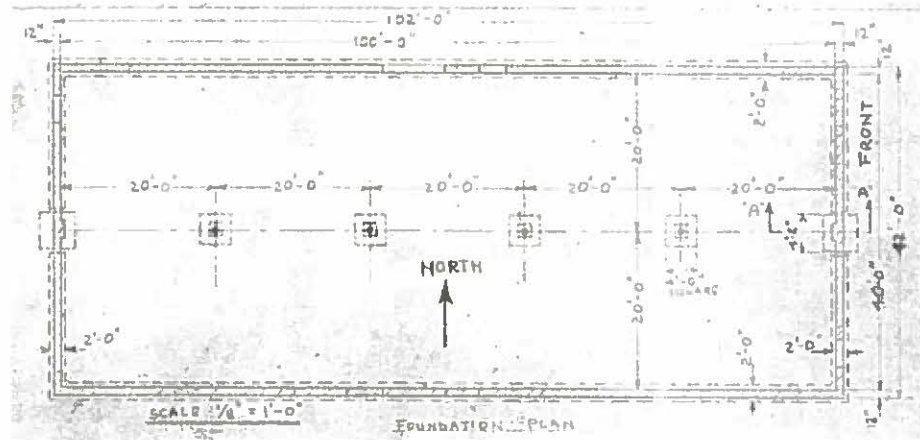
In order to determine if the non-potable aquifer around CR-1 was contaminated, monitoring wells (A-1 TOW-1, EOW-1 and A2-TOW-1) were positioned as close to the former CR-1 area as possible in a triangle pattern under condition of the referenced constraints. Groundwater sampling (four quarters) supported that no detectable level of hexavalent chromium was present in these groundwater samples. As such, the statement can be made (without limitations) that “laboratory data confirms that the non-potable aquifer under the plant in the area formerly supporting CR-1 has not been contaminated with hexavalent chromium”.

#### **Horizontal Extent of Impact**

With respect to the horizontal distribution of hexavalent chromium from the former operation of CR-1, several design controls were initially considered into the system’s location selection. These design controls were implemented at the time of construction not only to prevent a release migrating vertically beyond the clay containment unit (10 ft below the concrete floor), but also to restrict the horizontal distribution/movement of a release should it occur. As such, the selection of the location of the former CR-1 plating line took into consideration the location(s) of existing concrete barriers which would control the horizontal migration of hexavalent chromium, should a release exist in the future.

Secondly, as a mandatory requirement, all utilities in the area of plating operations were installed above the concrete containment barrier (no subsurface utilities were permitted). The restriction on subsurface utilities limits perforations in the concrete barrier and prevents the backfill around subsurface utilities from acting as a potential migration pathway.

The portion of the plant building supporting CR-1 was constructed in 1951; the foundations horizontally encapsulate the entire CR-1 area.

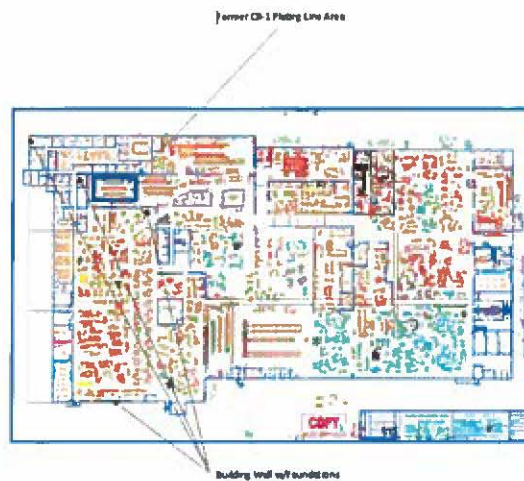


The following wall/foundation cross section shows the 1951 construction of the foundation walls:

- 1 ft concrete common foundation wall (4.5 ft below concrete floor)
- 1 ft concrete common foundation wall (4.16 ft above concrete floor)
- 2 ft concrete spread foundation footer (5.5 ft below concrete floor)

In 1981, when the building was modified to support CR-1, the concrete floor was removed, the secondary barrier was installed, and the primary barrier/concrete floor was installed, elevating the concrete floor to its current level, reducing the area between the floor and the trusses/roofing supporting beams from 13.33 ft to 11.5 ft, or a total of the concrete foundations being 6.83 ft vertically below grade. These foundations are concrete (1 to 2 ft thick) and act as a solid barrier along the exterior/interior walls of the area formerly supporting CR-1.

Furthermore, the plant supports additional foundation between the former CR-1 area and the exterior of the plant's current configuration. All surface water/rain is funneled by roofing drains to the exterior of the plant and discharged to a surface water control system. As such, shallow soils under the former CR-1 are stable and do not have the potential to move without physical destruction of portions of the plant.



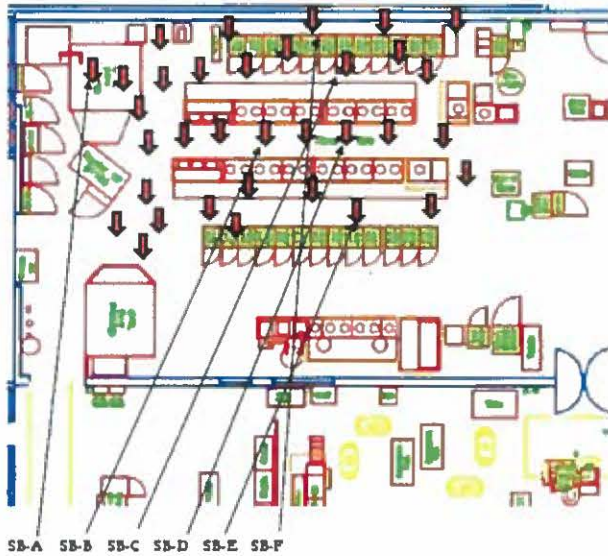
Prior to treatment, the source of the residual hexavalent chromium was defined by A-1 SB-1 through A-1 SB-3, or associated with the easternmost extents of the CR-1 plating line. This finding was expected, considering the primary concrete barriers supporting the plating line used gravity drainage to its lowest elevation (~1.25 ft below the general concrete floor elevation), where daily cleaning water was extracted.



The initial high levels of hexavalent chromium were identified in the 2-4 ft interval, which was expected based upon the depth of the primary containment barrier (~1.25 ft below the general concrete floor elevation). Furthermore, at the time of this initial inspection, the horizontal barriers (concrete foundation walls – minimum 6 ft below ground surface) were known to exist to limit the movement of hexavalent chromium horizontally, along with the presence of the secondary containment areas (engineered clay – minimum of 10 ft below bottom of the primary containment concrete barrier) which were known to have been installed to limit the movement of hexavalent chromium vertically. Based upon these barriers being present:

- Southern distribution of hexavalent chromium was defined as being north of the southern foundation wall by calculating change in concentration(s) of hexavalent chromium from the source area (A-1 SB-1 @ 270,000 ug/kg), decreasing horizontally away from the source area towards the south (SB-3 @ 12,000 ug/kg), with horizontal distance being ~25 ft away or an ~10,320 ug/kg decrease per linear foot.
- Western distribution of hexavalent chromium was defined as being east of the western foundation wall by calculating change in concentration(s) of hexavalent chromium from the source area (A-1 SB-1 @ 270,000 ug/kg), decreasing horizontally away from the source area towards the west (SB-4 @ 8,400 ug/kg), with horizontal distance being ~35 ft away or an ~7,474 ug/kg decrease per linear foot.
- Northern distribution of hexavalent chromium was defined as being south of the northern foundation wall by calculating change in concentration(s) of hexavalent chromium from the source area (A-1 SB-1 @ 270,000 ug/kg), decreasing horizontally away from the source area towards the north (A-1 TOW-2 @ 76,000 ug/kg), with horizontal distance being ~12 ft away or an ~16,166 ug/kg decrease per linear foot.
- Eastern distribution of hexavalent chromium was defined by the laboratory data from A-1 TOW-1, which indicated samples taken from 0-4 ft, 4-8 ft and 8-12 ft as reporting levels below the reported method detection limit.

During the abatement efforts (prior to chemical treatment), soil samples were collected from locations (SB-A through SB-F) to establish baselines and further define the hexavalent chromium pre-treatment levels towards the south.



Laboratory data, for (SB-A @ 2-6 ft and SB-F @ 2-6 ft) further define the horizontal extent of hexavalent chromium towards the south prior to treatment. The remaining data was used to estimate chemical treatment loading.

Boring Location ID	Sample Interval (ft)	Reported Level of Cr VI (mg/Kg)
SB-A	2-6	3.8
SB-B	2-6	84
SB-C	2-6	40
SB-D	2-6	43
SB-E	2-6	28
SB-F	2-6	U

Based upon the density of the clay and the lack of sand directly below the former CR-1 plating line, ECT established a more condensed injection pattern to ensure distribution of treatment chemicals, which resulted in a total of 35 injection locations (■); please reference the diagram above. Furthermore, based upon the clay's density, it is expected that the treatment cycle may take up to one year to convert the hexavalent chromium to trivalent chromium.

As stated in the case closure document, two additional sampling events were conducted to verify the hexavalent chromium was actively decreasing within the secondary containment unit. Also, four quarters of groundwater sampling were conducted around CR-1 which verified that the non-potable aquifer has not been impacted by the operations of CR-1.

Based upon additional information/explanations, FW/T and ECT are requesting the case closure document be reconsidered as showing compliance.

ECT and FM/T appreciates this opportunity to provide additional information and explanation to the WI DNR. Should the WI-DNR request additional information or assessments (where practical) to complete case closure, or if there are suggestions as how to bring this incident to closure, we would respectfully request such data.

Should questions arise regarding this correspondence, please contact our consultant directly at (517) 272-9200.

Sincerely,

**FEDERAL MOGUL CORPORATION/TENNECO**  
**Powertrain (Rings & Liners)**



Steven Adamavich

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Manitowoc, Wisconsin 54220

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**ENVIRONMENTAL CONSULTING & TECHNOLOGY, INC.**



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**ATTACHMENT No. 1**

WI DNR Case Closure (01/07/20)

WI DNR Request (10/12/17)



January 7, 2020

Federal-Mogul Powertrain  
Attn: Steven Adamavich  
2318 Waldo Boulevard  
Manitowoc, WI 54221

Subject: PFAS Sampling Requirements  
Federal – Mogul Powertrain, 2318 Waldo Boulevard, Manitowoc, WI  
BRRTS #: 02-36-580335

Dear Mr. Adamavich:

The Wisconsin Department of Natural Resources (DNR) has identified the Federal – Mogul Powertrain site as a potential source for per- and polyfluoroalkyl substances (PFAS). DNR believes this emerging contaminant may be present in soil and groundwater on your property identified above. The DNR has regulatory authority to ask responsible parties to evaluate hazardous substance discharges and environmental pollution, including emerging contaminants:

- Wis. Stat. § 292.01(3) "Discharge" means, but is not limited to, spilling, leaking, pumping, pouring, emitting, emptying or dumping.
- Wis. Stat. § 292.01 (4) "Environmental pollution" means contaminating ... air, land, or waters of the state or making the same injurious to public health ...
- Wis. Stat. § 292.01(5) "Hazardous substance" means any substance ... which may pose a substantial present or potential hazard to human health or the environment because of its quantity, concentration or physical, chemical or infectious characteristics ...

### Background

This site has been occupied by a chromium plating facility since 1981. An open contamination case with DNR's Remediation and Redevelopment Program titled Federal – Mogul Powertrain is tracked as BRRTS #: 02-36-580335. Soil and groundwater contamination resulted from a hazardous substance discharge of chromium. The use of PFAS have been associated with plating operations in Wisconsin; therefore, this site may be a source of PFAS contamination.

### Site Investigation

Information previously provided for this facility indicates a discharge of hazardous substances from plating activities. As stated above, plating operations have been historically linked to PFAS use and/or manufacture. Site investigation scoping (Wis. Admin. Code § NR 716.07) and the site investigation work plan (Wis. Admin. Code § NR 716.09) require an evaluation of the history of the facility, previous discharges, and uses on the site that may be associated with discharges of hazardous substances.

The DNR has the authority under the Wis. Admin. Code NR 700 series to require the evaluation of PFAS at this site. According to Wis. Admin. Code § NR 716.09, the DNR requires that you submit a site investigation work



January 7, 2020

Page 2 of 2

Mr. Steven Adamavich, Federal-Mogul Powertrain  
PFAS Sampling Requirements  
Federal - Mogul Powertrain, BRRTS # 02-36-580335

plan that includes an assessment of PFAS, and per Wis. Admin. Code § NR 716.07 (4), all environmental media affected or potentially affected by the contamination must be evaluated.

As stipulated in Wis. Admin. Code § NR 716.07 and Wis. Admin. Code § NR 716.09, the work plan should include a written evaluation of potential PFAS compounds that were historically or are presently produced, used, handled, or stored at the site. The evaluation should include any available information on whether any products containing PFAS were utilized in any production process services, the duration of PFAS use, the type of PFAS utilized, and any areas of the site where PFAS may have been used, stored, or discarded. The site investigation work plan must include a groundwater sampling program for evaluating PFAS compounds at the site.

#### Schedule

The DNR is requesting that you submit a site investigation work plan for PFAS by March 6, 2019.

The DNR appreciates your efforts to restore the environment at this site. If you have any questions regarding anything outlined in this letter, or would like to arrange a meeting, please contact me, the DNR Project Manager, at 920-662-5178, or at [Tauren.Beggs@wisconsin.gov](mailto:Tauren.Beggs@wisconsin.gov).

Sincerely,

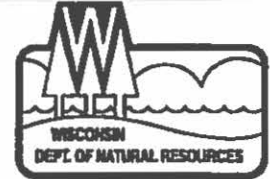


Tauren R. Beggs  
Hydrogeologist  
Remediation & Redevelopment Program

cc: Mike Hebert, ECT, Inc. ([mhebert@ectinc.com](mailto:mhebert@ectinc.com))

State of Wisconsin  
DEPARTMENT OF NATURAL RESOURCES  
2984 Shawano Avenue  
Green Bay WI 54313-6727

Tony Evers, Governor  
Preston D. Cole, Secretary  
Telephone 808-288-2621  
Toll Free 1-888-836-7463  
TTY Access via relay - 711



January 7, 2020

Federal-Mogul Powertrain  
Attn: Steven Adamavich  
2318 Waldo Boulevard  
Manitowoc, WI 54220

**Subject:** Case Closure under Wis. Admin. Code ch. NR 726 Not Recommended  
Federal – Mogul Powertrain, 2318 Waldo Boulevard, Manitowoc, WI  
DNR BRRTS Activity # 02-36-580335  
FID # 436039010

Dear Mr. Adamavich:

On November 21, 2019, the Wisconsin Department of Natural Resources (DNR) reviewed the closure request for the case identified above. As you are aware, the DNR reviews environmental remediation cases for compliance with applicable laws, including Wis. Stat. ch. 292 and Wis. Admin. Code chs. NR 700 – 754 and whether any further threat to public health, safety or welfare or the environment exists at the site or facility, per Wis. Admin. Code § NR 726.13 (2) (b). As discussed with your consultant on December 20, 2019, who then followed up with you, case closure is not recommended because additional legal requirements must be met. The purpose of this letter is to inform you of the remaining requirements for obtaining closure. We request that within 60 days of this letter, you provide us with the information requested or your written response regarding the necessary work and a schedule for completion of this work.

