

# Aqueous Film-Forming Foam Collection and Disposal Program: Draft Programmatic Environmental Impact Statement

## Appendix A.1, Part 3: DNS Public Comments Received



### Publication Information

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***Re: Comments on the September 1, 2020 Aqueous Film Forming Foam Collection, Transport, and Incineration Program by Washington Department of Ecology***

On behalf of the Sierra Club and Earthjustice, we thank the Department of Ecology for the opportunity to comment on its proposed plans for the management of Aqueous Fire Fighting Foams (AFFF) made from per- and polyfluoroalkyl substances (PFAS).

We commend the Department's leadership in addressing the threat of PFAS chemicals broadly and the significant resources the state has committed to getting PFAS-based AFFF out of use and removed from fire stations. Washington's investment in timely containment of AFFF is a model that we hope other states follow.

Yet we have serious concerns about Ecology's proposal to send its collected AFFF to an out-of-state hazardous waste incinerator for combustion. Our review of the scientific literature suggests that, instead of destroying PFAS, incineration risks redistributing these highly persistent chemicals and breakdown products into the atmosphere and back into circulation in the environment. This would simply transfer the harmful chemicals in AFFF from the firehouses of Washington to the air of Utah and beyond.

The environmental and health impacts from incineration are not fully addressed in Ecology's State Environmental Policy Act (SEPA) analysis or its proposed Determination of Nonsignificance (DNS). However, there is an available alternative that would realize the Department's objectives of PFAS collection and management without the adverse effects of incineration. We urge Ecology not to incinerate its collected AFFF but to instead arrange for limited-term storage of that foam at a permitted storage facility while safer disposal technologies are developed and validated to be used nationally. Our specific concerns and recommendations are discussed in more detail below.

**1. Using Incineration Technology for PFAS Is Dangerous and Poorly Studied.**

Existing incineration technologies are not proven to destroy PFAS chemicals and there is significant evidence that they lead to releases of dangerous products. Moreover, there are not yet

basic methods to reliably determine what is released from an incinerator after PFAS chemicals are put through it.

The United State Environmental Protection Agency (EPA) recently acknowledged risks and data gaps related to PFAS incineration that cast doubt upon the conclusion that incinerators will destroy PFAS compounds:<sup>1,2</sup>

- PFAS incineration studies are incomplete due to the lack of necessary measurement methods;
- The effectiveness of PFAS incineration and type of combustion byproducts generated are not well understood;
- Fluorinated compounds are more likely than other halogenated compounds to recombine during the incineration process to form products of incomplete combustion.

The Department of Defense (DOD) has acknowledged a similar set of issues. In a 2017 grant solicitation for research into alternative destruction methods, DOD cited key challenges with incineration that included "... no precedent to predict products of pyrolysis or combustion, temperatures at which these will occur, or the extent of destruction that will be realized," and cautioned that, "many likely byproducts will also be environmentally unsatisfactory -- e.g., any volatile perfluoroalkane will be a greenhouse gas -- or toxic... ."<sup>3</sup>

While there is a compelling need to collect PFAS-based AFFF to prevent exposures and further releases, the lack of validated methods to destroy the chemicals presents challenges for states like Washington. The need for effective destruction methods is widely recognized. EPA recently announced a design challenge to speed the development of non-incineration methods to destroy unused AFFF.<sup>4</sup> For its part, the Department of Defense has been actively funding research into non-incineration destruction techniques for PFAS-based fire fighting foams for years.

The EPA also claims to be working to develop and validate the analytical methods that will allow it and others to reliably measure PFAS and breakdown products in air and other media. Such tools are essential to allow regulators to determine whether the extremely strong carbon-fluorine bonds in PFAS can be broken in the conditions of a hazardous waste incinerator, and whether emissions controls can trap and remove byproducts. Until these methods are available there is no way to substantiate that incinerators like Clean Harbors Aragonite can effectively destroy the compounds.

