Toxics Evolution Metalworking Fluids Project Report

Hazardous Waste and Toxics Reduction Program

Washington State Department of Ecology
Olympia, Washington

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Related Information

- Chapter 173-303 WAC: Dangerous Waste Regulations of Washington State[1]
- Publication 97-407: Chemical Test Methods for Designating Dangerous Waste[2]
- Publication 21-04-003: Shoptalk Fall 2021 Issue[3]
- Publication 21-04-006: Pollution Prevention Practices for Metalworking Fluids[4]

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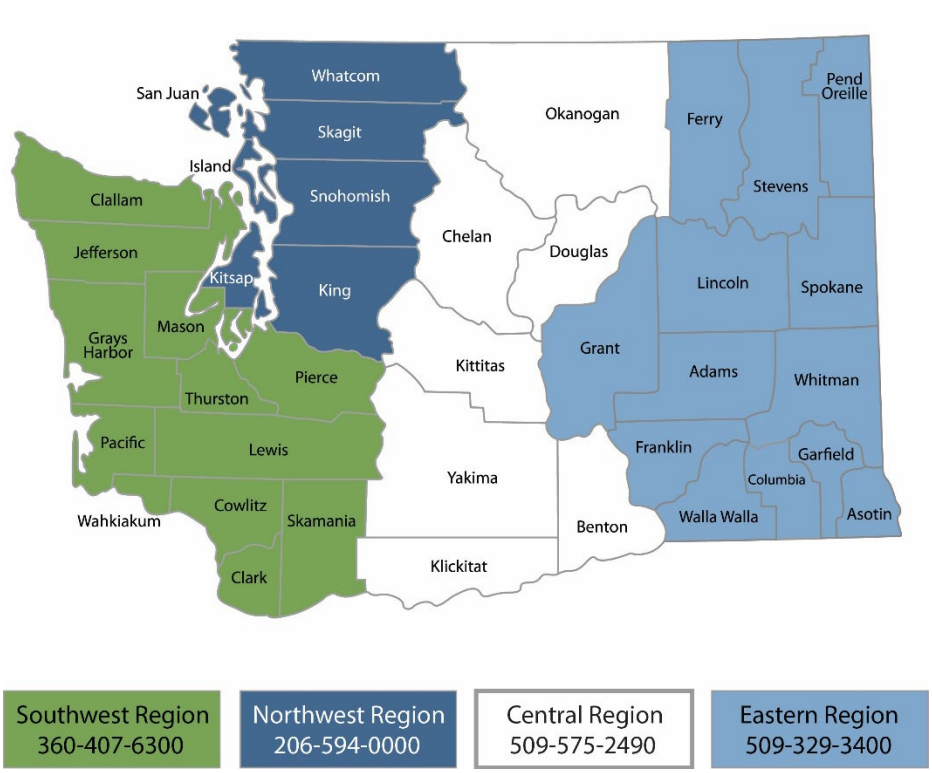
[1] https://apps.leg.wa.gov/wac/default.aspx?cite=173-303
[2] https://apps.ecology.wa.gov/publications/SummaryPages/97407.html
[3] https://apps.ecology.wa.gov/publications/SummaryPages/2104003.html
[4] https://apps.ecology.wa.gov/publications/SummaryPages/2104006.html
[5] www.ecology.wa.gov/contact
[6] www.ecology.wa.gov/accessibility

Department of Ecology's Regional Offices

Map of Counties Served



Region	Counties served	Mailing Address	Phone
Southwest	Clallam, Clark, Cowlitz, Grays Harbor, Jefferson, Mason, Lewis, Pacific, Pierce, Skamania, Thurston, Wahkiakum	PO Box 47775 Olympia, WA 98504	360-407-6300
Northwest	Island, King, Kitsap, San Juan, Skagit, Snohomish, Whatcom	PO Box 330316 Shoreline, WA 98133	206-594-0000
Central	Benton, Chelan, Douglas, Kittitas, Klickitat, Okanogan, Yakima	1250 W Alder St Union Gap, WA 98903	509-575-2490
Eastern	Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, Whitman	4601 N Monroe Spokane, WA 99205	509-329-3400
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Table of Contents

List of Tables

Executive Summary

What is the Metalworking Fluid by Score alternatives list?

In 2018, there were 800 machine shops operating in Washington state. The Department of Ecology's Hazardous Waste and Toxics Reduction Program and Pollution Prevention Assistance (PPA) Partnership routinely inspected and continues to inspect these businesses.

Ecology staff sometimes needs to tell shop owners that the metalworking fluid (MWF) they use to cool and lubricate their machine-cutting heads must be managed as dangerous waste when spent. Owners often ask, "Do you have a list of MWFs that are not dangerous waste when spent?" Until we developed the Metalworking Fluid by Score, the answer was no.

This project created a list of MWFs that are not dangerous waste when spent, called **Metalworking Fluid by Score** (you can see it in Appendix A). This list sorts different MWFs used in Washington state according to their chemical hazard assessment (CHA) safety. Fluids with the lowest weight percentage of toxic ingredients are at the top and those with the highest percentage of toxic ingredients are at the bottom.

Project benefits included:

- Finding a way for Ecology staff to get CHA information on proprietary chemicals.
- Developing a way to "score" products that contain a large number of chemicals based on toxicity and communicate this to the public in an easy-to-understand format.
- Creating a list of MWFs that are safer to use and not dangerous waste when spent.
- Working with manufacturers to:
    - Verify the Metalworking Fluid by Score.
    - Disclose the safety of their MWF ingredients without disclosing trade secrets.
    - Identify additional alternatives.
    - Encourage them to use the safest ingredients practical in formulation.
- Informing the public of the list's existence.

How was the Metalworking Fluid by Score list created?

We asked more than 100 machine shops in Washington state, "What MWFs do you currently use?" We also collected information through a questionnaire in Shoptalk[7] and a search of pollution prevention plans for the entire state. MWF manufacturers we later contacted added to the list as well. These were the sources of the MWFs listed in the Metalworking Fluids by Score in Appendix A.

[7] http://ecology.wa.gov/shoptalk

During the MWF project, Ecology communicated with 23 MWF manufacturers (see the list in Appendix B) to:

- Determine each metalworking fluid's unused product disposal status as dangerous waste or not.
- Let manufacturers challenge the accuracy of CHA results and MWF scoring.
- Enable manufacturers to disclose CHA information on ingredients that are trade secrets to Scivera LLC, an Ecology-contracted private business.
- Let manufacturers improve their product's rating or score.
- Add MWF products to the list.
- Encourage manufacturers to use the safest ingredients practical in formulation.

Further explanation of the details follow later in this report.

How will we share the Metalworking Fluid by Score?

The list will be communicated to the public via the fall 2021 edition of Shoptalk[8] and our Pollution Prevention Practices for Metal Machining publication.[9]

Ecology's compliance and technical assistance staff as well as PPA specialists working in local governments will also communicate the new information when discussing alternatives with machine shops.

Acknowledgements

Thank you to Ken Zarker and Thomas Boucher for securing the EPA pollution prevention grant that was used to fund the CHA information contract, and Huckleberry Palmer, Karen Wood, and Craig Manahan for evaluating and selecting the winning bid for the contract.

[8] Available beginning in October 2021: https://apps.ecology.wa.gov/publications/SummaryPages/2104003.html
[9] Available in mid-to-late 2021: https://apps.ecology.wa.gov/publications/SummaryPages/2104006.html

The Metalworking Fluid Project

The idea for this project came into being after numerous machine shop owners asked for a list of non–dangerous waste MWF alternatives during site visits.

The project was divided into two parts: creating an alternatives list to find MWFs that were not dangerous waste (DW) and then scoring the MWFs based on their chemical hazard assessment toxicity. Contracting with the successful bidder, Scivera, enabled comparisons between MWFs based on the chemical hazard assessment data.

The first project report, Toxics Evolution Metalworking Fluid Project Progress Report, is summarized before discussing the project as a whole.