**Additional Requirements Needed for Case Closure Under Wis. Admin. Code ch. NR 726**

As noted above, additional work is necessary to meet the requirements for case closure because additional site investigation is needed for chromium, investigation is needed for other applicable metals, volatile organic compounds (VOCs), cyanide, and per- and polyfluoroalkyl substances (PFAS), and no site investigation report or remedial action documentation report was submitted.

**Need to Define the Degree and Extent of Contamination**

Additional soil and groundwater sampling is needed to define the degree and extent of contamination per Wis. Admin. Code § NR 716.11.

- Soil and groundwater sampling is needed for chromium to define the horizontal and vertical degree and extent.
  - Soil sampling was primarily only done to a depth of six feet in the source area. There were still significant concentrations of chromium at six feet, so vertical extent was not delineated.

January 7, 2020  
Mr. Adamavich, Federal-Mogul Powertrain  
Closure Not Recommended Letter  
Federal – Mogul Powertrain, BRRTS # 02-36-580335

- It is unknown at this time if contaminant migration is impeded by the foundation walls under the building.
- It is also unknown if groundwater is impacted. A fairly shallow water table is expected at this site and based on the remaining chromium concentrations in soil, groundwater impacts are anticipated. If groundwater contamination is found in the source area, further delineation will be required. Vertical delineation with piezometers may be needed if significant contaminant concentrations in groundwater are detected.
- For appropriate scoping of the site investigation per Wis. Admin. Code § NR 716.07, soil and groundwater sampling also needs to be conducted for other applicable metals, cyanide, and VOCs that may have been used as part of the plating operation to determine if there has been a release of these contaminants. For PFAS sampling requirements, refer to the letter *PFAS Sampling Requirements*, dated January 7, 2019, being sent under separate cover.
  - Groundwater in the source area needs to be assessed to determine if it is impacted. This includes at a minimum installing a permanent monitoring well in the source area to a depth where groundwater is found. Vertical delineation with piezometers may be needed if significant contaminant concentrations in groundwater are detected.
  - A vapor investigation may be needed per Wis. Admin. Code § NR 716.11(5) if VOCs are found to determine whether vapor intrusion is a completed pathway at the site.
- A site investigation report per Wis. Admin. Code § NR 716.15 needs to be submitted when degree and extent of contamination has been fully defined.

A complete remedial action documentation report is also required to be submitted per Wis. Admin. Code § NR 724.15.

Depending on what is found during the required additional site investigation, additional soil, groundwater and/or vapor sampling, remedial action, and/or post-remediation sampling within the treatment area may be needed to comply with the closure criteria of Wis. Admin. Code ch. NR 726.

#### **Schedule**

**Within 60 days of the date of this letter, respond in writing with a schedule of your plans to meet these requirements. An additional site investigation workplan needs to be submitted within 60 days per Wis. Admin. Code § NR 716.09(1).**

**Until requirements are met, your site will remain “open” and you are required to submit semi-annual progress reports, per Wis. Admin. Code § NR 700.11. You are also responsible for any operation and maintenance activities required under Wis. Admin. Code § NR 724.13. Once the additional work has been completed, documentation should be submitted to the DNR to demonstrate that the applicable requirements have been met, per the timelines above.**

January 7, 2020  
Mr. Adamavich, Federal-Mogul Powertrain  
Closure Not Recommended Letter  
Federal – Mogul Powertrain, BRRTS # 02-38-580335

**Conclusion**

If you have any questions regarding the information in this letter or would like to schedule a meeting to discuss this case, please contact the DNR project manager, Tauren Beggs at 920-662-5178 or at [Tauren.Beggs@wisconsin.gov](mailto:Tauren.Beggs@wisconsin.gov). For more information on the closure reconsideration process, please see DNR publication, RR-102, "Wis. Admin. Code ch. NR 726 Case Closure Reconsideration Process" by visiting [dnr.wi.gov](http://dnr.wi.gov), search: RR-102, for more information.

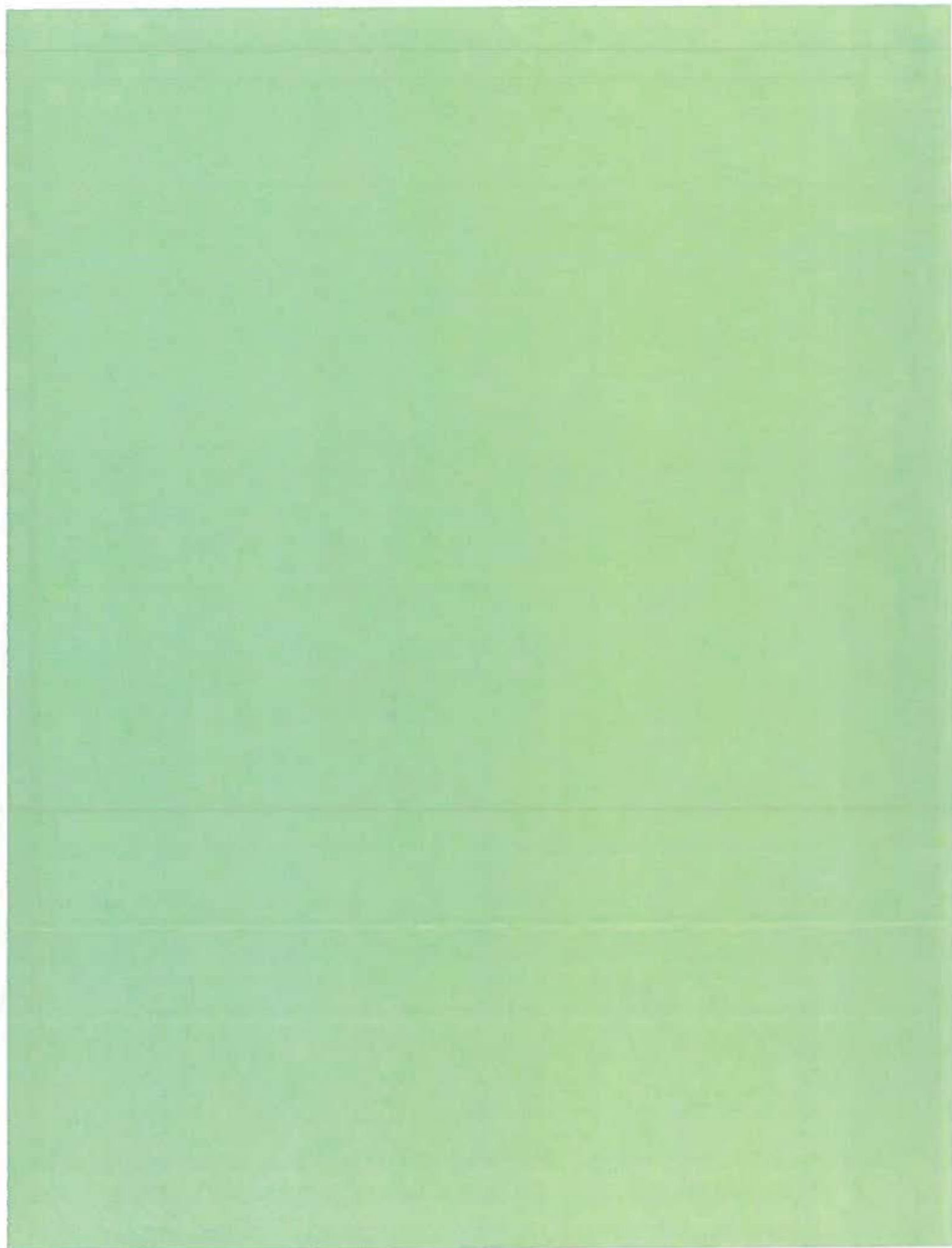
The DNR appreciates your efforts to restore the environment at this site.

Sincerely,



Roxanne N. Chronert  
Team Supervisor, Northeast Region  
Remediation & Redevelopment Program

cc: Mike Hebert, ECT, Inc. ([mhebert@ectinc.com](mailto:mhebert@ectinc.com))



From: Beggs, Tauren R - DNR [<mailto:Tauren.Beggs@wisconsin.gov>]  
Sent: Thursday, October 12, 2017 9:48 AM  
To: Farr, Terry <[Terry.Farr@federalmogul.com](mailto:Terry.Farr@federalmogul.com)>  
Cc: Kleiner, Kathryn <[Kathryn.Kleiner@federalmogul.com](mailto:Kathryn.Kleiner@federalmogul.com)>; Rick, Kevin <[Kevin.Rick@federalmogul.com](mailto:Kevin.Rick@federalmogul.com)>; McKnight, Kevin - DNR <[Kevin.McKnight@wisconsin.gov](mailto:Kevin.McKnight@wisconsin.gov)>  
Subject: Information for Injection Request

This email is from an external source. Only respond to the email, click links or open attachments if you recognize the sender and know the content is safe.

Hi Terry,

It was nice talking to you and Kathryn this morning! I will be getting the responsible party (RP) letter issued for this release as soon as I am able. I talked to Kevin McKnight and he provided me with the applicable documentation that needs to be provided for injection request submittals:

- Work Plan for Injection Request
- Request for WPDES Permit Coverage
- Technical Assistance Form for Other Technical Assistance with \$700 review fee, link to the form: <http://dnr.wi.gov/files/pdf/forms/4400/4400-237.pdf>.

Kevin's contact information:

Kevin McKnight  
Hydrogeologist  
Department of Natural Resources  
625 E. County Rd Y, STE 700  
Oshkosh, WI 54901  
(920) 424-7890  
[Kevin.McKnight@wisconsin.gov](mailto:Kevin.McKnight@wisconsin.gov)

I have provided an example of a typical injection request from another site for your reference and what DNR's template looks like for the injection approval. Hopefully this will assist your consultant on putting this together for your request. If you have any additional questions about the injection request, please contact Kevin. For any other questions, feel free to contact me.

Regards,

**We are committed to service excellence.**

Visit our survey at <http://dnr.wi.gov/customersurvey> to evaluate how I did.

Tauren R. Beggs

Hydrogeologist & Northeast Region Land Recycling Expert  
Remediation and Redevelopment Program  
Wisconsin Department of Natural Resources  
2984 Shawano Ave  
Green Bay, WI 54313  
Phone: (920) 662-5178  
[Tauren.Beggs@wisconsin.gov](mailto:Tauren.Beggs@wisconsin.gov)



**ATTACHMENT No. 2**  
Certification of Analysis  
Wastewater Discharge Analytical Reports



**PLATINGINTERNATIONAL, INC.**  
CHANGING THE WORLD OF PLATING!!!

**Certificate of Analysis**

Product: Chromic Acid Ultra  
Lot Number: 031119  
Date: 3/11/2019



Test	UOM	Results
Chromic Acid Content	%	99.91
Sulfate	%	0.07
Chloride	%	0.005
Insoluble Matter	%	0.005
Sodium (as Na <sub>2</sub> O)	%	0.015



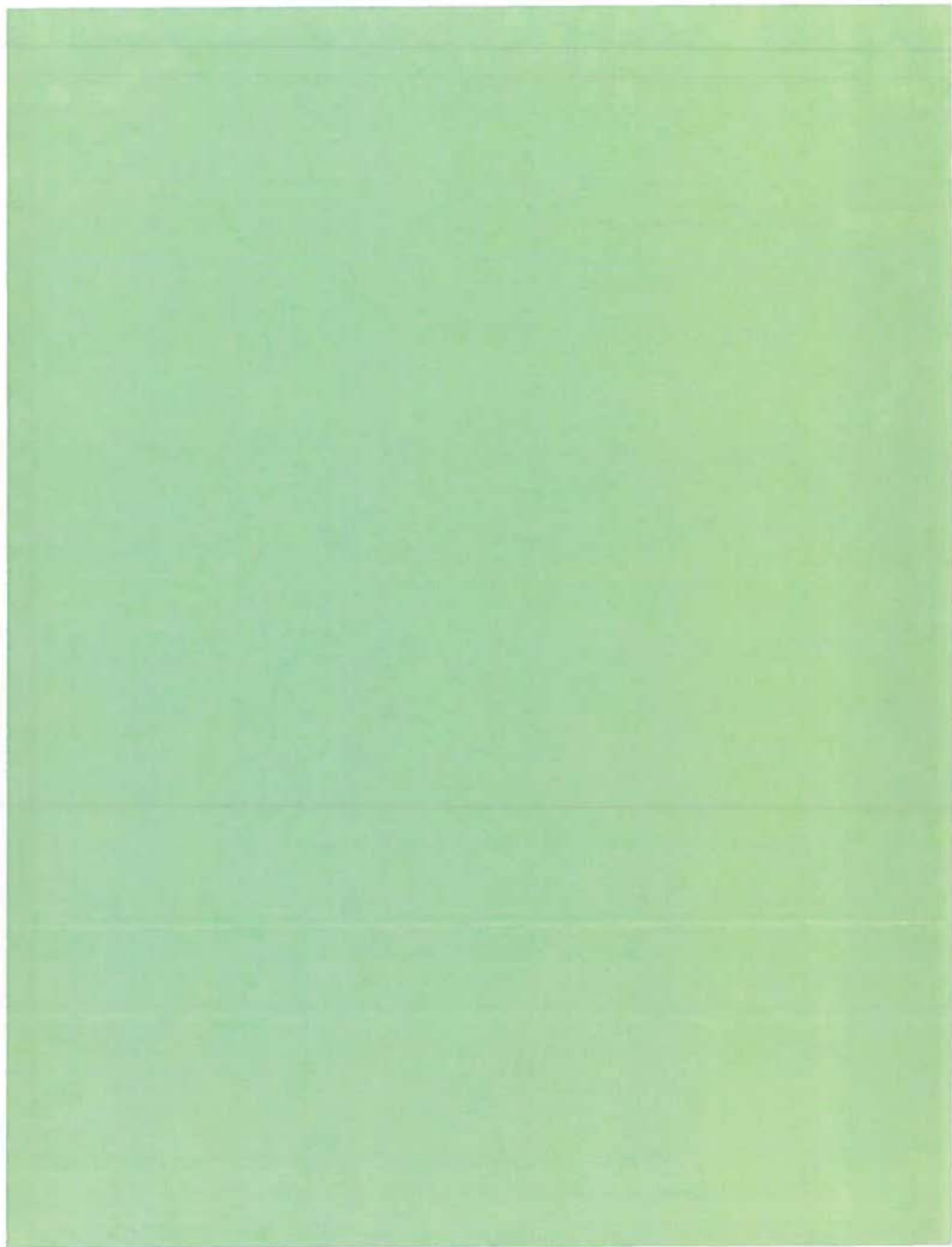


**PLATING INTERNATIONAL, INC.**  
CHANGING THE WORLD OF PLATING!!!

**Certificate of Analysis**

Product: Chromic Acid Ultra  
Lot Number: 051519  
Date: 5/15/2019

Test	UOM	Results
Chromic Acid Content	%	99.92
Sulfate	%	0.06
Chloride	%	0.005
Insoluble Matter	%	0.001
Sodium (as Na <sub>2</sub> O)	%	0.01