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<sup>1</sup> EPA, *Per- and Polyfluoroalkyl Substances (PFAS): Incineration To Manage PFAS Waste Streams Technical BRIEF: Innovative Research for a Sustainable Future* (Feb. 2020), [https://www.epa.gov/sites/production/files/2019-09/documents/technical\\_brief\\_pfas\\_incineration\\_ioaa\\_approved\\_final\\_july\\_2019.pdf?wpmobileexternal=true](https://www.epa.gov/sites/production/files/2019-09/documents/technical_brief_pfas_incineration_ioaa_approved_final_july_2019.pdf?wpmobileexternal=true).

<sup>2</sup> Marc Mills et al., *Thermal Treatment of PFAS in Environmental Media: A Review of the State-of-the-Science* (Feb. 25, 2020), [https://cfpub.epa.gov/si/si\\_public\\_record\\_Report.cfm?dirEntryId=348571&Lab=CESER](https://cfpub.epa.gov/si/si_public_record_Report.cfm?dirEntryId=348571&Lab=CESER).

<sup>3</sup> SBIR, Department of Defense, *Solicitation Number DoD 2017.B STTR: AFFF Disposal*, Topic No. AF17B- T001 (Apr. 21, 2017), <https://www.sbir.gov/sbirsearch/detail/1254657>.

<sup>4</sup> EPA, EPA, U.S. Department of Defense, and State Partners Launch Technical Challenge Seeking Innovative Ways to Destroy PFAS in Firefighting Foam (Aug. 25, 2020), <https://www.epa.gov/newsreleases/epa-us-department-defense-and-state-partners-launch-technical-challenge-seeking>.

## **2. Existing Data Shows the Formation of Dangerous Byproducts From PFAS Incineration.**

We reviewed published studies related to PFAS breakdown at high heat. Scientists are plagued by measurement challenges—studies have unacceptably high detection limits and/or analyze for just a limited number of potential breakdown products. Even so, several of the studies Ecology cites as proof of justification for incineration actually detected the formation of potent greenhouse gases, carbon tetrafluoride and hexafluoroethane.<sup>5,6</sup>

We have identified the shortcomings of industry-sponsored incineration research and available evidence from other peer-reviewed experimental studies. Collectively, the data suggest that some PFAS can break down at high heat but more sensitive methods will be needed to ensure that incineration results in a high level of thermal destruction.<sup>7</sup> The PFAS form a wide range of fluorochemicals with varied physical and chemical qualities. In addition to the one- and two-carbon greenhouse gases, these also include fluorinated acetic acids, dioxins and furans. Even complete destruction or “mineralization” of PFAS would convert all fluorine to hydrogen fluoride which is highly caustic and corrosive, in addition to being acutely toxic to people.

Much of the published incineration research for PFAS has been done at bench scale using just milligrams of starting materials, and in optimized temperature and handling protocols. These findings must be replicated at an operational scale.

**See Appendix A for a detailed review of the peer reviewed literature relating to the safety and effectiveness of thermal treatments to destroy PFAS chemicals.**

## **3. Commercial Hazardous Waste Incinerators Like Clean Harbors Aragonite Will Not Achieve the Idealized Conditions of Experimental Studies.**

The facility that the Department of Ecology has proposed to use for PFAS incineration has a history of operational and compliance issues, and the operating parameters proposed by the Department are beyond the permitted capability of this facility.

Commercial hazardous waste incinerators are plagued by compliance violations and safety issues. The Clean Harbors Aragonite facility is no exception, with several recent permit violations that should raise red flags.

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<sup>5</sup> Philip Taylor & Tak Yamada, *Final Report – Laboratory-Scale Thermal Degradation of Perfluoro-Octanyl Sulfonate and Related Precursors* (May 2003), <https://clu-in.org/download/contaminantfocus/pfas/UDR-TR-03-00044.pdf>.

<sup>6</sup> Tak Yamada et al., *Thermal Degradation of Fluorotelomer Treated Articles and Related Materials*, 61 *Chemosphere* 974–84 (Nov. 2005), <https://doi.org/10.1016/j.chemosphere.2005.03.025>.