Toxics Evolution Metalworking Fluid Project Progress Report

The first approach to creating an alternatives list was to evaluate manufacturer safety data sheets (SDS) and select those that were not DW. This approach did not work.

SDS from the internet

There are thousands of MWF SDS on the internet; many are no longer manufactured or locally available. Internet SDS do not provide enough information to determine MWF disposal status because of incomplete disclosure of some chemicals due to their proprietary nature.

None of the MWFs SDS evaluated during this project list 100 percent of the ingredients. Many list zero percent. DW "book" disposal determination (known as designation) requires knowing 100 percent of the ingredients, their percent by weight, and their chemical abstract service number (CASRN).

Internet SDS are not helpful in determining if a MWF is viable from an alternatives assessment perspective. Alternatives assessment considerations include all of the following for a MWF:

- It works well.
- It is currently being manufactured.
- It is locally available.
- It is available at a reasonable cost.
- It does not have an offensive odor.
- After prolonged use, it is easy to replenish, recycle, and maintain.

The internet approach to selecting alternatives does not address any of these alternatives assessment concerns with confidence.

Machine shop surveys

The best person to ask about the alternatives assessment considerations is a machinist who has used the MWF and keeps using it. We asked more than 100 machine shops in Washington

state, “What MWFs do you currently use?” Their responses became the MWFs listed in the Metalworking Fluid by Score.

Surveying machinists about the MWFs they used required finding their business names and phone numbers. We created a contact list by comparing a Google search of “Washington state machine shops” to a separate manufacturer database obtained from Steve Whittaker, King County Hazardous Waste Program Manager. There were about 800 machine shops in Washington State: 600 in the northwest and southwest regions, and the rest in the central and eastern regions.

Ecology cold-called about 100 machine shops in the central and eastern regions, 45 of which revealed the MWFs they use. These calls identified about 35 MWF products in use at these businesses as some shops use the same MWF.

Ecology identified about five more MWFs through a Shoptalk questionnaire and a search of pollution prevention plans for the entire state. MWF manufacturers we later contacted added to the list after proving the MWFs were used in Washington by providing product sales by county listings.

Ecology downloaded the SDS for these MWFs from their manufacturer websites. We determined the disposal status for the MWFs using SDS and additional information learned from talking to the manufacturer technical support staff (see the determining metalworking fluid disposal status section for an explanation of designation).

Disposal status for the MWFs ended up in one of following categories:

- Dangerous waste.
- Used oil.
- Not used oil, not DW.
- Not determined yet (a few of the MWFs ended up with this status because of insufficient response from manufacturer technical support).

The compiled results generated a list of MWFs used in Washington state that can be managed as used oil provided chlorinated tapping fluids are not used and spent MWF is mixed only with other used oil waste streams.

Determining MWF chemical safety

This list would have been the end of the project if it had not been for the Department of Ecology’s toxics evolution mission. The mission—to encourage businesses to make and use safer products using the smallest amount of toxic substances practical—created the need to look at the chemical safety of the MWFs. This meant empowering machine shops to be able to choose the safest MWF practical, which meant putting the safest MWFs at the top of the list sorting down to the least safe at the list’s bottom.

This was difficult to do for the following reasons:

- It would require communicating a large amount of complex chemical hazard assessment data to machinists in a format they could quickly understand and be willing to use.
- There was no established procedure to rate or compare MWF products composed of many different chemicals with many different CHA levels of concern.
- There was no viable CHA data for the 115 chemicals found in the MWF products.
- Ecology staff could not get CHA data in a reasonable time at a reasonable cost.
- Ecology staff could not sign a non-disclosure agreement (NDA), which prevented obtaining proprietary chemical CHA information. There was a large amount of proprietary data.

Creating an objective scoring system based on chemical weight percentages and chemical hazard assessments eliminated the product comparison problem. The system takes CHA information from Greenscreen, Scivera, and EPA Safer Choice, and puts it into a format useable by machinists. The scoring system is explained in the scoring a metalworking fluid section of this report.

Contracting with a business that specializes in CHAs solved the problem of lack of CHA data, the time and cost of getting the data, proprietary chemicals, and the inability of Ecology staff to sign an NDA. It was not known if any company could do all this. This led to the decision to bid for a contractor using EPA grant funding.

Contracting with Scivera

A CHA contracting team was created. The team took required contract management and procurement training. A numerical scoring system was created that enabled comparing bidder cost, staff, and company products. Scivera LLC was awarded a one year, $14,000 contract (March 2020–2021).

Contracting with Scivera solved the problem of Ecology not being able to get CHA data on proprietary chemicals. Scivera was able to obtain CHA data from two MWF manufacturers, Qualichem and Blaser Swiss Lube, utilizing their own confidentiality agreements.

The process of Ecology using Scivera to get proprietary MWF CHA information worked as follows:

- Ecology sent an MWF SDS to Scivera.
- Scivera emailed the SDS to the manufacturer with a request for 100 percent by weight or volume product information.
- The manufacturer sent Scivera the requested information (weight percent and CASRN) with directions on what CASRN must remain trade secret.
- Scivera performed CHA analysis and sent Ecology the weight percentage and CHA results with trade secret CASRN redacted.

The difficult and time-consuming part of the process was persuading manufacturers that it was in their best interest to disclose the information. A manufacturer's decision to disclose trade secrets is not made by the first people Ecology staff contact, which in this case was manufacturer technical support followed by sales staff. NDA trade secret disclosure approval authority resides higher up, in most businesses' corporate offices. The corporate offices decide if the reward (potential increased marketing share) justifies the expense of staff time and the risk of potential loss of trade secrets. This is probably why only two of the 23 companies (Blaser Swiss Lube and Qualichem) contacted by Ecology signed NDAs with Scivera in the MWF project.

It took time to contact the right corporate people and get approval, for them to make sure the right staff was available and make decisions, and for Ecology to get the responses. Blaser was contacted in August of 2020 and finished working with Ecology in March of 2021.

Contracting with Scivera overcame other obstacles that prevented project completion. The 115 MWF chemicals identified as being in Washington state's 35 MWFs were assessed using Scivera's CHA database in March of 2020. It took less than five minutes to get these chemicals' CHA data, compared to the six months it took to get information on just three dry cleaning chemicals. Long time delays would have made working with a business on the MWF project impractical or impossible.

Receiving Scivera's CHA data enabled chemical safety scoring of all Washington state MWF products (read more about scoring in the scoring a metalworking fluid section). This resulted in the creation of the MWF alternatives list, Metalworking Fluid by Score, in a draft form ready for manufacturers to review.

Manufacturer review

Manufacturer technical support staff, contacted previously for disposal assistance, were emailed the draft form of the Metalworking Fluid by Score with a statement of project intent. This assured all manufacturers were notified. Each manufacturers' tech support staff were asked to pass the information on to the company sales manager responsible for sales in Washington state. The statement of intent was used to generate project interest.

The statement of intent stated the MWF alternatives list would be published in Shoptalk[10] and our Pollution Prevention Practices for Metal Machining publication.[11] Ecology compliance inspectors would use the list to help machine shops find non–dangerous waste MWFs and, in doing so, be seen by many of the 800 machine shops in Washington state.

Manufacturers that participated could correct errors, suggest revisions, dispute CHA results, assure Ecology used the latest SDS, and delete products no longer sold in Washington. Manufacturers could submit more information to improve product ratings by reducing the weight percentage of toxics and percent of unknowns and add MWF products to the list if they could prove they were currently used in the state.

[10] Available beginning in October 2021: https://apps.ecology.wa.gov/publications/SummaryPages/2104003.html
[11] Available in mid-to-late 2021: https://apps.ecology.wa.gov/publications/SummaryPages/2104006.html

Blaser Swiss Lube and Qualichem did all of the above. Some of the other manufacturers detected minor errors that were resolved to their satisfaction.