# CARDINAL



## ENVIRONMENTAL

3303 Paine Avenue, Sheboygan, WI 53081  
 (920)459-2500 Fax: (920)459-2503  
 www.cardinalenvironmental.com  
 E mail: custserv@cardinalenvironmental.com

Terry Farr  
 Federal Mogul Piston Rings  
 2318 Waldo Boulevard  
 Manitowoc, WI 54221-0910

Batch Number: 58378  
 Report Date: 3/24/2016  
 Date Received: 2/26/2016  
 Project Mgr (PM): FS

Parameter	Result	Units	Dil	LOD	LOQ	Method	Analyst	Date Analyzed
Cardinal Sample Number: 181181			Date Collected: 2/26/2016	Composite				
Sample Description: Plant #1 (2/25-26/16)								
Metals Digestion (Hg)	DONE		PAS			EPA 200.7		3/9/2016
Cadmium	<0.0010	mg/L	PAS 1	0.001	0.005	EPA 200.7		3/10/2016
Chromium	0.21	mg/L	PAS 1	0.0015	0.01	EPA 200.7		3/10/2016
Copper	0.038	mg/L	PAS 1	0.0034	0.01	EPA 200.7		3/10/2016
Lead	0.0065*	mg/L	PAS 1	0.0016	0.012	EPA 200.7		3/10/2016
Mercury	<0.00010	mg/L	PAS 1	0.0001	0.0002	EPA 243.1		3/10/2016
Metal Digestion PAS	DONE		PAS			EPA 200.7		3/9/2016
Molybdenum	0.27	mg/L	PAS 1	0.0025	0.02	EPA 200.7		3/10/2016
Nickel	0.012	mg/L	PAS 1	0.0013	0.01	EPA 200.7		3/10/2016
Silver	<0.0032	mg/L	PAS 1	0.0032	0.01	EPA 200.7		3/10/2016
Zinc	0.11	mg/L	PAS 1	0.0058	0.04	EPA 200.7		3/10/2016
Flow	19,123	gpd				Flow	JLG	2/26/2016
Phosphorus (prep)	DONE					SM 4500 P-B(5)-1999	HDW	3/1/2016
Phosphorus, Total	5.3	mg/L	5	0.13	0.4	SM 4500 P-E-1999	HDW	3/1/2016

Cardinal Sample Number: 181182			Date Collected: 2/26/2016	Grab				
Sample Description: Plant #1								
Cyanide (prep)	DONE					SM 4500 CN-C-1999	AFL	3/3/2016
Cyanide, Total	<0.0048	mg/L	1	0.0048	0.02	SM 4500 CN-E-1999	AFL	3/3/2016
Oil and Grease, (SGT HEM)	<0.83	mg/L	LS 115	0.828	2.6	EPA 1664A	HDW	3/3/2016
pH, Field	7.92	units				SM 4500 H-BF	JLG	2/26/2016
Temperature, Field	8.0	C				SM 2150 B-2000	JLG	2/26/2016

# CARDINAL



ENVIRONMENTAL

3303 Pease Avenue, Sheboygan, WI 53081  
 (920)459-2500 Fax: (920)459-2503  
 www.cardinalenvironmental.com  
 E mail: custserv@cardinalenvironmental.com

Terry Farr  
 Federal Mogul Piston Rings  
 2318 Waldo Boulevard  
 Manitowoc, WI 54221-0910

Batch Number: 62550  
 Report Date: 12/22/2016  
 Date Received: 12/7/2016  
 Project Mgr (PM): JLG

Parameter	Result	Units	Dil	LOD	LOQ	Method	Analyst	Date Analyzed
Cardinal Sample Number: 190182      Date Collected: 12/7/2016      Flow Composite Sample Description:                      Sp #1 (12/6-7/16)								
Metals Digestion (Hg)	Done							12/12/2016
Cadmium	<0.0013	mg/L	PAS 1	0.0013	0.005	EPA 200.7		12/9/2016
Chromium	0.087	mg/L	PAS 1	0.0025	0.01	EPA 200.7		12/9/2016
Copper	0.014*	mg/L	PAS 1	0.0063	0.02	EPA 200.7		12/9/2016
Lead	<0.0043	mg/L	PAS 1	0.0043	0.013	EPA 200.7		12/9/2016
Mercury	<0.00013	mg/L	PAS 1	0.00013	0.00042	EPA 245.1		12/13/2016
Metal Digestion PAS	Done					EPA 200.7		12/9/2016
Molybdenum	0.0061*	mg/L	PAS 1	0.0014	0.01	EPA 200.7		12/9/2016
Nickel	<0.0026	mg/L	PAS 1	0.0026	0.01	EPA 200.7		12/9/2016
Silver	<0.0033	mg/L	PAS 1	0.0033	0.01	EPA 200.7		12/9/2016
Zinc	<0.0093	mg/L	PAS 1	0.0093	0.04	EPA 200.7		12/9/2016
Flow	30,314	gpd				Flow	JLG	12/7/2016
Phosphorus (prep)	Done					M 4500 P-B(5)-1999	AAG	12/14/2016
Phosphorus, Total	0.66	mg/L	1	0.026	0.08	SM 4500 P/E-1999	AAG	12/15/2016

Cardinal Sample Number: 190183      Date Collected: 12/7/2016      Grab Sample Description:                      Sp #1								
Cyanide (prep)	Done					M 4500 CN-C-1999	AFL	12/8/2016
Cyanide, Total	<0.0048	mg/L	1	0.0048	0.02	M 4500 CN-E-1999	AFL	12/8/2016
Oil and Grease, (SGT HEM)	<0.78	mg/L	1.08	0.7776	2.5	EPA 1664A	BAS	12/13/2016
pH, Field	7.12	units				SM 4500 H-BF	JLG	12/7/2016
Temperature, Field	11.3	C				SM 2550 B-2000	JLG	12/7/2016

Cardinal Sample Number: 190184      Date Collected: 12/7/2016      Flow Composite Sample Description:                      Sp #2 (12/6-7/16)								
Metals Digestion (Hg)	Done							12/12/2016

**ATTACHMENT No. 3**

Safety Data Sheets

# MATERIAL SAFETY DATA SHEET

Print date: 23-Feb-2006

Revision Number: 1

## 1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND THE COMPANY/UNDERTAKING

**Product code:** 2200298  
**Product name:** CHROMIC ACID ULTRA  
**Synonyms:** Chromium Trioxide, Chromic Anhydride.  
**Chemical characterisation:** Metal oxide.

<b>Supplier:</b>	ATOTECH USA INC 1750 OVERVIEW DRIVE ROCK HILL, SC 29730 TELEPHONE: 803-817-3500 HOURS: 9:00am - 5:00pm EST	ATOTECH CANADA LTD. 1180 CORPORATE DRIVE BURLINGTON, ONTARIO L7L 5R6 TELEPHONE: 905-332-0111 HOURS: 9:00am - 5:00pm EST
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### Emergency telephone number

SPILLS AND TRANSPORT	CHEMTREC: 800-424-9300 CANUTEC: 613-996-6666
TRANSPORT MEDICAL	ROCKY MOUNTAIN POISON CONTROL CENTER: 303-623-5716

## 2. HAZARDS IDENTIFICATION

**EMERGENCY OVERVIEW**  
DANGER CORROSIVE OXIDIZER TOXIC

This material is considered to be hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200). This material is a controlled product under WHMIS.

### Potential health & environmental effects

**Properties affecting health:** Toxic by inhalation Toxic in contact with skin Also toxic if swallowed The product causes burns of eyes, skin and mucous membranes Possible carcinogen

**Principle routes of exposure:** Respiratory system Skin Gastrointestinal tract Eyes

**Skin contact:** Toxic in contact with skin May cause sensitization by skin contact Large exposures may be fatal Causes severe irritation and burns Corrosive May cause systemic poisoning

**Eye contact:** Corrosive to the eyes and may cause severe damage including blindness

**Inhalation:** Very toxic by inhalation May cause sensitization by inhalation Causes severe irritation and burns Corrosive May cause bronchospasms Can cause ulceration of mucous membranes

**Ingestion:** Causes severe irritation and burns Toxic if swallowed Corrosive Liver and kidney injuries may occur May cause systemic poisoning

**Physico-chemical properties:** Contact with combustible material may cause fire.

**Potential environmental effects:** Dangerous for the environment

## 3. COMPOSITION/INFORMATION ON INGREDIENTS

### INGREDIENTS (BY WEIGHT PERCENT)

Product name: CHROMIC ACID ULTRA

Components	CAS-No	Weight %
Chromium trioxide (CrO3)	1333-82-0	90 - 100

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 regulations and or guidelines. Please refer to other sections of the MSDS for information on safety, health and environmental guidelines and precautions.

#### 4. FIRST AID MEASURES

<b>General advice:</b>	Immediate medical attention is required
<b>Skin contact:</b>	Rinse immediately with plenty of water and seek medical advice Remove and wash contaminated clothing before re-use Immediate medical attention is required
<b>Inhalation:</b>	Move to fresh air Artificial respiration and/or oxygen may be necessary Immediate medical attention is required
<b>Eye contact:</b>	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes Immediate medical attention is required
<b>Ingestion:</b>	Call a physician or Poison Control Center immediately Do not induce vomiting without medical advice Never give anything by mouth to an unconscious person Immediate medical attention is required
<b>Notes to physician:</b>	Overexposure to this product could lead to kidney failure and death It has been reported that there is little value from chelating agents; however death has been avoided in several such cases through the use of early renal dialysis Ascorbic acid by mouth or intravenously has been shown to be effective (converting Chrome VI to Chrome III) in preventing renal tubular failure Skin ulcers may be treated by removal from exposure, daily cleaning, debridement, and application of antibiotic cream and dressing Continue to monitor for respiratory distress for 72 hours
<b>Protection of first-aiders:</b>	Wear personal protective equipment

#### 5. FIRE-FIGHTING MEASURES

<b>Suitable extinguishing media:</b>	Use dry chemical, CO2, water spray or "alcohol" foam Use extinguishing measures that are appropriate to local circumstances and the surrounding environment
<b>Extinguishing media which must not be used for safety reasons:</b>	DO NOT use combustible materials such as sawdust
<b>Special protective equipment for firefighters:</b>	Use personal protective equipment As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA / NIOSH (approved or equivalent) and full protective gear
<b>Specific hazards:</b>	In the event of fire, the following can be released chromium oxides oxygen Oxidizing agent Contact with combustible material may cause fire
<b>Unusual hazards:</b>	Containers may explode when involved in fire Chromic acid reacts strongly with materials which are readily oxidized May sustain a fire involving easily oxidizable material
<b>Specific methods:</b>	Dike and collect water used to fight fire Water mist may be used to cool closed containers Collect contaminated fire extinguishing water separately. This must not be discharged into drains
<b>Flash Point:</b>	NOT APPLICABLE
<b>Flash point test method:</b>	Not applicable.
<b>Autoignition temperature:</b>	Not applicable.
<b>Flammability Limits in Air:</b>	
- Lower:	Not applicable.

Product name: CHROMIC ACID ULTRA

- Upper: Not applicable.

## 6. ACCIDENTAL RELEASE MEASURES

<b>Personal precautions:</b>	Use personal protection recommended in Section 8 Isolate area and deny entry to unauthorized and/or unprotected personnel
<b>Environmental precautions:</b>	Prevent product from entering drains Do not flush into surface water or sanitary sewer system Discharge to a public sewerage authority should coincide with all applicable local permits and notification requirements May be hazardous to aquatic life if released to open waters
<b>Methods for containment:</b>	Prevent further leakage or spillage if safe to do so
<b>Methods for cleaning up:</b>	Avoid dust formation Keep in suitable, closed containers for disposal For a spill involving a solid material, clean up promptly by scoop or vacuum Do not dry sweep Clean spills using wet clean up methods (i.e., misting, etc.) or with a HEPA vacuum Dike spilled liquid material with suitable inert absorbent (ex: sand, soil, vermiculite) and place in a clean dry container for later recycle or disposal Dispose of in accordance with all local, state, provincial, and federal regulations Run off water may be corrosive and / or toxic Spills should be cleaned up immediately to prevent dispersion of airborne mists and dusts

## 7. HANDLING AND STORAGE

### Handling

<b>Technical measures/precautions:</b>	Use only in area provided with appropriate exhaust ventilation
<b>Safe handling advice:</b>	Avoid dust formation Keep away from combustible material Do not breathe vapors/dust Remove and wash contaminated clothing before re-use Handle in accordance with good industrial hygiene and safety practice Do not ingest Do not contact with skin, eyes, or clothing

### Storage

<b>Technical measures/storage conditions:</b>	Keep tightly closed in a dry, cool and well-ventilated place Store away from ignition sources, combustible, organic, or other readily oxidizable materials
<b>Incompatible products:</b>	Corrosive in contact with metals Combustible, organic, other readily oxidizable materials
<b>Shelf Life (days):</b>	730

## 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

**Engineering measures to reduce exposure:**  
Ensure adequate ventilation, especially in confined areas

### Personal Protective Equipment

<b>Respiratory protection:</b>	Use NIOSH approved respiratory equipment when airborne concentrations are equal to or may exceed exposure limits For emergency or other conditions where exposure levels are not known or may be uncontrolled, use a positive pressure air-supplied or self-contained breathing apparatus (SCBA)
<b>Hand protection:</b>	Consult glove manufacturer to determine the most suitable chemical resistant glove for user's application. Consideration must be given to durability and permeation resistance
<b>Skin and body protection:</b>	Impervious clothing Usual safety precautions while handling the product will provide adequate protection against this potential effect Chemical resistant apron Boots Consult glove/clothing manufacturer to determine the most suitable chemical resistant glove/clothing for user's application. Consideration must be given to durability and permeation resistance
<b>Eye protection:</b>	Tightly fitting safety goggles Face-shield An emergency eye wash must be readily accessible to the work area