<sup>7</sup> Tasha Stoiber, et al., *Disposal of products and materials containing per- and polyfluoroalkyl substances (PFAS): A cyclical problem*, 260 *Chemosphere*. (Sept. 2020), <https://www.sciencedirect.com/science/article/pii/S0045653520318543>

Ecology shared the results of the most recent safety inspection, in which Aragonite was cited for mishandling of harmful compounds like mercury and PCBs, and violations related to bypassing the emissions control equipment.<sup>8</sup>

Even the design parameters for the proposed facility are outside what is already established to be a minimum requirement for any treatment for PFAS.

The temperature and holding times that Ecology will mandate for incineration of PFAS wastes are at the outer edge of operating conditions for the Aragonite incinerator. In its Determination of Nonsignificance, Ecology says it will require Clean Harbors to “expose the PFAS foam to temperatures in excess of 1000°C with hold times of two seconds or more.”<sup>9</sup> However, in a September 2020 meeting Ecology indicated it will require temperatures of 1300°C and a two-second residence time in the afterburner. EPA indicates that temperatures in excess of 1400°C are needed to destroy carbon tetrachloride, which is a potent greenhouse gas.<sup>2,10</sup>

Our technical consultant suggests that it could require a change to the facility’s operating permit to achieve temperatures of 1300°C, as Ecology suggests it will require. Aragonite’s operating permit indicates that the facility has been granted a waiver to operate at lower temperatures when incinerating PCBs, which causes further concern.<sup>11</sup> EPA has waived the requirement of a temperature of 1200°C (2192°F) at the afterburner exit to “allow a waste feed cutoff if the temperature drops to less than [1092°C] for more than 60 seconds.”<sup>12</sup>

#### **4. Incineration Poses a Threat to the Adjacent to the Skull Valley Goshute Reservation.**

The Aragonite incinerator is also located adjacent to tribal lands of the Skull Valley Goshute Reservation. Residual PFAS and toxic byproducts in waste ash will be shipped to the Grassy Mountain hazardous waste landfill south of the incinerator and reservation for perpetual storage and management. The region is heavily impacted by toxic industries, including a nerve agent storage site. Ecology has not considered the tribal impacts and environmental justice implications of its actions.

#### **5. The Department’s Proposed PFAS Incineration Requires Additional SEPA Analysis**

When enacting SEPA, the state legislature declared the protection of the environment to be a fundamental state priority.<sup>13</sup> SEPA provides that “[t]he legislature recognizes that each person

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<sup>8</sup> EPA Enforcement and Compliance History Online, Facility Report for Clean Harbors Aragonite, LLC, <https://documents.deq.utah.gov/waste-management-and-radiation-control/facilities/clean-harbors/aragonite/DSHW-2014-018229.pdf> (last visited October 1, 2020).

<sup>9</sup> Washington Dep’t of Ecology, *SEPA Determination of Nonsignificance* (Sept. 1, 2020), <https://apps.ecology.wa.gov/separ/Main/SEPA/Record.aspx?SEPANumber=202004521>.

<sup>10</sup> Washington Ecology, *Per- and polyfluoroalkyl Substances (PFAS) Disposal Considerations* (June 30, 2020).

<sup>11</sup> Clean Harbors Aragonite, LLC, *Permit Module 5 – Incineration* (Apr. 1, 2020), <https://documents.deq.utah.gov/waste-management-and-radiation-control/facilities/clean-harbors/aragonite/DSHW-2019-004179.pdf>.

<sup>12</sup> Clean Harbors Aragonite, LLC, *Attachment 17: Waste Management Plan for Polychlorinated Biphenyls* (June 19, 2013), <https://documents.deq.utah.gov/waste-management-and-radiation-control/facilities/clean-harbors/aragonite/DSHW-2013-008874.pdf>.