Ecology suggested to manufacturers that they might benefit in working with Scivera to find safer chemicals to formulate products. Scivera made a presentation to this effect during a webinar workshop. Both Blaser and Qualichem interacted with Scivera and got feedback on chemicals they use. They also stated they learned things they found valuable. Both companies, as evidenced by the ingredients used in their products, are already engaged in safer product design, but are always looking to improve safety, performance, and market share.

Several technical support representatives sent updated SDS. Some responded that an MWF product was to be discontinued and replaced with slightly different product with different name, in which case they sent an updated SDS. Every manufacturer had a sales department representative responsible for sales in Washington state. About half of the 23 MWF companies' sales representatives spoke directly with Ecology about the project.

- Hangsterfer responded that they were satisfied with how their products scored in the first draft of the Metalworking Fluids by Score and took no further part in the project.
- Qualichem was not satisfied and worked to understand how their products were scored and improve the ratings of their products. Qualichem's products ended up with a higher rating than Hangsterfer.
- Blaser Swiss Lube's approach was similar to Qualichem's with similar results.
- Qualichem and Blaser provided proof that machine shops in Washington state used other MWF products not previously looked at by Ecology and requested these products be evaluated and included. Both manufacturers ended up with several MWFs high up on the water-based and straight oil lists.
- One Qualichem staff member stated that he had worked for several different MWF manufacturers over the years. He said he was disappointed, but not surprised by what he saw revealed by competitor manufacturers' MWF products that he had previously worked for.

  He stated that he was certain that some of the other MWFs used the same biocides in their water-based chemistries that Qualichem did and was surprised that they were not listed in their SDS. He felt this caused their MWFs to be higher on the list than they should be because they under reported toxic substances.

  Ecology replied it could only use the data as was reported by a manufacturer. Ecology could not prove or disprove that any MWF had a hazardous chemical present above the 1% for toxic or 0.1% for a carcinogenic level that required SDS inclusion (See Appendix D for details about SDS requirements).

  Qualichem's staff member pointed out that most manufacturers use hydrotreated petroleum distillates. He stated that some of Qualichem's SDS did not state that they contained less than 3% DMSO extract as measured by IP 346, but were hydrotreated to the 3% standard. He corrected several Qualichem SDS to reflect this fact and worked

with Scivera to change the CHA. The 3% distinction is important because distillates hydrotreated to “less than 3%” are not classified as carcinogenic.

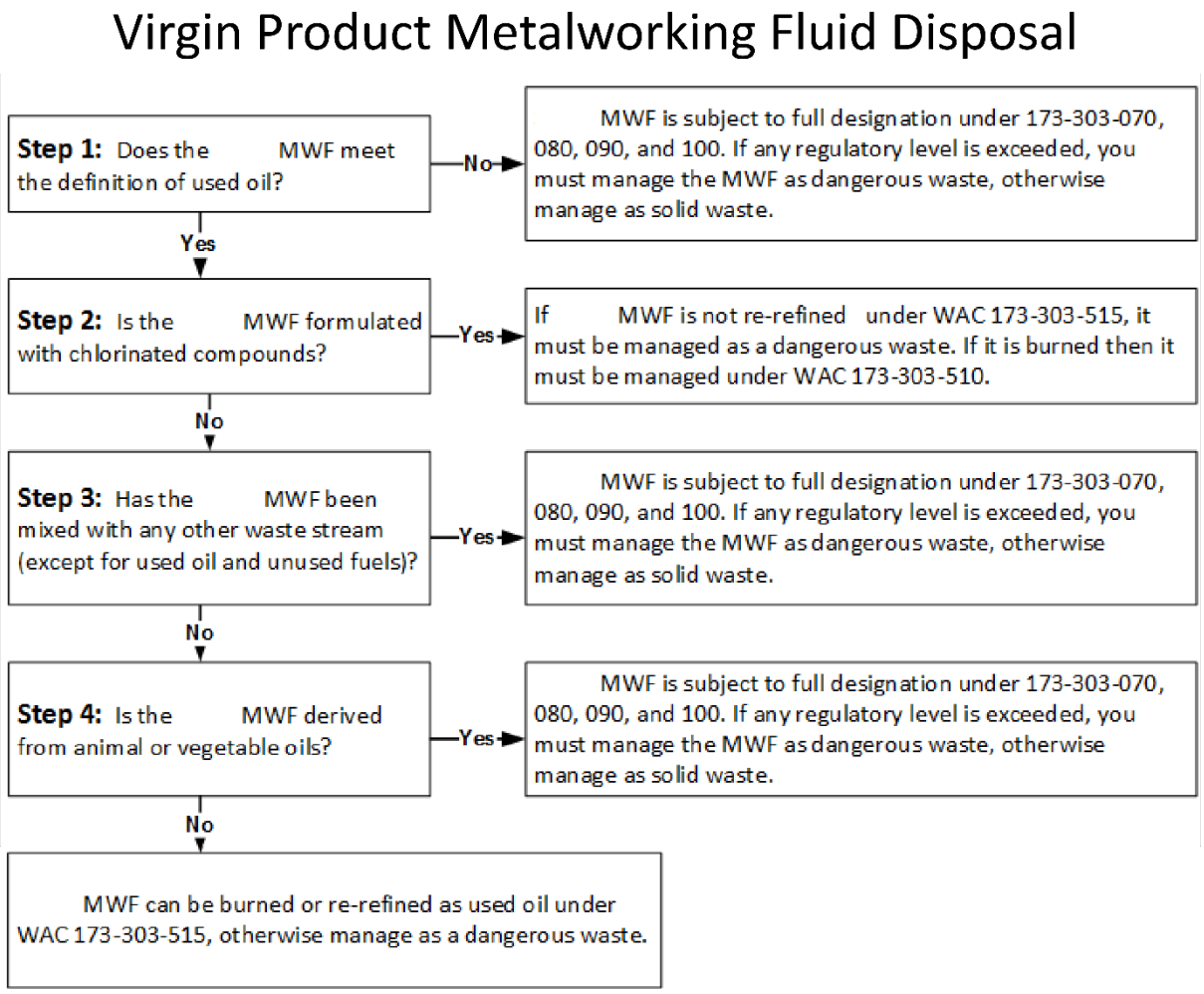
When Qualichem changed their MWF product SDS to include the “3% DMSO” statement, Scivera re-evaluation ended up changing Qualichem’s petroleum distillates level of concern and overall grade (the Scivera HC went from toxic red to acceptable yellow). This resulted in several Qualichem MWF products moving up to a higher rating in the Metalworking Fluid by Score.

- Blaser Swiss Lube provided confirmatory information that led to the introduction of several MWFs to the list.
- Qualichem provided additional information about three straight oil products that are sold in Washington state: EQO-Max 712 MM, EQO-Max 716, and Met-Cut 754HD.
- Blaser Swiss Lube generated additional interesting discussion about vegetable oils, their derivatives, and associated toxicity. Some chemicals have more than one CASRN and the CASRN that is entered into the Scivera database can have a significantly different CHA overall grade or (more properly) level of concern when assigning toxic or preferred status to that chemical.

Determining Metalworking Fluids' Disposal Status

The disposal status of unused MWF products was determined using manufacturer safety data sheets and information provided by manufacturer technical support staff. The basis for determining disposal status in Washington state is the Dangerous Waste Regulations, Chapter 173-303 WAC.[12] See our Pollution Prevention Practices for Metal Machining publication[13] for a flowchart about determining disposal status and helpful guidance on following the regulations.

The flowchart below, **Virgin Product Metalworking Fluid Disposal**, is a modified version of the flowchart mentioned above. It was used to determine the disposal status of the MWFs listed in Metalworking Fluids by Score in Appendix A.