Product name: CHROMIC ACID ULTRA

**Hygiene measures:**

Avoid contact with skin, eyes and clothing Handle in accordance with good industrial hygiene and safety practice Wash hands before breaks and immediately after handling the product Wear suitable gloves and eye/face protection



Exposure limits	ACGIH			OSHA			NIOSH			
	Components	TWA	STEL	Ceilings	TWA	STEL	Ceilings	TWA	STEL	Ceilings
Chromium trioxide (CrO3) 1333-82-0	0.05 mg/m <sup>3</sup>			1 mg/m <sup>3</sup>		0.1 mg/m <sup>3</sup>	0.001 mg/m <sup>3</sup>			

**9. PHYSICAL AND CHEMICAL PROPERTIES**

Physical state:	Solid	Color:	Dark red
Odor:	None	Specific gravity:	>1
pH:	<1(1% aqueous solution)	Boiling point:	Not applicable.
Melting point:	384.8°F 196°C	Bulk density:	100 lbs/cf
Evaporation rate:	Not applicable.	Vapor density:	Not applicable.
Vapor pressure:	Not applicable.	VOC content(%):	Not applicable.
Solubility in water:	Complete	Solubility in other solvents:	No information available

Flash Point:	NOT APPLICABLE	Flash point test method:	Not applicable.
Autoignition temperature:	Not applicable.	Decomposition temperature:	384.8°F 196°C

**Explosion limits:**  
- Upper: Not applicable.  
- Lower: Not applicable.

**10. STABILITY AND REACTIVITY**

**Stability:** Stable under recommended storage conditions

**Materials to avoid:** Metals Readily oxidizable or combustible material

**Conditions to avoid:** Extremes of temperature and direct sunlight Keep away from open flames, hot surfaces and sources of ignition Incompatible products

**Hazardous decomposition products:** chromium oxides oxygen

**Polymerization:** None under normal processing

**11. TOXICOLOGICAL INFORMATION**

**Acute toxicity**

**Component Information**

Components	LD50/oral/rat	LC50/inhalation/8h/rat	LD50/dermal/rabbit
Chromium trioxide (CrO3) - 1333-82-0	52 mg/kg	No information available	No information available

**Product Information**

LC50/inhalation/4h/rat = 217 mg/m<sup>3</sup>  
LD50/dermal/rabbit = 57 mg/kg  
LD50/oral/rat = 52 mg/kg

Product name: CHROMIC ACID ULTRA

**Local effects**

- Skin irritation:** Causes burns Toxic in contact with skin Chrome VI penetrates undamaged skin and reduces to Chrome III which forms a skin allergen by combining with proteins or other skin components Corrosive Chrome sores most commonly occur at breaks in the skin, nailroots, creases over knuckles, finger webs, backs of hands, and on forearms Direct contact can cause sensitization, severe burns, and external ulcers (chrome sores) Liver and kidney injuries may occur
- Eye irritation:** Corrosive to the eyes and may cause severe damage including blindness Can cause chronic conjunctival inflammation May cause discoloration of cornea
- Inhalation:** Inhaled corrosive substances can lead to a toxic edema of the lungs Corrosive Causes severe burns May cause bronchiospasms Repeated or prolonged inhalation may cause ulceration and perforation of the nasal septum Can cause ulceration of mucous membranes
- Ingestion:** Toxic if swallowed Ingestion causes burns of the upper digestive and respiratory tracts Harmful or fatal if swallowed Corrosive
- Sensitization:** May cause sensitization by inhalation and skin contact
- Chronic toxicity:** Repeated inhalation of chromic acid causes nasal perforation, skin ulceration, chronic rhinitis, pharyngitis, kidney and liver damage, inflammation of the larynx, changes in the blood and lung cancer Transfer to the eyes from the fingers or droplets in the air can cause chronic conjunctival inflammation and occasionally a brown band in the cornea

**Specific effects**

- Carcinogenic effects:** The National Toxicology Program (NTP) has designated Hexavalent Chromium Compounds as Known Human Carcinogens. The International Agency for Research on Cancer (IARC) has identified Hexavalent Chromium Compounds as Carcinogenic to Humans (group 1). The American Conference of Governmental Industrial Hygienists (ACGIH) has identified Water-Soluble Hexavalent Chromium Compounds as Confirmed Carcinogens
- Mutagenic effects:** No information available
- Reproductive toxicity:** No information available
- Target organ effects:** Kidneys Skin Eyes Liver Respiratory system

**Carcinogens**

Components	NTP:	IARC:	OSHA	ACGIH
Chromium trioxide (CrO3)	Known Carcinogen (Listed under 'Chromium hexavalent compounds')	1	Present	A1 - Confirmed Human Carcinogen

**12. ECOLOGICAL INFORMATION**

**Environmental Hazards**

- Ecotoxicity effects:** Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment Toxic to wildlife and domestic animals
- Aquatic toxicity:** Hexavalent chromium may remain unchanged or change slowly in many natural waters due to the low concentration of reducing matter Hexavalent chrome in water will eventually be reduced to trivalent chrome by organic matter The residence time of chromium in lake water has been estimated to be 4.6 to 18 years
- Mobility:** This product is soluble in water Chromium may be transported from soil through runoff and leaching of water and through aerosol formation. The organic matter present in soil is expected to reduce soluble chromate to insoluble chromic oxide
- Bioaccumulative potential:** Bioaccumulation from soil to above ground parts of plants is unlikely There is no indication of biomagnification along the terrestrial food chain (soil-plant-animal)

Components	Freshwater Algae	Freshwater Fish Species
------------	------------------	-------------------------

Product name: CHROMIC ACID ULTRA

Chromium trioxide (CrO <sub>3</sub> ) - 1333-82-0	96 h LC50 (striped catfish) = 200 mg/L 96 h LC50 (fathead minnow) = 36.2 mg/L 96 h LC50 (rainbow trout) = 7.6 mg/L
---	--

Components	Microtoxicity	Water Flea
Chromium trioxide (CrO <sub>3</sub> ) 1333-82-0		24 h LC50 = 435 µg/L

### 13. DISPOSAL CONSIDERATIONS

**Waste from residues / unused products:** Dispose of in accordance with federal, provincial, state, and local regulations

**Contaminated packaging:** Empty containers should be taken for local recycling, recovery or waste disposal

### 14. TRANSPORT INFORMATION



Not classified as dangerous in the meaning of transport

regulations

#### DOT

**Proper shipping name:** CHROMIUM TRIOXIDE, ANHYDROUS  
**Hazard Class:** 5.1  
**Subsidiary Class::** 8,6.1  
**UN-No:** 1463  
**Packing group:** II  
**DOT RQ (kg):** 4.54  
**Description:** CHROMIUM TRIOXIDE, ANHYDROUS, 5.1(8,6.1), 1463, PGII, (TOXIC)

#### TDG (Canada)

**Proper shipping name:** CHROMIUM TRIOXIDE, ANHYDROUS  
**Hazard Class:** 5.1  
**Subsidiary Class::** 8,6.1  
**UN-No:** 1463  
**Packing group:** II  
**Description:** CHROMIUM TRIOXIDE, ANHYDROUS, 5.1(8,6.1), 1463, PGII, (TOXIC)

#### IMO / IMDG

**Proper shipping name:** CHROMIUM TRIOXIDE, ANHYDROUS  
**Hazard Class:** 5.1  
**Subsidiary Class::** 8,6.1  
**UN-No:** 1463  
**Packing group:** II  
**Description:** CHROMIUM TRIOXIDE, ANHYDROUS, 5.1(8,6.1), 1463, PGII, (TOXIC)

#### IATA

**Proper shipping name:** CHROMIUM TRIOXIDE, ANHYDROUS  
**Hazard Class:** 5.1  
**Subsidiary Class::** 8,6.1  
**UN-No:** 1463  
**Packing group:** II  
**Description:** CHROMIUM TRIOXIDE, ANHYDROUS, 5.1(8,6.1), 1463, PGII, (TOXIC)  
**ERG Code:** 5C

Product name: CHROMIC ACID ULTRA

## 15. REGULATORY INFORMATION

### International Inventories

All of the components in this product are on or exempt from the following inventories:

U.S.A. (TSCA) Canada (DSL/NDL) Europe (EINECS/ELINCS/NLP) Australia (AICS) Korea (ECL) China (IECSC) Japan (ENCS) Philippines (PICCS)

### International Inventory Legend

TSCA: Toxic Substance Control Act

DSL: Domestic Substance List

NDL: Non-Domestic Substance List

EINECS: European Inventory of Existing Commercial Chemical Substances

ELINCS: EU List of Notified Chemical Substances

ECL: Existing Chemicals List aka Existing and Evaluated Chemical Substances

AICS: Inventory of Chemical Substances

ENCS: Existing and New Chemical Substances

PICCS: Philippines Inventory of Chemicals and Chemical Substances

### U.S. Regulations:

#### HAZARDOUS COMPONENTS

Components	CA PROP 65	SARA 302	SARA 313	CERCLA RQ	TSCA 12(b)	CWC	DEA
Chromium trioxide (CrO3)	X		X	5000 lb	X		

### U.S. Regulations Legend

CA PROP 65: California Proposition 65 - Carcinogens List

TSCA 12(b): TSCA Section 12(b) - Export Notification

SARA 302: CERCLA/SARA - Section 302 Extremely Hazardous Substances EPCRA RQs and TPQs

SARA 313: CERCLA/SARA - Section 313 - Emission Reporting

CERCLA RQ: CERCLA/SARA - Hazardous Substances and Their Reportable Quantities

CWC: Chemical Weapons Convention - Annex on Chemicals

DEA LISTED: DEA (Drug Enforcement Administration) - DEA Controlled, Precursors, and / or Essential Chemicals

SARA 311	
Acute Health Hazard	YES
Chronic Health Hazard	YES
Fire Hazard	YES
Sudden Release of Pressure Hazard	NO
Reactive Hazard	NO

### Canada

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

### WHMIS Controlled List

#### HAZARDOUS COMPONENTS

Components	CAS-No	WHMIS Call out threshold
Chromium trioxide (CrO3)	1333-82-0	0.1 %

### WHMIS hazard class:

C Oxidizing materials D1A Very toxic materials D2A Very toxic materials E Corrosive material



## 16. OTHER INFORMATION

**Product name: CHROMIC ACID ULTRA**



**NFPA:** Health: 3 Flammability: 0 Instability: 1 Other data: Oxy

**CAREFULLY READ THE FOLLOWING:** The identification of ingredients in this document meets or exceeds the requirements set forth in 29 CFR, 40 CFR, TDG et al. at the date of publication. Ingredients present in a mixture or solution which are generically identified or not referenced in this document are not regulatorily required to be specifically identified or referenced. The information contained herein should be provided to all those who will use, handle, store, transport, or may otherwise be exposed to this product.

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**Prepared by: H.E.S. Department**

## SAFETY DATA SHEET

# BARIUM CARBONATE

### 1. PRODUCT INFORMATION AND COMPANY IDENTIFICATION

Product Name:	Barium Carbonate
Product Grades:	A, B, C, D Barium Carbonate Granular Barium Carbonate Powder
Chemical Name:	Barium Carbonate
Synonyms:	Barium salt
Molecular Formula:	BaCO <sub>3</sub>
Molecular Weight:	197.3 g/mol
Recommended Use:	<ul style="list-style-type: none"><li>- Use in the manufacturing of other barium substances</li><li>- Use as reactive processing aid (sulfate removal)</li><li>- Glass industry</li><li>- Manufacture of ceramic materials</li><li>- Manufacture of electro-ceramic materials</li><li>- Manufacture of glazes, frits and enamels</li><li>- Use in welding electrode coating</li><li>- Use in the preparation of slurry</li><li>- Manufacture of pyrotechnical products</li><li>- Welding in industrial and professional settings</li></ul>
Company:	Kraft Chemical Company Melrose Park, IL 60160 Phone: 708-345-5200 Fax: 708-345-4005

### 2. HAZARD IDENTIFICATION

#### Emergency Overview:

NFPA : H= 2 F= 0 I= 1 S= None

HMIS: H= 2 F= 0 R= 1 PPE = Supplied by User; dependent on local conditions

Appearance: Powder, pellets

Colour: White

Odour: Odourless

#### Potential Health Effects

Inhalation: May cause irritation of the mucous membranes.

Eye contact: Contact with eyes may cause irritation.

Skin contact: Prolonged skin contact may cause skin irritation.

Ingestion: Acute intoxication by inhalation or ingestion of water soluble barium salts causes vomiting, diarrhoea, convulsive tremors and muscular paralysis.

Risk of convulsions, pulmonary arrest.

Risk of cardiac rhythm alteration, sudden cardiac failure.

Risk of shock.





Revision Date: May 28, 2015

Other toxicity effects      See section 11:      Toxicological Information  
 Environmental Effects:      See section 12:      Ecological Information

### 3. COMPOSITION/INFORMATION ON INGREDIENTS

Barium Carbonate  
 CAS-No:                    513-77-9  
 Concentration:            >= 97.0 %

### 4. FIRST AID MEASURES

Inhalation:                    Move to fresh air.  
                                       If Symptoms Persist, Call A Physician.

Eye Contact:                    Rinse thoroughly with plenty of water, also under the eyelids.  
                                       If eye irritation persists, consult a specialist.

Skin Contact                    Remove and wash contaminated clothing before re-use.  
                                       Wash off with plenty of water.  
                                       If symptoms persist, call a physician.

Ingestion:                      Call a physician immediately.  
                                       Take victim immediately to hospital.  
                                       If swallowed, rinse mouth with water (only if the person is  
                                       conscious).  
                                       Artificial respiration and/or oxygen may be necessary.

Notes to Physician:            Exposure to decomposition products :  
                                       Give to drink 30 grams of sodium sulphate in 250 ml of fresh  
                                       water. Immediate medical attention is required.  
                                       Medical examination necessary even only on suspicion of  
                                       intoxication.

### 5. FIREFIGHTING MEASURES

Suitable Extinguishing  
 Media:                        Use extinguishing measures that are appropriate to local  
                                       circumstances and the surrounding environment.

#### Extinguishing Media Which Shall Not Be Used For Safety Reasons

None.

Special Exposure Hazards  
 in a Fire:                    Not combustible.

Hazardous Decomposition  
 Products:                    Barium oxide  
                                       Other hazardous decomposition products may be formed.

Special Protective  
 Equipment for Firefighters: In the event of fire, wear self-contained breathing apparatus.  
                                       Use personal protective equipment.

### 6. ACCIDENTAL RELEASE MEASURES

#### Personal Precautions, Protective Equipment and Emergency Procedures

Advice For Non-Emergency  
 Personnel: Evacuate personnel to safe areas.