<sup>13</sup> Wash. Rev. Code § 43.21C.010.

has a fundamental and inalienable right to a healthful environment and that each person has a responsibility to contribute to the preservation and enhancement of the environment.”<sup>14</sup> This policy statement “indicates ... the basic importance of environmental concerns to the people of this state.”<sup>15</sup> At the heart of SEPA is a requirement to fully analyze the environmental impact of government decisions that have a significant impact on the environment.<sup>16</sup>

Under SEPA, an environmental impact statement (EIS) is required if a government action has a significant effect on the quality of the environment.<sup>17</sup> An action has a significant environmental effect, and thus requires an EIS, if it presents a “reasonable likelihood of more than a moderate adverse impact on environmental quality.”<sup>18</sup> To determine whether an EIS is needed, agencies make a “threshold determination” of environmental significance, often guided by a SEPA checklist.<sup>19</sup> If, in reviewing a project, the agency concludes that there “will be no probable significant adverse environmental impacts from a proposal,” it may issue a Determination of Nonsignificance (DNS) and proceed without further review.<sup>20</sup> In contrast, if a threshold determination concludes that the project “may have a probable significant adverse environmental impact,” the agency must mitigate that impact or conduct a full EIS.<sup>21</sup>

Here, Ecology prepared a SEPA checklist and proposed a DNS for its AFFF Collection Program. However, the record does not support that determination. First, Ecology concedes that it lacks sufficient information to adequately evaluate the effects of PFAS incineration. Second, the limited information that is available indicates a reasonable likelihood of serious impacts from PFAS incineration. Finally, while Ecology compared PFAS incineration to two alternatives (land disposal and indefinite, on-site stockpiling of AFFF), Ecology failed to consider temporary, off-site storage at its selected disposal facility—an available alternative that would achieve the objectives of Ecology’s proposed action with far fewer adverse environmental impacts. Ecology should pursue that commercial storage alternative, which would avoid the significant impacts associated with incineration and obviate the need for an EIS.

A. Ecology lacks sufficient information about PFAS incineration to support its DNS

As previously described, Ecology lacks sufficient information about the effects of PFAS incineration to meaningfully evaluate the consequences of its AFFF Collection Program and to make a Determination of Nonsignificance. EPA—the federal agency charged with regulating the incinerator at issue—has warned that “the effectiveness of incineration to destroy PFAS compounds and the tendency for formation of fluorinated or mixed halogenated organic byproducts is not well understood.”<sup>1</sup> The absence of this information is the result of inadequate testing; to date, “[f]ew experiments have been conducted under ... conditions representative of field-scale incineration,” and the studies that do exist “have been incomplete due to lack of necessary measurement methods suitable for the comprehensive characterization of fluorinated

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<sup>14</sup> *Id.* § 43.21C.020(3).

<sup>15</sup> *Leschi Imp. Council v. Wash. State Highway Comm’n*, 84 Wash. 2d 271, 279–80 (Wash. 1974).

<sup>16</sup> Wash. Rev. Code § 43.21C.031(1).

<sup>17</sup> Wash. Admin. Code § 197-11-330.

<sup>18</sup> *Id.* § 197-11-794(1).

<sup>19</sup> Wash. Rev. Code § 43.21C.033.

<sup>20</sup> Wash. Admin. Code § 197-11-340(1).

<sup>21</sup> *Id.* § 197-11-360(1).

and mixed halogenated organic compounds.”<sup>21</sup> The Department of Defense—the nation’s largest user of AFFF—has similarly warned that “there is no precedent to predict products of [AFFF] combustion.”<sup>23</sup> Yet Ecology did not attempt to fill these data gaps before proposing the incineration of more than 30,000 to 40,000 gallons of AFFF, the effects of which Ecology admits are “not well studied.”<sup>22</sup>

These data gaps are fatal to Ecology’s DNS, which must be “based on information sufficient to evaluate the proposal’s environmental impact.”<sup>23</sup> SEPA thus requires agencies to gather necessary information, so their decisions are “shape[d] ... by deliberation, not default.”<sup>24</sup> Because Ecology lacks sufficient information to determine the likely byproducts of its PFAS incineration—which, as described above, may include toxic chemicals and potent greenhouse gasses—it cannot support a DNS and must prepare a full EIS. Although SEPA permits agencies to proceed despite the absence of certain information where “the costs of obtaining [the missing information] are exorbitant” or “the means to obtain it are speculative or not known,” Ecology has not made either of those findings in its DNS.<sup>25</sup> Nor has Ecology provided a “worst case analysis” to compensate for the absence of information, as required by its SEPA regulations.<sup>26</sup> Instead, Ecology improperly presumes the absence of impacts from the absence of information and proposes a DNS that its analyses cannot support.