There is a huge difference between **unused product** and **spent waste** when it comes to designating waste in accordance with the Dangerous Waste Regulations. Using an MWF

[12] https://apps.leg.wa.gov/wac/default.aspx?cite=173-303
[13] Available in mid-to-late 2021: https://apps.ecology.wa.gov/publications/SummaryPages/2104006.html

product in a subtractive process (such as machining) adds contaminants that can cause some, but not all, spent MWFs to become dangerous waste MWFs. This is not the case if an MWF meets the definition of used oil as well as all the other conditions outlined below when formulated.

Disposal status of used oil

The disposal status of an **unused MWF** product can be used to determine the disposal status of the spent MWF if a machine shop owner is careful to:

- Use an MWF product that meets the definition of used oil.
- Use an MWF product that is not formulated with persistent chlorinated compounds, such as chlorinated paraffins or chlorinated alkanes (or any other halogenated organic compound).
- Use an MWF product that is not formulated with animal or vegetable oils (e.g., canola or tall oil).
- Not mix chlorinated tapping fluids in with their MWFs.
- Not mix spent MWF with any other waste streams except used oil.

If a machine shop is careful to do everything listed above, the "used oil" MWF product will not exceed 1,000 PPM halogens and is not subject to further designation under the regulations. It would not matter if the spent MWF picked up lead or chrome that exceeded RCRA toxicity characteristic leaching procedure (TCLP) levels, or copper or zinc that exceeded WAC 173-303-100 toxicity levels during use—it could still be managed as used oil, not dangerous waste.

Machine shops can control the above listed conditions and must do so if they wish to manage the spent MWFs listed in the score as having a disposal status of "used oil." It is important that Ecology staff points this out when assisting businesses. There is a warning to this effect in Appendices A and C.

Disposal status of dangerous waste

Some metalworking fluid products were determined to be formulated with halogenated organic compounds (HOCs), such as chlorinated paraffins or chlorinated alkanes. MWFs containing HOCs designated with the disposal status of WP01 (greater than or equal to 1% HOCs) or WP02 (greater than or equal to 100 PPM HOCs) dangerous waste under WAC 173-303-100[14] for two reasons:

- None of the chlorinated paraffin or chlorinated alkane chemical abstract service registry numbers encountered had discoverable test data that showed a persistence half life of less than 365 days. Many had half-life data of more than 365 days.

[14] https://apps.leg.wa.gov/wac/default.aspx?cite=173-303-100

- No re-refining businesses can economically take spent chlorinated MWF, re-refine it, and return it to the machine shop that generated it and meet quality specifications because shipping costs, re-refining, and reformulation for small volumes are uneconomical.

Metalworking fluids containing vegetable oils

Several of the metalworking fluids contain vegetable oils. None appeared to contain animal oils. Most MWFs containing vegetable oil had the disposal status of "not used oil, not dangerous waste."

Per 40 CFR 279, the used oil basis of WAC 173-303, waste oils (to include MWFs) that contain vegetable or animal oils can't be managed as used oil. When mixed with petroleum distillates, vegetable and animal oils tend to separate and form scum layers that are difficult and expensive to clean and process into re-refined oil. Vegetable and animal oils that have not been processed via transesterification plug fuel lines and injector nozzles.

A machine shop owner choosing to use an MWF that contains vegetable oil must designate the MWF under WAC 173-303 sections -070[15] through -100[16] when the MWF is spent to determine if it picks up DW contaminants in use. Ecology staff needs to point this out to people they are working with. A machine shop owner might want to use a vegetable oil–based MWF despite this inconvenience because vegetable oils are suspected to be less toxic than petroleum distillates.

Many vegetable oils lack CHA testing data; they are assumed safe because they have been used safely in cooking for thousands of years. The lack of vegetable oils CHA data leads to some MWF vegetable oils getting a toxicity status of unknown. This has no effect on designation under WAC 173-303-100.

Determining the disposal status of MWFs containing vegetable oils was always complicated by the manufacturer's need to keep trade secret CASRN proprietary and Ecology's inability to sign an NDA. This necessitated several phone calls to technical support to connect with the right people and to make sure they were knowledgeable enough with the Dangerous Waste Regulations.

If a manufacturer's technical support did not provide enough information to determine the product disposal status, the MWF status became "not yet determined." MWFs that received a disposal status of "not used oil, not dangerous waste" or "not yet determined" need to be designated or tested under WAC 173-303-070 through -100 when spent. This will probably require testing for substances like lead, chrome, copper, zinc, and HOCs depending on the metals machined and tapping fluids used in the shop.

[15] https://apps.leg.wa.gov/wac/default.aspx?cite=173-303-070
[16] https://apps.leg.wa.gov/wac/default.aspx?cite=173-303-100

Difficulties in Determining Disposal Status

Proprietary chemical ingredients are the greatest challenge in determining the disposal status of a MWF. It is strongly suspected that every MWF has at least one proprietary ingredient because none or very few SDS listed 100 percent of the ingredients by weight.

Straight oil petroleum distillate–based MWFs appear to have fewer proprietary ingredients based on SDS Section 3 disclosure. Water-based MWFs often have between three and 10 proprietary ingredients based on Section 3 of the SDS (e.g., biocides, surfactants, stabilizers, corrosion inhibitors, and extreme pressure additives).

The existence of proprietary ingredients means that the only way to determine the disposal status of an MWF with confidence is to ask manufacturer technical support staff or to test. For example, some safety data sheets gave no indication they were formulated with HOCs (i.e., the SDS did not list "oxides of chlorine" in the combustion byproducts section). Later discussion with technical support revealed they did contain chlorinated alkanes. Testing for this project would have been extremely expensive and was not feasible.

Contacting manufacturer technical support

Every manufacturer's technical support staff agreed to provide help when told their products' proprietary ingredients made determining proper local disposal impossible (which their SDS directs product users to do). MWF disposal status determination for every MWF began with an Ecology staff person calling technical support. While talking to technical support, a pre-prepared email was sent to them, and opened and read by them while we waited. The email contained:

- The flowchart shown in the determining metalworking fluids' disposal status section, Virgin Product Metalworking Fluid Designation.
- The online reference to WAC 173-303.
- The 40 CFR Subpart 260.10 definition of used oil.
- The definition of animal oils and vegetable oils with examples.
- The definition of halogenated organic compounds in WAC 173-303-040.
- Examples of chlorinated alkanes found in Chemical Test Methods for Designating Dangerous Waste.[17]

The emailed information was discussed until technical support understood why it mattered and what was meant. Technical support was then asked about the specifics of each of their MWFs.

- If they said the MWF product met the definition of used oil, did not contain animal or vegetable oils, and was not formulated with chlorinated alkanes, the designation was

[17] https://apps.ecology.wa.gov/publications/SummaryPages/97407.html

complete and the MWF could be managed as used oil (with adherence to Ecology best management practices).

- If they stated their product was formulated with an HOC (such as chlorinated alkanes), designation was complete and the MWF was DW after checking persistence half life.
    - If the persistence half life of all HOCs is less than 365 days, the HOCs under WAC 173-303 will not cause the MWF to be dangerous waste.
    - None of the HOCs observed had a half life of less than 365 days.
    - There is not much useful half-life data available. Data that does exist show half lives exceeding 365 days.

This process was not always successful—some attempts at designation resulted in unreturned phone calls, which resulted in a disposal status of "not yet determined."

MWFs containing vegetable oils

MWFs that contain vegetable oil(s) were the most time consuming to designate because we needed to train technical support to be able to answer the designation questions associated with WAC 173-303-070 through -100, especially -100. Technical support staff entered CASRN into the appropriate databases and stated non-proprietary fish, rat, and rabbit LC-50, LD-50,[18] etc. data, which enabled book designation.

Most searches of ingredients yielded "no data" or "not toxic enough" from Registry for Toxic Effects of Chemical Substances (RTECS),[19] etc., but some did. Usually the 20:1 dilution of water-based MWFs dropped the equivalent concentration (EC) concentration below 0.001, making the spent MWF not DW. A few—perhaps four out of 40 evaluated—did end up "not used oil, DW WT02."