Revision Date: May 28, 2015

**Advice for Emergency****Responders:** Use personal protective equipment.  
Prevent further leakage or spillage.**Environmental Precautions:** Should not be released into the environment.  
Local authorities should be advised if significant spillages cannot be contained.**Containment and Clean Up:** Pick up and transfer to properly labelled containers.  
Keep in suitable, closed containers for disposal.**Reference to Other Sections:** Refer to protective measures listed in sections 7 and 8.**7. HANDLING AND STORAGE****Handling:** Ensure adequate ventilation.  
Avoid contact with skin and eyes.**Storage** Store in original container.  
Keep in a well-ventilated place.  
Keep in a dry place.  
Keep in properly labelled containers.  
Keep container closed.Keep away from Incompatible products.  
Packaging material  
Paper + PE**8. EXPOSURE CONTROLS/PERSONAL PROTECTION****Exposure Limit Values:**

Barium carbonate

US. ACGIH Threshold Limit Values 2009time weighted average = 0.5 mg/m<sup>3</sup>

Remarks: as Ba

US. OSHA Table Z-1-A (29 CFR 1910.1000) 1989time weighted average = 0.5 mg/m<sup>3</sup>

Remarks: as Ba

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) 02 2006Permissible exposure limit = 0.5 mg/m<sup>3</sup>

Remarks: as Ba

US. Tennessee. OELs. Occupational Exposure Limits, Table Z1A 06 2008time weighted average = 0.5 mg/m<sup>3</sup>

Remarks: as Ba

Strontium carbonate

US. ACGIH Threshold Limit Values

Remarks: none established





Barium sulfate: US. ACGIH Threshold Limit Values 12 2010  
time weighted average = 10 mg/m<sup>3</sup>

US. OSHA Table Z-1 Limits For Air Contaminants (29 Cfr 1910.1000) 02 2006  
Permissible exposure limit = 5 mg/m<sup>3</sup>

US. OSHA Table Z-1 Limits For Air Contaminants (29 Cfr 1910.1000) 02 2006  
Permissible exposure limit = 15 mg/m<sup>3</sup>

US. OSHA Table Z-1-A (29 Cfr 1910.1000) 1989  
time weighted average = 5 mg/m<sup>3</sup>

US. OSHA Table Z-1-A (29 CFR 1910.1000) 1989  
time weighted average = 10 mg/m<sup>3</sup>

US. Tennessee. OELs. Occupational Exposure Limits, Table Z1A 06 2008  
time weighted average = 5 mg/m<sup>3</sup>  
Remarks: respirable dust fraction

US. Tennessee. OELs. Occupational Exposure Limits, Table Z1A 06 2008  
time weighted average = 10 mg/m<sup>3</sup>  
Remarks: Total dust

Engineering Controls: Apply technical measures to comply with the occupational exposure limits.

#### Personal Protective Equipment

Respiratory Protection: In case of insufficient ventilation, wear suitable respiratory equipment. Self-contained breathing apparatus (EN 133) Respirator with a dust filter Use only respiratory protection that conforms to international/ national standards. Use NIOSH approved respiratory protection.

Hand Protection: Impervious gloves  
Suitable material: PVC, Neoprene, Natural Rubber

Eye Protection: Dust proof goggles, if dusty.

Skin and Body Protection: Long sleeved clothing

Hygiene Measures: Eye wash bottles or eye wash stations in compliance with applicable standards.  
When using do not eat, drink or smoke.  
Wash hands before breaks and at the end of workday.  
Handle in accordance with good industrial hygiene and safety practice.

### 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: powder, pellets  
Colour: white



Revision Date: May 28, 2015

Odour:	odourless
pH:	5 - 7
Boiling Point/Boiling Range:	Remarks: not applicable, Thermal decomposition
Flash point:	Remarks: not applicable
Flammability:	Remarks: The product is not flammable.
Explosive Properties:	Explosion danger: Remarks: Not explosive
Oxidizing Properties:	Remarks: Non oxidizer
Vapour Pressure:	Remarks: Not applicable
Relative Density / Density:	4.31
Bulk Density:	from 400 - 2,000 kg/m <sup>3</sup>
Solubility(ies):	14 mg/l (Water)
Temperature:	20 °C ( 68 °F )
Partition Coefficient:	n-octanol/water Remarks: not applicable
Vapour Density:	Remarks: not applicable
Evaporation Rate:	Remarks; not applicable
Other data:	Melting point/range : >= 900 °C ( 1,652 °F ) Remarks: Thermal decomposition
Auto-flammability:	Remarks: not applicable
Granulometry:	2.32 - 14.6 µm (powder) Remarks: d 50
Decomposition Temperature:	1,380 °C ( 2,516 °F )

## 10. STABILITY AND REACTIVITY

Stability:	Stable under recommended storage conditions.
Conditions to Avoid:	None Keep at temperature not exceeding: 1,380 °C ( 2,516 °F )
Materials to Avoid:	Acids
Hazardous Decomposition Products:	Barium oxide, Other hazardous decomposition products may be formed.

## 11. TOXICOLOGICAL INFORMATION

Toxicological Data	
Acute oral toxicity	LD50, rat, < 300 mg/kg (Barium chloride anhydrous) LD50, rat, > 300 mg/kg, Remarks: practically insoluble
Acute Inhalation Toxicity:	LC50, , Remarks: study scientifically unjustified
Acute Dermal Irritation/ Corrosion:	LD50, rat, > 2,000 mg/kg (Barium chloride anhydrous)
Skin Irritation:	rabbit, No skin irritation
Eye Irritation:	rabbit, No eye irritation
Sensitization:	Did not cause sensitization. (Barium chloride anhydrous)



Chronic toxicity:	Inhalable dust, Repeated exposure, rat, Target Organs: cardiovascular system, hematology system, Respiratory system, NOEL: 5.2 mg/m <sup>3</sup> , observed effect  Inhalable dust, NOEL: 1 mg/m <sup>3</sup> , NOAEL Oral, Repeated exposure, rat/mouse, Target Organs: cardiovascular system, hematology system, renal system, adrenal glands, NOEL: 87.8 mg/kg, NOAEL
Carcinogenicity:	Oral, Prolonged exposure, rat/mouse, Animal testing did not show any carcinogenic effects., (Barium chloride anhydrous)
Genetic toxicity in vitro:	in vitro, Animal testing did not show any mutagenic effects. (Barium chloride anhydrous)
Carcinogenicity:	Oral, Prolonged exposure, rat/mouse, Animal testing did not show any carcinogenic effects., (Barium chloride anhydrous)
Reproductive Toxicity:	Effect on fertility, Repeated exposure, Target Organs: Oral, 258 - 290 mg/kg, NOAEL, (Barium chloride anhydrous)
Remarks:	Harmful if swallowed. The toxicity is mainly linked to the barium ion (nervous, cardiovascular, respiratory and gastro-intestinal troubles). Risk of effect on the liver, the cardiovascular system, the hematological system and the adrenals. Irritating to eyes and skin.

## 12. ECOLOGICAL INFORMATION

### Ecotoxicity Effects:

#### Acute toxicity

Remarks: Aquatic toxicity is unlikely due to low solubility.  
Fishes, *Brachydanio rerio*, LC<sub>50</sub>, 96 h, > 152 mg/l (Barium chloride anhydrous)  
Crustaceans, *Daphnia magna*, LC<sub>50</sub>, 48 h, 14.5 mg/l (Barium chloride anhydrous)

#### Chronic Toxicity:

Crustaceans, *Daphnia magna*, EC<sub>50</sub>, 21 Days, 2.9 mg/l  
*Pseudokirchneriella subcapitata* (green algae), growth rate, 72 h, >= 61 mg/l  
Remarks: NOEC  
*Pseudokirchneriella subcapitata* (green algae), EC<sub>50</sub>, growth rate, 72 h, > 100 mg/l

#### Mobility:

Air  
Remarks: mobility as solid aerosols  
Water/soil  
Remarks: low solubility and mobility

#### Persistence and Degradability:

Abiotic Degradation: Water/soil  
Result: slow ionization and cation precipitation in presence of sulfates or carbonates.





Revision Date: May 28, 2015

Bioaccumulative Potential: Biodegradation Remarks: The methods for determining biodegradability are not applicable to inorganic substances.  
Bioconcentration  
Result: potential accumulation of the cation

Other Adverse Effects: No data available

Remarks: Ecological injuries are not known or expected under normal use.  
Persistent product mainly in its inert form.

### 13. DISPOSAL CONSIDERATION

Waste From Residues /  
Unused Products:

In accordance with local and national regulations.  
Use a solution of sodium or magnesium sulphate or possibly a dilute solution of sulphuric acid to form a sulphate precipitate.

Packaging Treatment:

Dispose of wastes in an approved waste disposal facility.  
Containers that cannot be cleaned must be treated as waste.  
Must be incinerated in a suitable incineration plant holding a permit delivered by the competent authorities.

RCRA Hazardous Waste:

Listed RCRA Hazardous Waste (40 CFR 302) - No  
Unlisted RCRA Hazardous Waste (40 CFR 302) - Yes  
D005 (barium containing waste)

### 14. TRANSPORT INFORMATION

Not regulated

### 15. REGULATORY INFORMATION

Inventory Information:

Toxic Substance Control Act List (TSCA)

In compliance with inventory.

Australian Inventory of Chemical Substances (AICS)

In compliance with inventory.

Canadian Domestic Substances List (DSL)

In compliance with inventory.

Korean Existing Chemicals Inventory (KECI (KR))

In compliance with inventory.

EU list of Existing Chemical Substances (EINECS)

In compliance with inventory.

Japanese Existing and New Chemical Substances: (MITI List) (ENCS)

In compliance with inventory.

Inventory of Existing Chemical Substances (China) (IECS)

In compliance with inventory.





Revision Date: May 28, 2015

Philippine Inventory of Chemicals and Chemical Substances (PICCS)

In compliance with inventory.

New Zealand Inventory of Chemicals (NZIOC)

In compliance with inventory.

## Other Regulations:

US. EPA Emergency Planning and Community Right-To-Know Act (EPCRA) SARA Title III Section 302 Extremely Hazardous Substance (40 CFR 355, Appendix A)

Not regulated.

SARA Hazard Designation (SARA 311/312)

Acute Health Hazard: Yes.

US. EPA Emergency Planning and Community Right-To-Know Act (EPCRA) SARA Title III Section 313 Toxic Chemicals (40 CFR 372.65)- Supplier Notification Required

Not regulated.

US. EPA CERCLA Hazardous Substances (40 CFR 302)

Not regulated.

US. New Jersey Worker and Community Right-to-Know Act (New Jersey Statute Annotated Section 34:5A-5)

Yes.

US. Pennsylvania Worker and Community Right-to-Know Law (34 Pa. Code Chap. 301-323)

Yes.

US. California Safe Drinking Water & Toxic Enforcement Act (Proposition 65)

Not regulated.

**16. OTHER INFORMATION**

## Ratings :

NFPA

Health = 2 Flammability = 0 Instability = 1 Special =None

HMIS

Health = 2 Fire = 0 Reactivity = 1 PPE : Supplied by User  
dependent on local conditions

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MATERIAL SAFETY DATA SHEET  
CHROMLIFT LIQUID

SECTION I - IDENTIFICATION

24 HOUR EMERGENCY ASSISTANCE:  
413-452-2000 (EASTERN TIME) 8:00AM-5:00PM  
800-424-9300 (OFF HOURS) CHEMTREC

HMIS HEALTH 3  
HMIS FLAMMABILITY 0  
HMIS REACTIVITY 1  
HMIS PROTECTION X

HEATBATH CORPORATION  
107 FRONT STREET  
INDIAN ORCHARD, MASS. 01151

PREPARED BY: DAVID NAGY  
INFORMATION: 413-452-2000  
DATE REVISED: 12/01/97 REV.01

PRODUCT NAME..... CHROMLIFT LIQUID  
DESCRIPTION..... Chemical product for stripping chromium.  
DOT CLASS: CAUSTIC ALKALI LIQUIDS, N.O.S., (CONTAINS POTASSIUM HYDROXIDE LIQUID), 8, UN 1719, PG II

SECTION II - HAZARDOUS INGREDIENTS

HAZARDOUS COMPONENT	CAS NUMBER	PEL(MG/M3)	TLV(MG/M3)	%
POTASSIUM HYDROXIDE	1310-58-3	N.E.	2.0	20-30

N.E.=NOT ESTABLISHED

N.A.=NOT APPLICABLE

SECTION III - PHYSICAL DATA

BOILING Point(F)..... >212 F      SPECIFIC GRAVITY (H2O=1).... 1.60  
VAPOR PRESSURE (mm Hg).....NIL      MELTING POINT..... N.E.  
VAPOR DENSITY (Air=1)..... N.E.      EVAPORATION RATE.....N.E.  
SOLUBILITY IN H2O..... completely miscible.      PH.....14  
APPEARANCE/ODOR.....odorless, clear liquid.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT..... None.      FLAMMABLE LIMITS.....None.  
LOWER FLAME LIMIT..... N.A.      HIGHER FLAME LIMIT..... N.A.  
IN CASE OF FIRE: Material is nonflammable. Use extinguishing media appropriate to surrounding conditions.  
SPECIAL FIREFIGHTING PROCEDURES: Wear protective clothing.  
UNUSUAL FIRE HAZARDS: Prolonged contact with some metals (i.e. aluminum, tin, zinc etc.) may release flammable hydrogen gas.

SECTION V - REACTIVITY DATA

CHEMICAL STABILITY: STABLE      CONDITIONS TO AVOID: None.  
INCOMPATIBLE MATERIALS: strong acids, chlorinated hydrocarbons, leather, wool, metals such as aluminum, zinc, tin, brass etc.  
DECOMPOSITION PRODUCTS: none.  
HAZARDOUS POLYMERIZATION: WILL NOT OCCUR

SECTION VI - HEALTH HAZARD DATA

ROUTES OF ENTRY: inhalation, ingestion.

MATERIAL SAFETY DATA SHEET  
CHROMLIFT LIQUID

HEALTH HAZARDS (ACUTE,CHRONIC): Contains ALKALI. Causes eye, skin and tissue burns. May cause respiratory tract irritation. May be harmful if swallowed.

CARCINOGENICITY: None. NTP?: No. IARC?: No. OSHA REGULATED?: No.

SYMPTOMS OF EXPOSURE: eye, skin and respiratory tract irritation. eye, skin and tissue burns.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Not known.

FIRST AID: INHALATION: Move victim to fresh air. If not breathing, give artificial respiration. If breathing is difficult,give oxygen. Get medical attention. EYES: Hold eyelids apart and flush with running water for at least 15 minutes. Get medical attention. SKIN: Wash affected area with plenty of water. Remove contaminated clothing. If irritation or burns are present, get medical attention. INGESTION: If conscious, give plenty of water, milk or fruit juice. Do not induce vomiting. Get medical attention.

SECTION VII - PRECAUTIONS/PROCEDURES

IN CASE OF SPILL: Contain spills with inert absorbant. Scoop up into a chemical waste container. Neutralize spill area with dilute acid.