B. PFAS incineration presents a reasonable probability of significant environmental impacts

The limited information that is available on PFAS incineration confirms the existence of risks that preclude the issuance of a DNS. Under SEPA, Ecology can issue a DNS only if it “determines there will be no probable significant adverse environmental impacts from a proposal.”<sup>27</sup> Here, Ecology cannot make that finding, because its SEPA checklist confirms the “reasonable likelihood of more than a moderate adverse impact on environmental quality.”<sup>28</sup>

According to Ecology, AFFF incineration “can produce air emissions” which “deposit[] upon the land and surface water.”<sup>22</sup> “The deposition can then be taken up by biota including humans, potentially negatively impacting their growth and development.”<sup>22</sup> The potential emissions from PFAS incineration include carbon tetrafluoride (a potent greenhouse gas with more than 6,000 times the global warming potential of carbon dioxide), fluoroform (a potent greenhouse gas with more 12,000 times the global warming potential of carbon dioxide), perfluoroisobutylene (a toxic chemical that has been used as a chemical warfare agent), hydrogen fluoride (a highly toxic chemical that can damage lung tissue and cause severe burns), and other PFAS chemicals.<sup>22,3</sup>

<sup>22</sup> Washington Dep’t of Ecology, *SEPA Environmental Checklist: Ecology AFFF Collection Program* (July 2016), <https://apps.ecology.wa.gov/separ/Main/SEPA/Record.aspx?SEPANumber=202004521>.

<sup>23</sup> *Coal. to Protect Puget Sound Habitat v. Pierce Cty.*, 2012 WL 3577481, at \*9 (Wash. Shore. Hrg. Bd. July 13, 2012); see also *Pease Hill Cmty. Grp. v. Cty. of Spokane*, 62 Wash. App. 800 (Wash. Ct. App. 1991).

<sup>24</sup> *Klickitat Cty. Citizens Against Imp. Waste v. Klickitat Cty.*, 122 Wash. 2d 619, 640 (Wash. 1994), amended 866 P.2d 1256 (Wash. 1994) (citation omitted).

<sup>25</sup> Wash. Admin. Code § 197-11-080(3).

<sup>26</sup> *Id.*

<sup>27</sup> *Id.* § 197-11-340(1).

<sup>28</sup> *Id.* § 197-11-794.

Ecology does not dispute that the emission of greenhouse gasses, toxic chemicals, or PFAS would have “more than a moderate adverse impact on environmental quality.”<sup>29</sup> Therefore, the only question is whether those incineration byproducts are “reasonably likely,” as opposed to “merely speculative.”<sup>30</sup> Ecology does not answer that question, but the Department of Defense has stated that PFAS incineration is “likely” to produce “environmentally unsatisfactory ... or toxic” byproducts.<sup>3</sup> Moreover, the Environmental Protection Agency recently affirmed the “need for new non-thermal technologies that destroy PFAS, without generating hazardous byproducts” and established a prize for the development of alternatives to incineration.<sup>4</sup> The existence of that incentive itself is a further acknowledgment of the risks associated with PFAS incineration.

Instead of measuring the likelihood that PFAS incineration would result in environmental harm, Ecology erroneously asserts that “[i]ncineration is the only technology available now that can under appropriate conditions, process large volumes of AFFF foam [and] destroy the foam’s PFAS molecule.”<sup>22</sup> As described above, there is no evidence that incineration “destroys” PFAS chemicals, as opposed to altering their chemical structure and emitting new PFAS as byproducts of incomplete combustion. Moreover, PFAS incineration would require an EIS even if it were the best available treatment technology (and it is not), since the threshold determination under SEPA turns solely on the impacts of the proposed action, which here are likely to be significant. Therefore, if Ecology proceeds with the AFFF Collection Program in its current form, it must prepare an EIS.