[18] LC-50 and LD-50 refer to lethal concentration 50% and lethal dose 50% (so it kills 50% of the test population).
[19] See details about the Registry for Toxic Effects of Chemical Substances equivalent concentration in WAC 173-303-100 https://app.leg.wa.gov/wac/default.aspx?cite=173-303-100.

Scoring a Metalworking Fluid

Metalworking fluid products were safety (toxicity) scored using Scivera LLC's chemical hazard assessment (CHA) data, which used CASRN and weight percentages from manufacturer product safety data sheets (SDS). The average weight percentage of a chemical was used if the SDS gave the weight percentage as a range (for example, 10–20% became 15%) unless the manufacturer gave the specific percentage to use. Blaser Swiss Lube and Qualichem provided additional information through Scivera.

For water-based MWFs, the "as used by the machinist in the shop" diluted concentration of an MWF's chemical was used to score the chemical. Manufacturer technical specification sheets often suggested a range of dilution, but then also would suggest using 5% concentrate or 19 parts water to one part MWF. In scoring a water-based MWF, this means dividing the SDS-stated chemical concentration by twenty to calculate the weight percent of the chemical as used.

Scivera's CHA system is very similar to EPA's Safer Choice and Greenscreen (GS®). All evaluate the same endpoints using remarkably similar criteria. All emphasize carcinogenicity, mutation, reproductive toxicity, and developmental toxicity (C, M, R, and D) in assessing a chemicals' overall level of concern. The Scivera CHA overall level of concern (or **grade**) of a chemical is its hazard category (HC), a color code system:

- Red
- Yellow
- Half-yellow half-green
- Green
- Gray

A chemical assigned a Scivera HC of red is considered a toxic substance (red is analogous to a GS® BM-1). The MWF project reported MWF chemicals that received a Scivera HC of gray to be of unknown toxicity (analogous to GS® BM-UNK). MWF chemicals that got a Scivera overall grade of yellow, half-yellow half-green, or green are considered preferred by this MWF project's scoring system, although Scivera' description (like EPA's Safer Choice and GS®) have more refined levels of concern.

This project's simplification differs from the level of concern description used by Scivera and Greenscreen out of machinist (end user) necessity, discussed shortly.

An example of how an MWF product was toxicity scored in this MWF project is the fictitious metalworking fluid named MWF XYZ below. The example shows how the Scivera HC color grade of each chemical and SDS weight percent are converted into the percent toxic, percent preferred, percent unknown score, and what is to be shown to machinists in the Metalworking Fluid by Score. CASRN and associated HC colors are fictitious.

Table 1: Example metalworking fluid XYZ safety data sheet, Section 3.

CASRN	As used weight percentage	Scivera database HC results
123-45-6789	20%	Red (analogous GS® BM-1)
9876-543-21	16%	Half-yellow half green (GS® BM-3)
6666-66-666	15%	Yellow (GS® BM-2)
22-33-44	6%	Red (GS® BM-1)
11-111-111	3%	Gray (GS® BM-UNK)
Water	2%	Green (GS® BM-4)

Note: All other MWF XYZ ingredients are proprietary and, as per CFR, not disclosed because they are not required to be disclosed.

Showing the above result for 40 different MWFs to a machinist trying to pick out an alternative MWF would overwhelm them with new terminology and data. The goal of the MWF project was to enable the machinist to choose the safest, not DW, metal fluid that works without needing to learn toxicology. Most machinists do not want to take the time to learn chemical hazard assessment or toxicology—they are busy being machinists. Toxicologists are not this project's end user target audience, although they are welcome to look at the project's supporting data.

The above results for **Product Name: Metalworking Fluid XYZ** are converted into three terms a machinist would need to know:

- Weight percent of toxic substances in the MWF.
- Weight percent of preferred (safer) substances.
- Weight percent of unknown substances.

The sum of all three always add up to 100 percent.

Weight percent of metalworking fluid XYZ:

- **Toxic substances** add together all Scivera red HC weight percentages.
- **Preferred substances** add together all Scivera yellow and yellow-green HC weight percentages and EPA Safer Choice Ingredient List (SCIL) percentages.
- **Unknown substances** is 100 percent minus the percent of toxic substances and percent of preferred substances.

For metalworking fluid XYZ this looks like:

- Weight percent of toxic substances in XYZ is 20 plus 6, which equals 26%.
- Weight percent of preferred substances in XYZ is 16 plus 15 and 2, which equals 33%.
- Weight percent of unknown substances in XYZ is 100 minus 26 and 33, which equals 41%.

If metalworking fluid XYZ was reported in Metalworking in Metalworking Fluid by Score, it would look like this:

Table 2: Example metalworking fluid on Metalworking Fluid by Score.

Name	% Toxic substances	% Unknown substances	% Preferred substances
MWF XYZ	26	41	33

If a chemical is on EPA's SCIL list and used as suggested, it is a preferred chemical irrelevant of its Scivera or GS® score.

Limitations of Safety Data in the Metalworking Fluid by Score

The Metalworking Fluid by Score is derived from chemical hazard assessments (CHA) data, not exposure risk assessment. Emphasis is on avoiding MWFs with toxic chemicals rather than avoiding MWFs based on the evaluation of risk-based exposure. Each approach has strengths and weaknesses.

After-use toxicity concerns

Some of the chemicals in a MWF change with use, especially in water-based MWFs. Machine cutting heads generate extreme heat and pressure, which will cause MWF chemical change over time. Bacterial and fungal decomposition byproducts and the oils, dirt, and metals removed from the metals being machined add new chemistry to the MWF. Way oils from the machines end up in the MWF. Dust and dirt and fall in. All these things cause chemical changes in the MWF. This project does not consider the associated after-use toxicity concerns.

SDS challenges

For most MWFs evaluated in this project, the only information available to Ecology came from each manufacturer's SDS. Two manufacturers provided additional chemical information; some manufacturers did not disclose any of the ingredients in their product—their SDS Section 3 reported zero percent by weight of the ingredients CASRN. A chemical cannot be hazard-assessed without a CASRN.

This resulted in some MWF products being 100 percent unknown substances by weight and zero percent preferred "safer" substances. Our Pollution Prevention Practices for Metal Machining publication[20] recommends that, when selecting an MWF alternative, **you use the lowest weight percentage of unknown chemicals in your MWF as possible because unknown substances are potentially toxic.**

Manufacturers usually state as few chemicals as required on their SDS (Appendix D). This is understandable from a perspective focused on protecting trade secrets, but regrettable from a perspective focused on safety and transparency. An MWF product with a high percentage of unknown substances by weight would be acceptable if it was required that all chemicals be thoroughly CHA safety tested before use. This is not the case. More chemicals in industrial use are poorly tested or not tested at all than those tested properly.

Manufacturers are required to search all available scientific literature and seek other evidence concerning potential chemical hazards. If a chemical has no test data available, there is no requirement to test a chemical to determine how to SDS-classify its hazards. Untested

[20] Available in mid-to-late 2021: https://apps.ecology.wa.gov/publications/SummaryPages/2104006.html

chemicals are assumed "safe" and need not be listed on the SDS. Testing is incredibly expensive and takes years to complete, which can be at odds with business profit objectives.[21]

Performance and safety tradeoffs

Many MWF manufacturers are doing the best job they can to use the safest chemicals possible that get the job done. There are tradeoffs between performance and safety—some of the most toxic chemicals perform wonderfully without the performance baggage of safer chemicals.

Using water is a good example. It is the safest chemical and it has great cooling properties. However, as soon as you formulate with water, the MWF becomes subject to bacterial and microbial degradation.

Water does not lubricate well, which requires lubricant additives, biocides and corrosion inhibitors and emulsifiers, or surfactants—all of which may have toxicity baggage. Water-based MWFs also have more involved maintenance issues, such as keeping water within proper use range (for example, 19 parts water to one part MWF concentrate).