WASTE DISPOSAL METHOD: Neutralize with dilute acid and dispose of in accordance with federal, state and local regulations.

PRECAUTIONS: Wear proper protective clothing when using this product. Use with adequate ventilation. Wash thoroughly after handling. Store away from strong acids. When making a solution, add slowly to water with constant stirring.

OTHER PRECAUTIONS: Emptied containers of this product may contain hazardous vapors and residue. Clean thoroughly before reusing or discarding. Do not use a welding torch to cut container. Do not use for water or food storage.

SECTION VIII - SPECIAL PROTECTION

RESPIRATORY PROTECTION: Use NIOSH/MSHA approved respirator if dust, fumes or vapors are excessive. VENTILATION: maintain below PEL,TLV.

MECHANICAL EXHAUST..... X PROTECTIVE GLOVES: rubber

LOCAL EXHAUST..... X EYE PROTECTION: safety goggles, face shield.

OTHER PROTECTIVE EQUIPMENT..... apron,boots, full cover work clothes.

WORK/HYGIENIC PRACTICES..... wash thoroughly after handling,laundry clothes.

SECT IX -SARA TITLE III INFORMATION

HAZARDOUS COMPONENT	CERCLA RQ LBS.	SECT 302 TPQ LBS.	SECT 313 TOXIC	SECT.311/312 HAZARDS
POTASSIUM HYDROXIDE	1000	N.A.	NO	A,E

A=IMMEDIATE (ACUTE) HEALTH HAZARD

B=DELAYED (CHRONIC) HEALTH HAZARD

C= FIRE HAZARD

D=SUDDEN RELEASE OF PRESSURE HAZARD

E=REACTIVE HAZARD

**Material Safety Data Sheet  
HOCUT 797-E****1. Chemical Product and Company Identification**

Product Name	HOCUT 797-E	CHEMTREC Company Code	HOUH
Company Name	Houghton International Inc. Madison & Van Buren Aves Valley Forge, PA 19482	CHEMTREC Customer Number	10769
Company Name	Houghton Canada Inc. 115 Walker Drive, Unit B Brampton, ON L6T 5P5 Phone: 905-494-3770	FAX	(610) 666-1376
		Customer Service	(888) 459-9844
Website	www.houghtonintl.com	Product Use	Metalworking Fluid
Telephone	(610) 666-4000		
Emergency Phone Number	24 HOUR - (800) 424-9300 or (703) 527-3887 (CHEMTREC)		
Emergency Phone Number - Canada	24 HOUR - 613-996-6666 (CANUTEC)		

**2. Hazardous Ingredients**

Component	Cas No	% by Weight	Hazards
Amine	124-68-5	1-5	TLV: N/E PEL: N/E STEL: N/E Other: Corrosive
Amine Borate	-Mixture-	1-5	TLV: N/E
Mineral Oil	64742-52-5	5-10	TLV: 5 mg/m <sup>3</sup> as oil mist PEL: 5 mg/m <sup>3</sup> as oil mist STEL: 10 mg/m <sup>3</sup> as oil mist Other:

N/E - Not Established; N/A - Not Applicable; Mfr - Manufacturer Recommendation  
TLV, STEL - ACGIH; PEL - OSHA





# Material Safety Data Sheet HOCUT 797-E

## 3. Hazards Identification

Primary Entry Routes	EYES, SKIN, INHALATION
Acute Effects	
Inhalation	INHALATION OF MISTS MAY CAUSE IRRITATION OF THE UPPER RESPIRATORY TRACT.
Eye	MAY CAUSE EYE IRRITATION.
Skin	PROLONGED OR REPEATED SKIN CONTACT MAY CAUSE IRRITATION.
Ingestion	INGESTION MAY CAUSE NAUSEA, VOMITING, DIARRHEA.
Carcinogenicity	THIS PRODUCT DOES NOT CONTAIN ANY COMPONENT REPORTABLE AS A CARCINOGEN UNDER 29 CFR 1910.1200.
Medical Conditions Aggravated by LongTerm Exposure	PRE-EXISTING SKIN AND RESPIRATORY CONDITIONS MAY BE AGGRAVATED BY EXPOSURE.
Chronic Effects	SEE EFFECTS ABOVE.
HMIS:	
Health	1
Flammability	0
Physical Hazard	0

\* Indicates that there may be chronic health effects present

## 4. First Aid Measures

Inhalation	IF INHALED, REMOVE TO A SOURCE OF FRESH AIR.
Eye Contact	FLUSH EYES WITH WATER FOR 15 MINUTES. CONSULT PHYSICIAN.
Skin Contact	WASH SKIN WITH SOAP AND WATER. REMOVE CONTAMINATED CLOTHING AND LAUNDRY BEFORE REUSING.
Ingestion	IF INGESTED, DO NOT INDUCE VOMITING! CONSULT PHYSICIAN.
Note to Physicians	NO SPECIFIC ANTIDOTE KNOWN. BASED ON INDIVIDUAL REACTIONS OF THE PATIENT, THE PHYSICIAN'S JUDGMENT SHOULD BE USED TO CONTROL SYMPTOMS AND CLINICAL CONDITIONS.



# Material Safety Data Sheet HOCUT 797-E

## 4. First Aid Measures - continued

N/A - Not Applicable

## 5. Fire Fighting Measures

Flash Point	N/A
Autoignition Temperature	N/D
LEL	N/D
UEL	N/D
Extinguishing Media	PRODUCT CONTAINS WATER. IF WATER IS REMOVED, USE CARBON DIOXIDE, DRY CHEMICAL OR FOAM.
Unusual Fire or Explosion Hazards	NO UNUSUAL FIRE OR EXPLOSION HAZARDS.
Fire Fighting Instructions	WEAR PROTECTIVE GEAR DURING FIREFIGHTING.
NFPA:	
Health	1
Flammability	0
Reactivity	0
Special	N/A

N/A - Not Applicable; ND - Not Determined; > - Greater Than; < - Less Than

## 6. Accidental Release Measures

Spill or Release Procedures      DILUTE WITH WATER, NEUTRALIZE TO PH 7 WITH DILUTE ACID AND MOP UP THOROUGHLY TO AVOID RESIDUAL SLIPPERINESS.

**Material Safety Data Sheet  
HOCUT 797-E****7. Handling and Storage**

Handling Precautions	AVOID CONTACT WITH STRONG OXIDIZERS. WEAR GOGGLES AND GLOVES WHEN HANDLING NEAT MATERIAL.
Storage Requirements	KEEP AWAY FROM STRONG OXIDIZERS. KEEP CONTAINERS CLOSED WHEN NOT IN USE. IF FROZEN OR EXPOSED TO HIGH AMBIENT TEMPERATURES, RETURN TO ROOM TEMPERATURE AND MIX WELL BEFORE USING.

**8. Exposure Controls/Personal Protection**

Engineering Controls	PROVIDE GENERAL AND/OR LOCAL EXHAUST VENTILATION TO MAINTAIN AIRBORNE CONCENTRATIONS BELOW THE EXPOSURE LIMITS IN SECTION 2.
Personal Protective Equipment	
Eye/Face Protection	WEAR SAFETY GOGGLES OR SAFETY GLASSES WITH SIDE SHIELDS.
Skin Protection	USE RUBBER GLOVES, LONG SLEEVES TO MINIMIZE SKIN CONTACT. USE APRON OR OVERALLS IF SPLASHING IS POSSIBLE.
Respiratory Protection	RESPIRATORY PROTECTION REQUIRED IF APPLICABLE EXPOSURE LIMITS ARE EXCEEDED.
Other	EYEWASH AND SAFETY SHOWER RECOMMENDED.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, or applying cosmetics.

**9. Physical and Chemical Properties**

Appearance	BLUE-GREEN LIQUID	Water Solubility	EMULSIFIES
Odor	MILD OIL-AMINE ODOR	Boiling Point	215°F / 102°C
Vapor Pressure (mmHg)	N/D	Freezing/ Melting Point	N/D
Vapor Density (Air = 1)	N/D	VOC	68 g/L
Specific Gravity (Water = 1)	1.02	VOC Method Used	ASTM E1868-10



# Material Safety Data Sheet HOCUT 797-E

## 9. Physical and Chemical Properties - continued

pH (Neat)	10.0	Evaporation Rate (BuAc = 1)	< 1
pH (Dilution)			
At Percent	5		
pH	9.6		

N/D - Not Determined; N/A - Not Applicable; > - Greater Than; < - Less Than

## 10. Stability and Reactivity

Stability	THIS PRODUCT IS STABLE AT ROOM TEMPERATURE IN CLOSED CONTAINERS UNDER NORMAL STORAGE AND HANDLING CONDITIONS.
Chemical Incompatibilities	AVOID CONTACT WITH STRONG OXIDIZERS.
Hazardous Decomposition Products	THERMAL; OXIDES OF CARBON; TRACE OXIDES OF SULFUR AND NITROGEN.
Hazardous Polymerization	HAZARDOUS POLYMERIZATION WILL NOT OCCUR.

## 11. Toxicological Information

NO DATA AVAILABLE

## 12. Ecological Information

NO DATA AVAILABLE

## 13. Disposal Considerations

Disposal	FOLLOW PERTINENT REGULATIONS FOR DISPOSAL. IT IS THE RESPONSIBILITY OF THE PRODUCT USER TO DETERMINE, AT THE TIME OF DISPOSAL, WHETHER A MATERIAL CONTAINING THE PRODUCT OR DERIVED FROM THE PRODUCT SHOULD BE CLASSIFIED AS A HAZARDOUS WASTE. (40 CFR 261.20-24)
RCRA Hazardous Waste Number	N/A

**Material Safety Data Sheet  
HOCUT 797-E****14. Transportation Information**

Proper Shipping Name NOT HAZARDOUS UNDER DOT, AIR OR IMO REGULATIONS.  
TDG NOT REGULATED UNDER THE CANADIAN TRANSPORTATION OF DANGEROUS GOODS REGULATION.

**15. Regulatory Information**

TSCA Section 8(b) ALL OF THE COMPONENTS IN THIS PRODUCT ARE ON THE TSCA INVENTORY.

DSL ALL OF THE COMPONENTS IN THIS PRODUCT ARE ON THE CANADIAN DSL. THIS PRODUCT HAS BEEN CLASSIFIED IN ACCORDANCE WITH THE HAZARD CRITERIA OF THE CPR AND THE MSDS CONTAINS ALL OF THE INFORMATION REQUIRED BY THE CPR.

CERCLA Reportable Quantity NONE

SARA Title III, Section 313 THIS PRODUCT CONTAINS NO TOXIC CHEMICAL SUBJECT TO THE REPORTING REQUIREMENTS OF SECTION 313 OF TITLE III OF THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 AND 40 CFR PART 372.

SCAQMD SCAQMD RULE 1144: THIS PRODUCT CONTAINS VOCS AS DETERMINED BY TEST METHOD ASTM E1868-10 AND CAN ONLY BE USED AS A METAL WORKING FLUID OR AS A DIRECT CONTACT LUBRICANT AT A MAXIMUM CONCENTRATION OF 20% IN CALIFORNIA'S SCAQMD REGION AS PER RULE 1144. VOC CONTENT FOR THIS PRODUCT IS 68 G/L.

Ozone Depleting Substances THIS PRODUCT WAS NOT MANUFACTURED, DOES NOT CONTAIN, AND WAS NOT PACKAGED USING ANY CLASS I OR CLASS II OZONE DEPLETING SUBSTANCE AS DEFINED BY THE CLEAN AIR ACT.

WHMIS D2B

**16. Other Information**

Date of Preparation: 26 January 2012  
Prepared By GARY CARL  
Title MANAGER, PRODUCT SAFETY  
Telephone Number (610) 666-4000



**Material Safety Data Sheet  
HOCUT 797-E**

**16. Other Information - continued**

Disclaimer: The information presented herein has been compiled from sources considered to be dependable and is accurate as of the date issued. However, since data, safety standards, and government regulations are subject to change and the conditions of handling and use are beyond our control, Houghton International makes no warranty regarding the accuracy of such data or its suitability for any purchaser's use or for any consequence of its use. The data in this MSDS relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process. Safe handling and use remains the responsibility of the purchaser and the purchaser has the sole responsibility to determine the suitability of the materials for any use and the manner of use contemplated. Houghton International assumes no responsibility for injury to the recipient or to third persons or for any damage to any property and the recipient assumes all such risks.

PRODUCT NAME: ECONO-CHROME AA-70 CATALYST

MSDS No.: 11737

REVISION: 3

PREPARED BY: DIR OF ENV AFFAIRS ISSUE DATE: 07/01/90 EFFECTIVE DATE: 03/29/00

SECTION A. MATERIAL IDENTIFICATION.

MANUFACTURER: McGEAN-ROHCO, INC.

CHEMTREC:

TELEPHONE #: 800-424-9300  
OR 703-527-3887

2910 HARVARD AVE.  
CLEVELAND OH 44105  
TELEPHONE: 216-441-4900

SECTION B. INGREDIENTS AND HAZARDS.

INGREDIENT: MAGNESIUM SILICA FLUORIDE

*mmj*  
RECEIVED

JUN - 5 2000

10.0 - 15.0%  
CAS NUMBER: 16949-65-8  
EXPOSURE LIMIT: TWA: 2.5mg/CUBIC METER AS FLUORIDE  
SUSPECT CARCINOGEN: NO

SECTION C. PHYSICAL DATA.

APPEARANCE: COLORLESS LIQUID

BOILING POINT: 100C

ODOR: NONE

FREEZING POINT: UK

SPECIFIC GRAVITY: 1.06

VAPOR PRESSURE: AS WATER

pH: 2-3

VAPOR DENSITY: AS WATER

EVAPORATION RATE: <BUTYL ACETATE

% VOLATILE BY VOLUME: NA

SOLUBILITY IN WATER: COMPLETE

SECTION D. FIRE AND EXPLOSION HAZARD DATA.

FLASH POINT: NONE

HAZARD SYMBOL CODES

TEST METHOD: NA

NFPA HMIS

LIMITS: LEL: NA

HEALTH: 2 2

UEL: NA

FLAMMABILITY: 0 0

REACTIVITY: 0 0

SPECIAL:

EXTINGUISHING MEDIA: NOT FLAMMABLE

SPECIAL FIRE FIGHTING SELF-CONTAINED BREATHING APPARATUS AND FULL PROCEDURES: PROTECTIVE GEAR SHOULD BE WORN.

UNUSUAL FIRE OR EXPLOSION HAZARDS: NONE KNOWN

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SECTION E. REACTIVITY DATA.

MATERIAL IS STABLE.  
 HAZARDOUS POLYMERIZATION WILL NOT OCCUR.