C. Ecology failed to consider the reasonable alternative of commercial PFAS storage

There is a readily available alternative that could avoid the significant impacts associated with PFAS incineration and eliminate the need for an EIS, while still realizing the core objections of Ecology’s AFFF Collection Program. Instead of incinerating its PFAS-containing foam, Ecology could collect unused foam from fire stations across the state and temporarily store it at a permitted hazardous waste storage facility, such as the Clean Harbors Aragonite facility. In addition to its incineration capacity, that facility has “ample on-site storage capacity,” including “a bulk liquid tank farm (sixteen ~30,000 gallon tanks); container storage areas (~12,000 55-gallon drum capacity); direct burn tanker storage areas (~30,000 gallons total capacity); sludge storage tanks (~38,000 gallon total capacity); and bulk solids storage tanks (~1100 yd<sup>3</sup> total capacity).”<sup>31</sup> Use of that storage capacity would reduce the risk of accidental releases while Ecology, EPA, and others evaluate long-term treatment alternatives. Temporary commercial storage of AFFF is thus a “[r]easonable alternative,” which Ecology failed to consider in its SEPA Checklist.<sup>32</sup>

In its review of the AFFF Collection Project, Ecology did reject the alternative of “hold[ing] stockpiles [of AFFF] indefinitely until there is more research and consensus on how to best

<sup>29</sup> *Id.*

<sup>30</sup> *Id.* §§ 197-11-060(4)(a), 197-11-782.

<sup>31</sup> Clean Harbors, “Aragonite Incineration Facility,” <https://fr.cleanharbors.com/node/1156> (last visited Oct. 1, 2020); Utah Dep’t of Env’tl. Quality, “Aragonite Permit: Clean Harbors, LLC,” <https://deq.utah.gov/waste-management-and-radiation-control/aragonite-permit-clean-harbors-llc> (last updated Aug. 20, 2020).

<sup>32</sup> Wash. Admin. Code § 197-11-786 (defining “reasonable alternative” as “an action that could feasibly attain or approximate a proposal’s objectives, but at a lower environmental cost or decreased level of environmental degradation”).



dispose of PFAS waste streams” because incineration alternatives “are not yet feasible at a large scale.”<sup>22</sup> But the storage of AFFF need not be indefinite, and it can be conducted under controlled conditions that minimize the likelihood of a PFAS release. Moreover, commercial storage would allow EPA and others to develop additional information about the effects of PFAS incineration and alternative disposal technologies. EPA has stated that it plans to release a new method to measure PFAS air emissions over the coming months, and that it will release refined methods to measure products of incomplete PFAS combustion in the third quarter of 2021.<sup>33</sup> That soon-to-be-released information would help Ecology better understand the impacts of PFAS incineration and make an informed decision concerning different disposal options. There is no reason to rush into a poorly reviewed incineration alternative that presents a serious threat to public health and the environment.

## 6. Conclusion

For the foregoing reasons, we urge the Department of Ecology to temporarily store, as opposed to incinerate, the PFAS collected under the AFFF Collection Project.

Respectfully submitted,



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<sup>33</sup> EPA, *Status of EPA Research and Development on PFAS*, <https://www.epa.gov/chemical-research/status-epa-research-and-development-pfas#methods> (last updated July 17, 2020).

## **Appendix A**

A careful review of the scientific literature reveals gaps in assessing each of these outcomes for the incineration of PFAS waste. To ensure safe destruction of PFAS we need answers to three questions:

- 1. Are the original PFAS chemicals destroyed by the technology?**
- 2. What do they turn into?**
- 3. Does the output from the destruction process release any harmful chemicals into the environment?**

### **Are the original PFAS destroyed in incinerators?**

Washington Ecology cites several studies as proof of thermal breakdown of PFAS chemicals

- “[S]tudies in 2005 and 2014 showed that perfluorooctanoic acid (PFOA) was not measured at detectable levels after a 2 second residence time at 1000°C.” (Wash Ecology 2020 citing: Yamada 2005, Taylor 2014)
- “Additionally, research by 3M found that properly operating incineration systems do not release PFOS and C8 perfluorosulfonamides into the environment.” (Wash Ecology 2020 citing: Taylor 2003)

Both studies lack the sensitivity to ensure a high level of thermal destruction. Destruction efficiencies of 99.9999% are required for highly toxic wastes, like PCBs (USEPA 2019a). The 2003 and 2005 studies didn’t detect PFOS and PFOA, but had a detection limit of 0.1%, which means concentrations of up to 1,000 parts per million of PFOS or PFOA in air would not be detected under the conditions of this study.