Straight oils do not have the biological issues prevalent with water and fluid upkeep is simpler, but they do not cool as well. The specific application and machinist decide what works best and the MWF manufacturers try to make a product that meets their needs.

This can leave manufacturers using chemicals that perform adequately with some toxicity concern, but with less toxicity as the high performing chemical of choice. Manufacturers must be careful about disclosing CHA information because they do not want to put their product at a competitive disadvantage. Revealing a chemical's toxicity when not required may put a manufacturer at a competitive disadvantage to a competitor that does not.

Manufacturer formulation decisions

The safety conservative course of action for a manufacturer using untested chemicals would be to use only chemicals that have a long history of use with little or no health or environmental impact. Practical considerations sometimes make this difficult to do (e.g., cost and functionality).

This is being done as is evident by some MWF manufacturers formulating with vegetable oils, such as canola oil. Canola oil has not been well tested from a CHA perspective, but has a long history of safe use.

Some MWF manufacturers are using synthetic chemicals made from natural gas, which is suspected (but for the most part not proven) to avoid toxicity issues associated with petroleum distillates. Limited toxicity data prevents drawing definitive conclusions.

Many manufacturers use EPA's Safer Choice Ingredient List (SCIL) chemicals as much as practical.

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[21] The federal regulations that describe the requirements for a chemical to be SDS-listed are the Hazard Communication Standard (HCS) 29 CFR 1910.1200. MWF-relevant excerpts of 29 CFR 1910 are in Appendix D.

Scoring limitations

Other limitations of the Metalworking Fluid by Score include not being able to include a strongly suspected toxic substance into a score calculation because:

- The CASRN is listed in the SDS, but no weight percentage is given.
- The CASRN is not listed in the SDS, but the compound class is known to be toxic.
- It has not been tested or it is present at less than 1% or 0.1% for carcinogens.

A toxicologist might argue that the MWF project's definition of **preferred substances** is used too loosely. Scivera and Greenscreen chemical hazard assessments offer a much finer distinction for chemicals than this project's use of toxic, preferred, and unknown.

The use of **toxic** to describe Scivera red HC (Greenscreen BM-1) chemicals would not be challenged by a toxicologist.

Grouping Scivera yellow (BM-2), yellow-green (BM-3) and green (BM-4) all together and calling them **preferred** could generate passionate discussion. The real description of Scivera yellow (equivalent Greenscreen BM-2) is that the chemical has some toxicological concerns. A yellow chemical is much better than a red BM-1 chemical. Yellow is better than red, but one should continue looking for a better chemical.

The real description of Scivera yellow-green (GS® BM-3) is, "Better than yellow (BM-2), an acceptable chemical not as good as Green (BM-4)." Green (BM-4) chemicals are outstanding, but very few in number. Often you may not find a chemical that does the job better than the yellow one being used. Many EPA SCIL chemicals are yellow BM-2. If there was a safer chemical to use, and EPA knew about it, they would put it on the SCIL.

Losing the finer level of concern distinctions (and the inherent complexity) is the tradeoff for making the alternatives list user friendly for the machinist target audience. The alternatives list tells the machinist what MWFs have the highest percent toxics and what MWFs have too much weight percent unknowns. If a machinist wants to dig deeper into the toxicology, they may contact Ecology[22] for the information for free. Most, if not all, probably never will.

[22] https://ecology.wa.gov/contact

Conclusions

Project summary

The MWF project developed a list of safer, non–dangerous waste straight oil and water-based metalworking fluids to help Washington state machine shops find alternatives to dangerous waste metalworking fluids they may be using. The list is composed only of MWFs currently used in the state as a means of addressing alternatives assessment concerns.

The MWF project created a way to take complex chemical hazard safety assessment information for a large number of products containing many different chemicals and put the information into a user-friendly format for its intended audience (machinists) while remaining scientifically and regulatory defensible. The project developed a way for Ecology to get a large amount of CHA data quickly and inexpensively, which may help other projects—such as the search for PBT alternatives.

Some manufacturers expressed interest and participated in the project (Qualichem and Blaser Swiss Lube), but most did not. Companies that participated did so to obtain competitive advantage and they were successful in this. Many of the benefits to them included:

- Adding more competitive products.
- Improving their ratings (how high up their products are listed) by reducing weight percentages of toxic and unknown substances.
- Questioning CHA results.
- Updating their SDS.
- Deleting products that are no longer sold.
- Providing proprietary CHA data using Scivera's NDA capability.

Their participation improved their products rating and brand image, and also strengthened the quality of Ecology's final product.

Ecology learned a lot from Blaser, Qualichem, Scivera, and other manufacturers. For example:

- Hydrotreating petroleum distillates to eliminate carcinogenicity from aromatic petroleum distillates is the defacto standard for all MWFs, except probably low-grade imports.
- Synthetic lubricants made from natural gas are found in high-end synthetics. They probably have superior properties and are suspected to have lower toxicity at greater cost.
- Vegetable oils, such as canola oil and natural gas–derived synthetic oils, are used in some straight oil metalworking fluids.
- Many manufacturers are already trying to formulate their MWFs using safer chemicals. The number of EPA Safer Choice Ingredients chemicals used in their MWF formulations is not accidental.

Project communication

The Metalworking Fluids by Score will be communicated to the public in the fall 2021 issue of Shoptalk,[23] Pollution Prevention Practices for Metal Machining,[24] and Ecology compliance, pollution prevention, and technical assistance site visits.

Medium and large quantity generators

There were about 800 machine shops operating in Washington state in 2018. About 40–50 of them have or have had EPA/State Identification Numbers and are visited by Ecology compliance inspectors every 2–5 years because they are medium or large quantity generators. Most of these machine shops likely subscribe to Shoptalk.[25]

Small quantity generators

Most machine shops are small quantity generators (SQGs). Ecology usually does not visit SQGs unless there is a complaint. It is not known how many of the SQG machine shops subscribe to Shoptalk. It is suspected (for the above reasons) that many do not know the disposal requirements of the MWFs they use.

Many of these small machine shops are under the jurisdiction of King County. Pollution Prevention Assistance could visit the rest of Washington state's SQGs in a technical assistance capacity and share this information.

Project data use

Ecology staff must be careful about how they use Scivera data in future projects. The terms of agreement state that it is for internal Ecology use only, unless Ecology buys the rights to publish CHA data from Scivera for an additional fee. Scivera staff worked with Ecology and understood how Ecology was going to use Scivera data in the MWF project. Because of this contractual obligation, raw Scivera data was not published in Metalworking Fluids by Score. Ecology staff should not use Scivera's information unless they carefully read the Scivera terms of agreement first.

Scivera worked with Blaser Swiss Lube and Qualichem LLC on the project in a helpful, positive way.

Project next steps

An interesting but difficult follow up project would be to look at the toxicological properties of the MWFs after they have been used—especially the water-based MWFs. This would be difficult to do because of the complex nature of organic "bucket" chemistry, especially after heat, pressure, and microbiology has had the opportunity to change that chemistry. It would require testing, and it probably would be expensive to do.

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[23] Available beginning in October 2021: https://apps.ecology.wa.gov/publications/SummaryPages/2104003.html
[24] Available in mid-to-late 2021: https://apps.ecology.wa.gov/publications/SummaryPages/2104006.html
[25] http://ecology.wa.gov/shoptalk

It would be good to keep the Metalworking Fluids by Score current and allow manufacturers to add new products to the list. A Scivera subscription will be necessary to do this. A follow-up discussion with Scivera is needed to see if any MWF manufacturers became Scivera customers to enhance their product's formulation.

At the beginning of the MWF project, Ecology considered working with the Independent Lubricant Manufacturers Association. The decision was made to not work with the association because much of the project (such as the disposal of spent MWFs) is endemic to Washington state and only four of the 23 MWF manufacturers or suppliers in the state were members of the Independent Lubricant Manufacturers Association. Concern was that not all members of the association would be receptive to a safety review of MWF products. The fact that Blaser (one of the members) did actively participate makes follow up with the association plausible.