CONDITIONS TO AVOID: NA

CHEMICAL INCOMPATIBILITIES: STRONG ALKALIES

HAZARDOUS DECOMPOSITION PRODUCTS: NONE KNOWN

SECTION F. HEALTH HAZARD DATA.

SUMMARY OF RISKS: SARA--ACUTE

MEDICAL CONDITIONS WHICH MAY BE AGGRAVATED BY CONTACT: NONE KNOWN

TARGET ORGANS: SKIN, EYES, UPPER RESPIRATORY TRACT, LUNGS, CN SYSTEM, MUCOUS MEMBRANES.

PRIMARY ENTRY ROUTES: THROUGH CONTACT AND INHALATION OF VAPORS.

ACUTE EFFECTS: CHEMICAL BURNS.

CHRONIC EFFECTS: NONE KNOWN

SIGNS & SYMPTOMS OF OVEREXPOSURE:

EYE CONTACT: STINGING OR BURNING SENSATION.

SKIN CONTACT: STRONG IRRITATION TO BURNING.

INHALATION: IRRITATION OF RESPIRATORY SYSTEM. COUGHING.

INGESTION: STINGING OR BURNING OF MOUTH AND THROAT.



PRODUCT NAME: ECONO-CHROME AA-70 CATALYST

MSDS No.: 11737

REVISION: 3

PREPARED BY: DIR OF ENV AFFAIRS

ISSUE DATE: 07/01/90 EFFECTIVE DATE: 03/29/00

EMERGENCY & FIRST AID PROCEDURES:

EYE CONTACT: FLUSH EYES WITH WATER FOR AT LEAST 15 MINUTES. GET MEDICAL ATTENTION.

SKIN CONTACT: FLUSH WITH WATER. SOAK AREA WITH 0.13% ZEPHIRAN (R) SOLUTION THEN MASSAGE IN 2.5% CALCIUM GLUCONATE GEL INTO THE BURN SITE.

INHALATION: REMOVE TO FRESH AIR.

INGESTION: IF CONSCIOUS, GIVE SEVERAL GLASSES OF MILK OR WATER. DO NOT INDUCE VOMITING. GET MEDICAL ATTENTION.

SECTION G. SPILL, LEAK AND DISPOSAL PROCEDURES.

SPILL/LEAK PROCEDURES: NEUTRALIZE WITH SODA ASH OR LIME. FLUSH AREA WITH WATER. FOLLOW ALL APPLICABLE GOEVRNMENTAL REGULATIONS.

WASTE MANAGEMENT & DISPOSAL PROCEDURES: NEUTRALIZE WITH SODA ASH OR LIME TO WITHIN POTW PH DISCHARGE LIMITS AND SEWER. FOLLOW ALL LOCAL, STATE, AND FEDERAL REGULATIONS.

RCRA # (IF DISPOSED AS RECEIVED): D002

SECTION H. SPECIAL PROTECTION INFORMATION

PERSONAL PROTECTIVE EQUIPMENT:

GOGGLES: CHEMICAL GOGGLES.

GLOVES: RUBBER.

RESPIRATOR: IF TWA IS EXCEEDED, MUST BE NIOSH OR MSHA APPROVED.

OTHER: SUFFICIENT TO PREVENT SKIN CONTACT.

PRODUCT NAME: ECONO-CHROME AA-70 CATALYST

MSDS No.: 11737

REVISION: 3

PREPARED BY: DIR OF ENV AFFAIRS ISSUE DATE:07/01/90 EFFECTIVE DATE: 03/29/00

WORKPLACE CONSIDERATIONS:

VENTILATION: SUFFICIENT TO KEEP BELOW TWA LIMITS.

SAFETY STATIONS: EYE WASH

OTHER: SAFETY SHOWER

SECTION I. SPECIAL PRECAUTIONS.

SPECIAL HANDLING & STORAGE PROCEDURES: NORMAL HANDLING AND STORAGE FOR ACIDS.

D.O.T. CLASS: 8.0

UN REGISTER: UN-3264

IMCO CLASS: 8.0

UN REGISTER: UN-3264

EXPLANATION OF SYMBOLS

NA = NOT APPLICABLE

UK = UNKNOWN

THIS MATERIAL SAFETY DATA SHEET IS OFFERED SOLELY FOR YOUR INFORMATION, CONSIDERATION, AND INVESTIGATION. WHILE THE INFORMATION AND RECOMMENDATIONS SET FORTH HEREIN ARE BELIEVED TO BE ACCURATE AS OF THE DATE HEREOF, McGEAN-ROHCO, INC. MAKES NO WARRANTY WITH RESPECT THERETO AND DISCLAIMS ALL LIABILITY FROM RELIANCE THEREON.

THIS MATERIAL SAFETY DATA SHEET HAS BEEN PREPARED TO COMPLY WITH TITLE 29 CODE OF FEDERAL REGULATIONS, PART 1910.1200, OSHA HAZARD COMMUNICATION STANDARD, AND TO FULFILL THE ANNUAL CHEMICAL NOTIFICATION REQUIREMENTS OF SARA TITLE III, SECTION 313.

**ATTACHMENT No. 4**

**Chemicals Added to the Toxics Release Inventory Pursuant to Section 7321  
of the National Defense Authorization Act**

## Chemicals Added to the Toxics Release Inventory Pursuant to Section 7321 of the National Defense Authorization Act

Section 7321 of the National Defense Authorization Act for Fiscal Year 2020 (P.L. 116-92) (NDAA) added certain Per- and Polyfluoroalkyl Substances (PFAS) to the TRI list of reportable chemicals. Among these added chemicals are chemicals that met two criteria: (1) they were subject to a significant new use rule at either 40 CFR 721.9582 or 721.10536 on or before December 20, 2019; and (2) they were identified as active in commerce on the Toxic Substances Control Act (TSCA) Inventory that was published in February 2019. Chemicals meeting only one of the two criteria were not added to the TRI list.

The names and CASRNs for some of the chemicals listed under 40 CFR 721.9582 and/or 40 CFR 721.10536 are subject to a claim of protection from disclosure. Under Section 7321 of the NDAA, EPA must review any such chemicals before the chemicals are added to the TRI list (NDAA Section 7321(e)). Therefore, the chemicals that are subject to a claim of protection from disclosure will not be added to the EPCRA Section 313 toxic chemical list until EPA completes the process provided by Section 7321(e) of the NDAA.

Via the considerations described above, 158 chemicals were identified. Additionally, the NDAA specifically identified fourteen PFAS for addition to the TRI list. Twelve of these fourteen chemicals were among the chemicals described above; with the addition of the other two, there are a total of 160 PFAS subject to the NDAA.

The chemicals listed in this Excel file have an effective date of January 1, 2020.

CASRN	TRI Chemical Name
307-35-7	Perfluorooctylsulfonyl fluoride
307-55-1	Perfluorododecanoic acid
307-70-0	1-Undecanol, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11-eicosafluoro-
335-66-0	Octanoyl fluoride, pentadecafluoro-
335-67-1	Perfluorooctanoic acid
335-71-7	1-Heptanesulfonyl fluoride, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,7-pentadecafluoro-
335-76-2	Perfluorodecanoic acid
335-95-5	Sodium perfluorooctanoate
355-46-4	Perfluorohexanesulfonic acid
355-50-0	Hexadecane, 1,1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,13,13,14,14,15,15,16,16-tritriacontafluoro-16-iodo-
375-95-1	Perfluorononanoic acid
376-06-7	Perfluorotetradecanoic acid
376-14-7	2-[Ethyl[(heptadecafluorooctyl)sulfonyl]amino]ethyl methacrylate
376-27-2	Methyl perfluorooctanoate

383-07-3	2-[Butyl[(heptadecafluorooctyl)sulfonyl]amino]ethyl acrylate
423-62-1	Decane, 1,1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10-heneicosafuoro-10-iodo-
423-82-5	2-[Ethyl[(heptadecafluorooctyl)sulfonyl]amino]ethyl acrylate
507-63-1	Octane, 1,1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8-heptadecafluoro-8-iodo-
678-39-7	1-Decanol, 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-heptadecafluoro-
865-86-1	1-Dodecanol, 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,12-heneicosafuoro-
1652-63-7	3-[[Heptadecafluorooctyl)sulfonyl]amino]-N,N,N-trimethyl-1-propanaminium iodide
1691-99-2	N-Ethyl-N-(2-hydroxyethyl)perfluorooctanesulfonamide
1763-23-1	Perfluorooctane sulfonic acid
1996-88-9	2-Propenoic acid, 2-methyl-, 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-heptadecafluorodecyl ester
2043-53-0	Decane, 1,1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8-heptadecafluoro-10-iodo-
2043-54-1	Dodecane, 1,1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10-heneicosafuoro-12-iodo-
2144-53-8	2-Propenoic acid, 2-methyl-, 3,3,4,4,5,5,6,6,7,7,8,8,8-tridecafluorooctyl ester
2144-54-9	2-Propenoic acid, 2-methyl-, 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,12-heneicosafuorododecyl ester
2263-09-4	1-Octanesulfonamide, N-butyl-1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-N-(2-hydroxyethyl)-
2795-39-3	Potassium perfluorooctanesulfonate
2991-51-7	Glycine, N-ethyl-N-[(heptadecafluorooctyl)sulfonyl]-, potassium salt
3107-18-4	Cyclohexanesulfonic acid, undecafluoro-, potassium salt
3825-26-1	Ammonium perfluorooctanoate
3871-99-6	1-Hexanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,6-tridecafluoro-, potassium salt
3872-25-1	1-Pentanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,5-undecafluoro-, potassium salt
4151-50-2	Sulfluramid
4980-53-4	2-Propenoic acid, 2-methyl-, 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,13,13,14,14,15,15,16,16,16-nonacosafuorohexadecyl ester
6014-75-1	2-Propenoic acid, 2-methyl-, 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,13,13,14,14,14-pentacosafuorotetradecyl ester
13252-13-6	Hexafluoropropylene oxide dimer acid
16517-11-6	Octadecanoic acid, pentatriacontafuoro-
17202-41-4	1-Nonanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,9-nonadecafluoro-, ammonium salt
17741-60-5	1,1,2,2-Tetrahydroperfluorododecyl acrylate
21652-58-4	Perfluorooctyl Ethylene

24448-09-7	1-Octanesulfonamide, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-N-(2-hydroxyethyl)-N-methyl-
25268-77-3	2-[[[Heptadecafluorooctyl)sulfonyl]methylamino]ethyl acrylate
26738-51-2	3,6,9,12-Tetraoxapentadecane, 1,1,1,2,4,4,5,7,7,8,10,10,11,13,13,14,14,15,15,15-eicosafluoro-5,8,11-tris(trifluoromethyl)-
27619-90-5	1-Decanesulfonyl chloride, 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-heptadecafluoro-
27619-91-6	1-Dodecanesulfonyl chloride, 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,12-heneicosafluoro-
27619-97-2	1-Octanesulfonic acid, 3,3,4,4,5,5,6,6,7,7,8,8,8-tridecafluoro-
27905-45-9	1,1,2,2-Tetrahydroperfluorodecyl acrylate
29081-56-9	1-Octanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-, ammonium salt
29117-08-6	Poly(oxy-1,2-ethanediyl), $\alpha$ -[2-[ethyl[(heptadecafluorooctyl)sulfonyl]amino]ethyl]- $\omega$ -hydroxy-
29457-72-5	Lithium (perfluorooctane)sulfonate
29809-34-5	Eicosane, 1,1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,13,13,14,14,15,15,16,16,17,17,18,18,19,19,20,20-hentetracontafluoro-20-iodo-
29809-35-6	Octadecane, 1,1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,13,13,14,14,15,15,16,16,17,17,18,18-heptatriacontafluoro-18-iodo-
30046-31-2	Tetradecane, 1,1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,12-pentacosafuoro-14-iodo-
31506-32-8	1-Octanesulfonamide, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-N-methyl-
34362-49-7	1,1,2,2-Tetrahydroperfluorohexadecyl acrylate
34395-24-9	1,1,2,2-Tetrahydroperfluorotetradecyl acrylate
37338-48-0	Poly[oxy(methyl-1,2-ethanediyl)], $\alpha$ -[2-[ethyl[(heptadecafluorooctyl)sulfonyl]amino]ethyl]- $\omega$ -hydroxy-
38006-74-5	1-Propanaminium, 3-[[[heptadecafluorooctyl)sulfonyl]amino]-N,N,N-trimethyl-, chloride
39239-77-5	1-Tetradecanol, 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,13,13,14,14,14-pentacosafuoro-
52166-82-2	1-Propanaminium, N,N,N-trimethyl-3-[[[tridecafluorohexyl)sulfonyl]amino]-, chloride
52591-27-2	1,1,2,2-Tetrahydroperfluorohexyl acrylate
55910-10-6	Glycine, N-[(heptadecafluorooctyl)sulfonyl]-N-propyl-, potassium salt
56372-23-7	Poly(oxy-1,2-ethanediyl), $\alpha$ -[2-[ethyl[[tridecafluorohexyl)sulfonyl]amino]ethyl]- $\omega$ -hydroxy-
56773-42-3	Ethanaminium, N,N,N-triethyl-, salt with 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-1-octanesulfonic acid (1:1)
59071-10-2	2-Propenoic acid, 2-[ethyl[(pentadecafluoroheptyl)sulfonyl]amino]ethyl ester
60270-55-5	1-Heptanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,7-pentadecafluoro-, potassium salt
60699-51-6	1-Hexadecanol, 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,13,13,14,14,15,15,16,16,16-nonacosafuoro-

61660-12-6	1-Octanesulfonamide, N-ethyl-1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-N-[3-(trimethoxysilyl)propyl]-
61798-68-3	Pyridinium, 1-(3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-heptadecafluorodecyl)-, salt with 4-methylbenzenesulfonic acid (1:1)
62037-80-3	Hexafluoropropylene oxide dimer acid ammonium salt
65104-65-6	1-Eicosanol, 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,13,13,14,14,15,15,16,16,17,17,18,18,19,19,20,20,20-heptatriacontafluoro-
65104-67-8	1-Octadecanol, 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,13,13,14,14,15,15,16,16,17,17,18,18,18-tritriacontafluoro-
65510-55-6	Hexadecane, 1,1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,13,13,14,14-nonacosafuoro-16-iodo-
65545-80-4	Poly(oxy-1,2-ethanediyl), $\alpha$ -hydro- $\omega$ -hydroxy-, ether with $\alpha$ -fluoro- $\omega$ -(2-hydroxyethyl)poly(difluoromethylene) (1:1)
67584-42-3	Cyclohexanesulfonic acid, decafluoro(pentafluoroethyl)-, potassium salt
67584-52-5	Glycine, N-ethyl-N-[(undecafluoropentyl)sulfonyl]-, potassium salt
67584-53-6	Glycine, N-ethyl-N-[(tridecafluorohexyl)sulfonyl]-, potassium salt
67584-56-9	2-Propenoic acid, 2-[methyl[(undecafluoropentyl)sulfonyl]amino]ethyl ester
67584-57-0	2-Propenoic acid, 2-[methyl[(tridecafluorohexyl)sulfonyl]amino]ethyl ester
67584-58-1	1-Propanaminium, N,N,N-trimethyl-3-[[pentadecafluoroheptyl)sulfonyl]amino]-, iodide
67584-62-7	Glycine, N-ethyl-N-[(pentadecafluoroheptyl)sulfonyl]-, potassium salt
67905-19-5	Perfluoropalmitic acid
67906-42-7	1-Decanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-heneicosafuoro-, ammonium salt
67969-69-1	1-Octanesulfonamide, N-ethyl-1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-N-[2-(phosphonoxy)ethyl]-, diammonium salt
68084-62-8	2-Propenoic acid, 2-[methyl[(pentadecafluoroheptyl)sulfonyl]amino]ethyl ester
68140-18-1	Thiols, C4-10, $\gamma$ - $\omega$ -perfluoro
68140-20-5	Thiols, C6-12, $\gamma$ - $\omega$ -perfluoro
68140-21-6	Thiols, C10-20, $\gamma$ - $\omega$ -perfluoro
68141-02-6	Chromium(III) perfluorooctanoate
68156-01-4	Cyclohexanesulfonic acid, nonafluorobis(trifluoromethyl)-, potassium salt
68156-07-0	Cyclohexanesulfonic acid, decafluoro(trifluoromethyl)-, potassium salt
68187-25-7	Butanoic acid, 4-[[3-(dimethylamino)propyl]amino]-4-oxo-, 2(or 3)-[( $\gamma$ - $\omega$ -perfluoro-C6-20-alkyl)thio] derivs.