A 0.1% failure rate could result in pounds of PFAS escaping into the air from the 30,000 to 40,000 gallons of PFAS fire fighting foam that Washington seeks to incinerate.

EPA is developing methods to measure individual PFAS chemicals at a higher level of sensitivity in air samples (USEPA 2020a).

### **What are the potential byproducts of PFAS incineration?**

The existing data fall short in assessing the types and quantities of chemicals formed during thermal treatments, and the hazard they may pose toward people and the environment.

Like other aspects of PFAS disposal, ensuring safety is challenging due to methodological limitations. As many scientists state, “There are no proven analytical technologies which have

been demonstrated to detect all potential fluoro-organic by-products,” (Horst 2020). Of particular concern are PFAS that get volatilized or transformed into volatile organofluorine compounds and escaped detection (Watanabe 2018).

Independent studies detect a range of concerning breakdown products in bench scale incineration studies. They include:

**Greenhouse gases** - The original studies promoted by Washington Ecology and others as proof of incineration effectiveness both measured several potent greenhouse gases and other breakdown products (Taylor 2003, Yamada 2005). In Taylor (2003) PFOS byproducts include: fluorobenzene, one- and two- carbon fluoroalkanes (tetrafluoromethane, fluoroform, and hexafluoroethane), and fluoroalkenes (1,1-difluoroethene and 1,2-difluoroethene).

Yamada (2005) heated PTFE (a polytetrafluoroethylene polymer) to a maximum of 1000C with a 2 second residency time, and detected one- and two- carbon fluorochemicals (fluoroform ion and fluoropropene ion). Concentrations of these breakdown products were estimated to be less than or equal to 1000 parts per million or 0.1%.

In addition to the industry studies, another by Garcia (2007) detected one-, two- and three-chain fluorochemical formation from the thermal degradation of PTFE at temperatures between 750 to 1050C.

The global warming potential of fluorine-containing byproducts is thousands of times more potent than carbon dioxide, which has a Global Warming Potential of 1 on this unitless scale (GGP 2016).

Chemical	Global Warming Potential over 100 year time horizon*
Carbon tetrafluoride (CF4)	6,630
Fluoroform (CHF3)	12,400
Hexafluoroethane (C2F6)	11,100
Perfluoropropane (C3F8)	8,900

\* the Global Warming Potential of carbon dioxide is 1.

**Fluorinated acetic acids** - mono-, di-, and tri-fluoroacetic acids are common thermal breakdown products of PTFE, particularly at lower heats (Ellis 2001). They are toxic to aquatic ecosystems and widely detected in the atmosphere and in precipitation. Some scientists suggest they may be partially responsible for pulmonary edema seen in workers at PTFE plants (Garcia 2007).

**Dioxins and furans** - Dioxins and furans can be formed in municipal solid waste incinerators when PFAS are incinerated alongside other wastes. (Merino 2016, citing Tupperainen 1998 and McKay 2002). Methodological constraints hinder monitoring for dioxins and furans in other PFAS incineration studies (Aleksandrov 2019).

**Un- or partially-reacted PFAS** - EPA lists “shorter chain PFAS, partially fluorinated PFAS, and defunctionalized perfluorinated carbon chains” as other potential thermal by-products (USEPA 2020a). Short-chain polyfluorinated alkyl acids require higher temperatures to achieve thermal destruction than long-chain acids (Watanabe 2016). Wang tested for PFAS in air at two municipal solid waste incinerator facilities in China. They reporting higher concentrations of PFOA in air at the incinerator sites compared to an upwind site, while fluorotelomer concentrations were comparable across all samples (Wang 2020).