Publishing the chemicals safety portion of the Metalworking Fluids by Score in a national machining magazine (if there is interest) might further leverage manufacturers towards self-product evaluation and safe product design. Manufacturers that did not participate because of limited Washington state business exposure might become interested if they thought tens of thousands of U.S. machine shops could start looking at the safety of the ingredients in their MWFs.

Appendix A. The Metalworking Fluids by Score

Warning: Businesses in Washington state are ultimately responsible for the proper designation and disposal of the waste they generate. Improper use of this score (using the score without understanding its underlying assumptions and limitations) does not change your disposal responsibilities. Do not use the list until you understand it.

Want help or an explanation on using the list? Contact Rolfe Parsloe, rpar461@ecy.wa.gov.

Understanding disposal status

Businesses must know the **disposal status of their spent MWF** to properly manage and dispose of their spent MWF. The alternatives list shows the **unused product disposal status**. What is the difference between the two?

- Spent MWF has been used to depletion.
- Unused product is fresh out of the drum (diluted if water based).

Knowing the unused product disposal status can really help you pick an alternative MWF by screening out ones that are guaranteed to become dangerous waste (DW) when spent and identifying ones that will not be DW, **provided that you follow certain best management practices**. Businesses are ultimately responsible for proper designation and disposal of spent MWF because Ecology cannot control business management practices.

Ecology worked with MWF manufacturers to identify the chemicals and properties of their product MWFs. We used the information to designate and determine the disposal status of the MWFs as unused product. **Sometimes** the disposal status of an unused product is the same as the disposal status of the spent MWF.

The disposal status of an unused product MWF and the disposal status of a spent MWF **are the same** if:

- The disposal status of the unused product is DW. Then the disposal status of the spent MWF will be DW too. Avoid managing DW by avoiding MWFs with an unused product disposal status of DW.
- The disposal status of unused product is “used oil.” Then the disposal status of the spent MWF will be “used oil” as long as chlorinated tapping fluids are not used and spent MWF is not mixed with anything except other used oil. You risk making dangerous waste if do not follow these best management practices.

The unused product MWF disposal status and spent MWF disposal status **are not the same** if:

- The unused product disposal status is “not used oil” (it contains a vegetable or animal oil). MWFs with unused product status of “not used oil” must be fully designated under the Dangerous Waste Regulations (WAC 173-303, sections -070 through -100) to determine if it’s DW. Ecology review indicated that many of these MWFs appeared not to be DW before use, but could end up being DW depending on the contaminants they pick up on the way to becoming spent. Some (very few) were DW before use.

How to use the MWF by Score Alternatives List

What does all this mean to you? How should you use the Metalworking Fluids by Score to find a non DW MWF?

If you do all of the following, you will stop making dangerous waste MWF:

- Pick an MWF as high up the list as you can that has an unused product disposal status of "used oil."
- Do not use chlorinated tapping fluids.
- Do not mix spent MWF with anything except other used oil.

The fluids higher up the list means they contain fewer toxic substances for your workers to breathe and touch. We recommend you pick one with the lowest weight percentage of unknown toxic substances because unknowns may be toxic.

If you pick an MWF that is "not used oil," designate the MWF when spent. If you pick or use one that is DW, manage it as DW when spent.

Metalworking Fluids by Score Alternatives List

This score was last updated July 14, 2022.

Table 3: Water-based metalworking fluids found in Washington state.[26]

Metalworking Fluid Name	Unused Product Disposal Status	% Toxic Substances	% Unknown Substances	% Preferred Substances
Blaser Synergy 735[27]	Not used oil, not DW	0	0.6	99.4
Goodson SGC-10 (SDS: FG-550)[27]	Used oil	0	1.3	98.7
Blaser Blasocut 4000 STRONG[27]	DW WP01, WP02	0	1.5	98.5
Blaser Vasco 7000[27]	Not used oil, not DW	0	2.0	98.0
Qualichem Xtreme Cut 250C[27]	DW WP02	0	2.3	97.7
Blaser Blasocut 935 SW[27]	Not used oil, not DW	0	3.2	96.8
Qualichem Q-Cool 355D[27]	Used oil	0	3.2	96.8
Trimmicrosol585XT[28]	Used oil	0	4.7	95.3
Buckeye Lubricants #324-24NC[27]	Used oil	0	5.0	95.0
Hangsterfers-500CF German MWF[27]	Not used oil, not DW	0	5.0	95.0
Hangsterfers Semi Synthetic S-787[27]	Not used oil, not DW	0	5.0	95.0

[26] Sorted by percent toxic substances reported by manufacturer as being in product as used.

Metalworking Fluid Name	Unused Product Disposal Status	% Toxic Substances	% Unknown Substances	% Preferred Substances
Fuchs Ecocool S 761B[27]	Used oil	0	5.0	95.0
Syntillo 9918[27]	DW WP02	0.02	4.68	95.3
Blaser Blasocut 2000 CF SW[27]	Not used oil, not DW	0.03	0.97	99.0
Blaser Blasocut BC 35 NF[27]	Not used oil, not DW	0.05	0.95	99.0
Blaser Blasocut BC 35 SW[27]	Not used oil, DW WT02	0.05	0.95	99.0
Castrol Carecut S 130[27]	Not yet determined	0.05	4.05	95.9
Chevron Soluble B OIL[27]	Used oil	0.07	4.73	95.2
Qualichem Xtreme Cut 290[27]	Used oil	0.15	2.85	97.0
Qualichem EQO PURE 450[27]	Not used oil, not DW	0.15	4.35	95.5
Syntillo AL 30[27]	DW WT02	0.15	4.55	95.3
Castrol 311 Synkool SS[27]	Used oil	0.18	4.82	95.0
Cimstar Qualstar LF Pink[28]	Used oil	0.27	5.33	94.4
Lenox Band Ade[29]	DW WT02	0.5	7.5	92.0
Schaeffers Maxkool 411 SS[27]	DW WT02	0.58	3.02	96.4
Rustlick WS 5050[29]	DW WP01, WP02	1.0	2.4	96.6
Techcool 35052[27]	DW WP02	1.3	3.7	95.0
Xtreme Cut 291VLC[27]	DW WP01, WP02	1.5	3.3	95.2
Hocut 795 B[27]	Used oil	1.7	3.0	95.3
Cimcool Cimperial 1070B Blue[27]	DW WP01, WP02	1.7	0.6	97.7
Spirit 6000	DW WP02	3.1	0.75	96.15
SemiSpar HD[29]	DW WP01, WP02	3.25	2.3	94.45
Far West soluble Oil 2500[28]	DW WP01, WP02	4.3	3.2	92.5
Rustlick WS 1000[29]	DW WP01, WP02	?	10.0	90.0

[27] Water diluted 20:1, which is 19 parts water to 1 part concentrate.
[28] Water diluted 15:1, which is 14 parts water to 1 part concentrate.
[29] Water diluted 10:1, which is 9 parts water to 1 part concentrate.

Table 4: Straight oils and synthetics not mixed with water.

Metalworking Fluid Name	Unused Product Disposal status	% Toxic Substances	% Unknown Substances	% Preferred Substances
Blaser Blasogrind GTC7	Not used oil, not DW	0	2.0	98.0
Blaser Vascomill 10	Not used oil, not DW	0	3.0	97.0
Blaser Vascomill 22	Not used oil, not DW	0	4.0	96.0
Blaser Blasomill TLB	Not used oil, not DW	0	5.0	95.0
Blaser Blasogrind HC 5	Not used oil, not DW	0	8.0	92.0
Goodson Man845	DW WP01, WP02	0	5.0	95.0
Qualichem EQO-Max 712 MM	Not used oil, not DW	0	30.3	69.7
Qualichem EQO-Max 716	Not used oil, not DW	0	50.0	50.0
Hangsterfers Missile Lube	Not used oil, not DW	0	100.0	0
Goodson VG010 valve grinding oil	Used oil	0	100.0	?
EQO-Max 716	Not used oil, not DW	0	50.0	50.0
Blaser Blasomill GT 22	Used oil	5.0	13.0	82.0
Met-Cut 754HD	Not used oil, not DW	20.0	80.0	0
Lubricoolant 2050 AC	DW WT02	75.0	22.0	3.0
Rapid Tap Cutting Fluid 22 oil	DW WP01, WP02	85.0	15.0	0
Fuchs Ecocut 30EDM	Used oil	?	100.0	0
Smartcut	WP01	?	100.0	?