68187-47-3	1-Propanesulfonic acid, 2-methyl-, 2-[[1-oxo-3-[( $\gamma$ - $\omega$ -perfluoro-C4-16-alkyl)thio]propyl]amino] derivs., sodium salts
68188-12-5	Alkyl iodides, C4-20, $\gamma$ - $\omega$ -perfluoro
68227-96-3	2-Propenoic acid, butyl ester, telomer with 2-[[heptadecafluorooctyl)sulfonyl]methylamino]ethyl 2-propenoate, 2-[methyl[(nonafluorobutyl)sulfonyl]amino]ethyl 2-propenoate, $\alpha$ -(2-methyl-1-oxo-2-propenyl)- $\omega$ -hydroxypoly(oxy-1,4-butanediyl), $\alpha$ -(2-methyl-1-oxo-2-propenyl)- $\omega$ -[(2-methyl-1-oxo-2-propenyl)oxy]poly(oxy-1,4-butanediyl), 2-[methyl[(pentadecafluoroheptyl)sulfonyl]amino]ethyl 2-propenoate, 2-[methyl[(tridecafluorohexyl)sulfonyl]amino]ethyl 2-propenoate, 2-[methyl[(undecafluoropentyl)sulfonyl]amino]ethyl 2-propenoate and 1-octanethiol
68259-07-4	1-Heptanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,7-pentadecafluoro-, ammonium salt
68259-08-5	1-Hexanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,6-tridecafluoro-, ammonium salt
68259-09-6	1-Pentanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,5-undecafluoro-, ammonium salt
68259-38-1	Poly[oxy(methyl-1,2-ethanediyl)], $\alpha$ -[2-[ethyl[(tridecafluorohexyl)sulfonyl]amino]ethyl]- $\omega$ -hydroxy-
68259-39-2	Poly[oxy(methyl-1,2-ethanediyl)], $\alpha$ -[2-[ethyl[(pentadecafluoroheptyl)sulfonyl]amino]ethyl]- $\omega$ -hydroxy-
68298-62-4	2-Propenoic acid, 2-[butyl[(heptadecafluorooctyl)sulfonyl]amino] ethyl ester, telomer with 2-[butyl[(pentadecafluoroheptyl)sulfonyl] amino]ethyl 2-propenoate, methyloxirane polymer with oxirane di-2-propenoate, methyloxirane polymer with oxirane mono-2-propenoate and 1-octanethiol
68298-80-6	Poly(oxy-1,2-ethanediyl), $\alpha$ -[2-[ethyl[(undecafluoropentyl)sulfonyl] amino]ethyl]- $\omega$ -hydroxy-
68298-81-7	Poly(oxy-1,2-ethanediyl), $\alpha$ -[2-[ethyl[(pentadecafluoroheptyl)sulfonyl]amino]ethyl]- $\omega$ -hydroxy-
68310-17-8	Poly[oxy(methyl-1,2-ethanediyl)], $\alpha$ -[2-[ethyl[(undecafluoropentyl)sulfonyl]amino]ethyl]- $\omega$ -hydroxy-
68391-08-2	Alcohols, C8-14, $\gamma$ - $\omega$ -perfluoro
68412-68-0	Phosphonic acid, perfluoro-C6-12-alkyl derivs.
68412-69-1	Phosphinic acid, bis(perfluoro-C6-12-alkyl) derivs.
68515-62-8	1,4-Benzenedicarboxylic acid, dimethyl ester, reaction products with bis(2-hydroxyethyl) terephthalate, ethylene glycol, $\alpha$ -fluoro- $\omega$ -(2-hydroxyethyl)poly(difluoromethylene), hexakis(methoxymethyl) melamine and polyethylene glycol
68555-74-8	1-Pentanesulfonamide, 1,1,2,2,3,3,4,4,5,5,5-undecafluoro-N-(2-hydroxyethyl)-N-methyl-
68555-75-9	1-Hexanesulfonamide, 1,1,2,2,3,3,4,4,5,5,6,6,6-tridecafluoro-N-(2-hydroxyethyl)-N-methyl-
68555-76-0	1-Heptanesulfonamide, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,7-pentadecafluoro-N-(2-hydroxyethyl)-N-methyl-



68555-81-7	1-Propanaminium, N,N,N-trimethyl-3-[[[pentadecafluoroheptyl)sulfonyl]amino]-, chloride
68555-91-9	2-Propenoic acid, 2-methyl-, 2-[ethyl[(heptadecafluorooctyl)sulfonyl]amino]ethyl ester, polymer with 2-[ethyl[(nonafluorobutyl)sulfonyl]amino]ethyl-methyl-2-propenoate, 2-[ethyl[(pentadecafluoroheptyl)sulfonyl]amino]ethyl 2-methyl-2-propenoate, 2-[ethyl[(tridecafluorohexyl)sulfonyl]amino]ethyl 2-methyl-2-propenoate, 2-[ethyl[(undecafluoropentyl)sulfonyl]amino]ethyl 2-methyl-2-propenoate and octadecyl 2-methyl-2-propenoate
68758-57-6	1-Tetradecanesulfonyl chloride, 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,13,13,14,14,14-pentacosafuoro-
68867-60-7	2-Propenoic acid, 2-[[[heptadecafluorooctyl)sulfonyl]methylamino]ethyl ester, polymer with 2-[methyl[(nonafluorobutyl)sulfonyl]amino]ethyl 2-propenoate, 2-[methyl[(pentadecafluoroheptyl)sulfonyl]amino]ethyl 2-propenoate, 2-[methyl[(tridecafluorohexyl)sulfonyl]amino]ethyl 2-propenoate, 2-[methyl[(undecafluoropentyl)sulfonyl]amino]ethyl 2-propenoate and $\alpha$ -(1-oxo-2-propenyl)- $\omega$ -methoxypoly(oxy-1,2-ethanediyl)
68957-55-1	1-Propanaminium, N,N,N-trimethyl-3-[[[undecafluoropentyl)sulfonyl]amino]-, chloride
68957-57-3	1-Propanaminium, N,N,N-trimethyl-3-[[[undecafluoropentyl)sulfonyl]amino]-, iodide
68957-58-4	1-Propanaminium, N,N,N-trimethyl-3-[[[tridecafluorohexyl)sulfonyl]amino]-, iodide
68957-62-0	1-Heptanesulfonamide, N-ethyl-1,1,2,2,3,3,4,4,5,5,6,6,7,7,7-pentadecafluoro-
68958-60-1	Poly(oxy-1,2-ethanediyl), $\alpha$ -[2-[ethyl[(pentadecafluoroheptyl)sulfonyl]amino]ethyl]- $\omega$ -methoxy-
68958-61-2	Poly(oxy-1,2-ethanediyl), $\alpha$ -[2-[ethyl[(heptadecafluorooctyl)sulfonyl]amino]ethyl]- $\omega$ -methoxy-
69116-73-0	Methyl perfluoro[8-(fluoroformyl)-5-methyl-4,7-dioxanonanoate]
70225-14-8	1-Octanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-, compd. with 2,2'-iminobis[ethanol] (1:1)
70225-15-9	1-Heptanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,7-pentadecafluoro-, compd. with 2,2'-iminobis[ethanol] (1:1)
70225-16-0	1-Hexanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,6-tridecafluoro-, compd. with 2,2'-iminobis[ethanol] (1:1)
70225-17-1	1-Pentanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,5-undecafluoro-, compd. with 2,2'-iminobis[ethanol] (1:1)
70969-47-0	Thiols, C8-20, $\gamma$ - $\omega$ -perfluoro, telomers with acrylamide
70983-59-4	Poly(oxy-1,2-ethanediyl), $\alpha$ -methyl- $\omega$ -hydroxy-, 2-hydroxy-3-[( $\gamma$ - $\omega$ -perfluoro-C6-20-alkyl)thio]propyl ethers
70983-60-7	1-Propanaminium, 2-hydroxy-N,N,N-trimethyl-, 3-[( $\gamma$ - $\omega$ -perfluoro-C6-20-alkyl)thio] derivs., chlorides

71608-60-1	Pentanoic acid, 4,4-bis[( $\gamma$ - $\omega$ -perfluoro-C8-20-alkyl)thio] derivs.
72623-77-9	Fatty acids, C6-18, perfluoro, ammonium salts
72968-38-8	Fatty acids, C7-13, perfluoro, ammonium salts
78560-44-8	Silane, trichloro(3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-heptafluorodecyl)-
79070-11-4	Poly(difluoromethylene), $\alpha$ -chloro- $\omega$ -(2,2-dichloro-1,1,2-trifluoroethyl)-
83048-65-1	Silane, (3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-heptafluorodecyl)trimethoxy-
97553-95-2	Thiocyanic acid, $\gamma$ - $\omega$ -perfluoro-C4-20-alkyl esters
97659-47-7	Alkenes, C8-14 $\alpha$ -, $\delta$ - $\omega$ -perfluoro
118400-71-8	Disulfides, bis( $\gamma$ - $\omega$ -perfluoro-C6-20-alkyl)
125476-71-3	Silicic acid (H <sub>4</sub> SiO <sub>4</sub> ), disodium salt, reaction products with chlorotrimethylsilane and 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-heptafluoro-1-decanol
135228-60-3	Hexane, 1,6-diisocyanato-, homopolymer, $\gamma$ - $\omega$ -perfluoro-C6-20-alc.-blocked
142636-88-2	2-Propenoic acid, 2-methyl-, octadecyl ester, polymer with 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,12-heneicosafuorododecyl 2-propenoate, 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-heptafluorodecyl 2-propenoate and 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,13,13,14,14,14-pentacosafuorotetradecyl 2-propenoate
143372-54-7	Siloxanes and Silicones, (3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-heptafluorodecyl)oxy Me, hydroxy Me, Me octyl, ethers with polyethylene glycol mono-Me ether
148240-85-1	1,3-Propanediol, 2,2-bis[[( $\gamma$ - $\omega$ -perfluoro-C4-10-alkyl)thio)methyl] derivs., phosphates, ammonium salts
148240-87-3	1,3-Propanediol, 2,2-bis[[( $\gamma$ - $\omega$ -perfluoro-C6-12-alkyl)thio)methyl] derivs., phosphates, ammonium salts
148240-89-5	1,3-Propanediol, 2,2-bis[[( $\gamma$ - $\omega$ -perfluoro-C10-20-alkyl)thio)methyl] derivs., phosphates, ammonium salts
150135-57-2	2-Propenoic acid, 2-methyl-, 2-(dimethylamino)ethyl ester, polymers with Bu acrylate, $\gamma$ - $\omega$ -perfluoro-C8-14-alkyl acrylate and polyethylene glycol monomethacrylate, 2,2'-azobis[2,4-dimethylpentanenitrile]-initiated
178094-69-4	1-Octanesulfonamide, N-[3-(dimethyloxidoamino)propyl]-1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptafluoro-, potassium salt
178535-23-4	Fatty acids, linseed-oil, $\gamma$ - $\omega$ -perfluoro-C8-14-alkyl esters
180582-79-0	Sulfonic acids, C6-12-alkane, $\gamma$ - $\omega$ -perfluoro, ammonium salts
182176-52-9	Ethaneperoxoic acid, reaction products with 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-heptafluorodecyl thiocyanate and 3,3,4,4,5,5,6,6,7,7,8,8,8-tridecafluorooctyl thiocyanate

196316-34-4	2-Propenoic acid, 2-methyl-, 2-(dimethylamino)ethyl ester, polymers with $\gamma$ - $\omega$ -perfluoro-C10-16-alkyl acrylate and vinyl acetate, acetates
200513-42-4	2-Propenoic acid, 2-methyl-, polymer with butyl 2-methyl-2-propenoate, 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-heptafluorodecyl 2-propenoate, 2-hydroxyethyl 2-methyl-2-propenoate and methyl 2-methyl-2-propenoate
238420-68-3	Propanedioic acid, mono( $\gamma$ - $\omega$ -perfluoro-C8-12-alkyl) derivs., di-me esters
238420-80-9	Propanedioic acid, mono( $\gamma$ - $\omega$ -perfluoro-C8-12-alkyl) derivs., bis[4-(ethenyloxy)butyl] esters
1078142-10-5	1,3-Propanediol, 2,2-bis[[( $\gamma$ - $\omega$ -perfluoro-C6-12-alkyl)thio)methyl] derivs., polymers with 2,2-bis[[( $\gamma$ - $\omega$ -perfluoro-C10-20-alkyl)thio)methyl]-1,3-propanediol, 1,6-diisocyanato-2,2,4(or 2,4,4)-trimethylhexane, 2-heptyl-3,4-bis(9-isocyanatononyl)-1-pentylcyclohexane and 2,2'-(methylimino)bis[ethanol]
1078712-88-5	Thiols, C4-20, $\gamma$ - $\omega$ -perfluoro, telomers with acrylamide and acrylic acid, sodium salts
1078715-61-3	1-Propanaminium, 3-amino-N-(carboxymethyl)-N,N-dimethyl-, N-[2-[( $\gamma$ - $\omega$ -perfluoro-C4-20-alkyl)thio]acetyl] derivs., inner salts