Appendix B. Manufacturers Selling MWFs in Washington State

The following manufacturers sell MWFs in Washington state and are included in the Metalworking Fluids by Score.

- Ashburn Industries
- Blaser Swisslube, Inc.[30]
- Buckeye Lubricants.
- Castrol Industrial North America, Inc.
- Chemcentral Corporation Dye and Pigment Div.
- Chevron Products Company[31]
- CIMCOOL® Industrial Products LLC[30]
- Dubois Chemicals
- Far West Oil Company, Inc.
- Fuchs Lubricants Co.
- Goodson Tool & Supply
- Hangsterfers Laboratories, Inc.
- Hartland Lubricants & Chemicals
- Houghton International
- ITW ROCOL or ITW Probrand
- Johnson Diversey Dubois Chemicals
- Lenox Tools
- Master Fluid Solutions[30]
- North American Tool
- QA Lubricants, Inc.
- QUALICHEM, Inc.
- Relton Corporation-Chemical Division
- Schaeffer Mfg. Company[30]
- Spartan Chemical Company, Inc.

[30] Independent Lubricant Manufacturers Association Manufacturing member.
[31] Supplier member.

Appendix C. Scivera's Chemical Hazard Assessment System Grading

SciveraLENS Human and Environmental Health Endpoints provided the following explanation for their chemical hazard assessment system grading.

SciveraLENS Rapid Screen generates an overall hazard assessment for each chemical present in a collection. SciveraLENS processes chemical hazard assessments using authoritative lists, regulatory lists, experimental data, modeled data, analogous data, and expert judgment.[32]

SciveraLENS Hazard Assessment Levels

SciveraLENS generates a hazard assessment at two levels for a chemical:

Endpoint Level Hazard Assessment

Data and/or expert judgment enables an assessment. Scivera's board-certified toxicology team generates a hazard assessment for up to:

- 16 human health endpoints.
- 4 Ecotox and environmental fate endpoints.
- 2 physical hazard endpoints.

Scivera Grading

A solid green, yellow, red, or black circle indicates sufficient authoritative or experimental evidence for an unequivocal hazard assessment.

When half of the circle is gray, this indicates limited evidence is available for the endpoint. Scivera's toxicologists used modeling software, quantitative structural activity relationship (QSAR) methods, and expert judgment to complete the assessment.

Table 5: Visual indicators and their meaning.

Visual Indicator	Meaning
	Green is good. Green signals an overall assessment for a chemical or a specific human or environmental health endpoint shows evidence of low hazard.
	Yellow is acceptable. Yellow signals an overall assessment for a chemical or a specific human or environmental health endpoint shows evidence of moderate hazard.
	Red indicates concern. Red signals an overall assessment for a chemical or a specific human or environmental health endpoint shows evidence of high hazard.

[32] See User Guide article SciveraLENS GHS+ Hazard Assessment Framework (https://www.scivera.com/scivera-ghsplus-framework) for specifics on Hazard and Dose-Response Assessment criteria by endpoint.

Visual Indicator	Meaning
	Black indicates high concern. Black signals an overall assessment for a chemical or a specific human or environmental health endpoint shows evidence of high hazard.
	The light blue and gray indicates an endpoint or chemical overall that does not show list evidence of concern, but after additional work by our toxicology team, we are not currently able to conclude an assessment. Data are currently not sufficient for an assessment.
	Light blue signals the endpoint does not show concern for the designated endpoint based on list evidence only, but a hazard assessment has not been completed for that chemical. It also indicates Scivera's toxicology team has this chemical and endpoint in its assessment queue for deeper review via the expert methods mentioned above (QSAR, expert judgment, etc.). Scivera prioritizes this additional review based on subscriber interest in chemicals across the SciveraLENS system.

Scivera also provided two summary assessments for human and environmental health screen results.

The **maximum hazard** (MH) result is based on the highest hazard assessment for each chemical in the collection. We look across all human endpoints and a combination of environmental health endpoints for each chemical.

The **hazard category** (HC) score is based on an algorithm very similar to EPA's Safer Choice, which uses core endpoints (CMRD/PBT) and supplemental endpoints (all the rest), and suggests:

- Replace (red light)
- Concern (yellow light)
- Acceptable (yellow-green)
- Preferred (green)
- Incomplete (gray)

Appendix D. SDS Requirements for Manufacturers

Manufacturers usually state on an SDS as few chemicals as they are allowed to do so under federal regulation. This protects trade secrets and product formulation from piracy.

The following is taken in part from 29 CFR 1910:

> MWFs that are composed of a mixture of chemicals: manufacturers must list a chemical on the SDS if the chemical has been determined to be health hazard which comprise 1% or greater of the composition, carcinogens if the concentrations are 0.1% or greater; and all ingredients which have been determined to be health hazards, which comprise less than 1% (0.1% for carcinogens if there is evidence that the ingredients could be released from the mixture in concentrations which would exceed an established OSHA (PEL) or ACGIH Threshold Limit Value, or could present a health risk or physical hazard to employees.

Hazardous chemicals are defined as any chemical that is classified as a physical hazard or a health hazard (e.g., simple asphyxiant, combustible dust, or pyrophoric gas).

Health hazard is defined as a chemical that is classified as posing one of the following hazardous effects:

- Acute toxicity (any route of exposure).
- Skin corrosion or irritation.
- Serious eye damage or eye irritation.
- Respiratory or skin sensitization.
- Germ cell mutagenicity.
- Carcinogenicity.
- Reproductive toxicity.
- Specific target organ toxicity (single or repeated exposure).
- Aspiration hazard.

Manufacturers are required to search all available scientific literature and other evidence concerning chemical potential hazards. If a chemical has no test data available, there is no SDS requirement to test a chemical to determine how to classify its hazards.

These requirements do not apply to many products and substances. Examples include insecticides, TSCA substances, and many drugs and foods. Consult 29 CFR 1910 for a more complete list of the CFRs that apply to these products.

Appendix E. Acronyms and Abbreviations

CASRN: Chemical abstract service number

CFR: Code of Federal Regulations

CHA: Chemical hazard assessment

C, M, R, and D: Carcinogenicity, mutagenicity and genotoxicity, reproductive toxicity, and developmental toxicity

CRO: Ecology's central regional office

DMSO: Dimethyl sulfoxide

DW: Dangerous waste

EC: Equivalent concentration, see WAC 173-303-100

Ecology: Washington State Department of Ecology

EPA: U.S. Environmental Protection Agency

ERO: Ecology's eastern regional office

GS: Greenscreen

HC: Hazard category

HCS: Hazard communication standard

HOCs: Halogenated organic compounds

LC-50: Lethal concentration 50%—kills 50% of the test population.

LD-50: Lethal dose 50%—kills 50% of the test population.

MH: Maximum hazard

MWF: Metalworking fluid

NDA: Non-disclosure agreement

NWRO: Ecology's northwest regional office

PBT: Persistent bioaccumulative toxic

PPA: Pollution Prevention Assistance

PPM: Parts per million

QSAR: Quantitative structural activity relationship

RTECS: Registry for Toxic Effects of Chemical Substances

Safer Choice: EPA’s product certification and labeling program

SCIL: EPA's Safer Choice Ingredient List

SDS: Safety data sheets

SWRO: Ecology's southwest regional office

TCLP: Toxicity characteristic leaching procedure

WAC: Washington Administrative Code