**Hydrogen fluoride** - The complete liberation of fluorine from carbon sources in the incinerator would produce hydrogen fluoride, an acutely toxic and corrosive gas. Hydrogen fluoride has to be managed to ensure it doesn't impact machinery of the incinerator itself (USEPA 2020b). As the ITRC reports in its PFAS destruction guidance related to incineration, “there have not been sufficient pilot studies to determine the validity of this concern. This could pose serious health and safety issues and could compromise equipment components.” (ITRC 2020)

EPA developing untargeted analytical method, which will help map the full extent of PFAS breakdown products (USEPA 2020a). This is not expected until 2021 at the earliest.

### **How many breakdown products are present in stack gases or waste ash?**

The third major aspect of uncertainty is the ability of incinerator emission controls to capture and contain any harmful byproducts. This is obviously impossible to gauge without full knowledge of the products and their physical and chemical characteristics.

EPA and scientists are optimizing methods that quantify the total organic fluorine in air or other environmental media. These methods are also expected to take at least another year to validate.

They will provide important verification about whether PFAS breakdown happens in the idealized setting of an experimental laboratory, not to mention real world operating conditions of a functional incinerator.

Studies note increased risk of emissions and discharges of products of incomplete combustion during non-normal operating conditions (upset conditions) including start up, shut down, malfunction or during equipment failure (NRC 2000). One study reviewed facility-specific data

on pollutants emitted during startup and shutdown conditions. There was wide variability but 88% of facilities studied had vastly increased emissions of dioxins and furans, dioxin/furan precursors, and carbon monoxide during start up or shut down monitoring compared to normal operating conditions, likely due to incomplete combustion (Obaid 2017).

The portion of incineration byproducts stripped by emission control systems will end up in incineration ash requiring perpetual storage in a hazardous waste landfill or other site. Several studies find incineration reduces but does not eliminate the PFAS in ash residues, and the chemicals are found in leachate from landfills accepting incinerator ash (Solo-Gabriele 2020). Therefore, incineration does not terminate the management responsibilities for entities disposing of PFAS wastes.

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October 2, 2020

Ms. Laura Watson  
Director  
Department of Ecology  
PO Box 47600  
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Submitted by email: [Laura.watson@ecy.wa.gov](mailto:Laura.watson@ecy.wa.gov)

Dear Director Watson:

We recognize that these are difficult times for public agencies, particularly for environmental agencies, due to pandemic and the wildfires driven by climate change in the Pacific Northwest. We honor the efforts of you and your staff to respond to these difficult challenges.

We are writing to ask that you reject incineration as the Department of Ecology's preferred disposal technology for dangerous per- and polyfluoroalkyl (PFAS) chemicals. Hazardous waste incineration and ash landfilling is currently under consideration for the disposal of PFAS-containing Aqueous Film Forming Foam (AFFF) to be collected by the agency. As an alternative approach, we request that the agency arrange secure storage of AFFF at a permitted hazardous waste facility until a non-incineration alternative is identified and approved.

We recognize the leadership role Washington state has played in tackling the PFAS chemical crisis as the first state in the nation to regulate PFAS as a class and ban them in firefighting foam and food packaging. We applaud the agency's efforts to get dangerous PFAS foams out of fire departments and fund disposal through the state toxics account. This is a critical step to protect the health of firefighters and our drinking water. However, we have serious concerns with the agency's proposal to send PFAS foams for incineration and ash disposal at the Aragonite hazardous waste facilities in Utah. The concerns include:

- **Incineration can result in PFAS and other toxic air, water and land pollution.** Available evidence suggests that incineration does not effectively destroy persistent PFAS chemicals, which have one of the strongest known chemical bonds. In fact, there is evidence that PFAS and related by-products are released into the air, resulting in widespread dispersion and deposition of the chemicals back to land and water. PFAS and related by-products will also be in the incinerator ash that is sent to a Utah landfill. Ecology's June 2020 memo on disposal considerations recognizes the limited data to demonstrate incineration's effectiveness as well as the potential for incineration to release PFAS and other toxic pollution.
- **Test methods and regulatory requirements for PFAS air, ash and hazardous waste landfills do not exist.** EPA is currently beginning to develop methods to measure some PFAS chemicals in



air, and to test incinerators to measure the type and quantity of hazardous materials formed. It is premature to send wastes to these facilities without the ability to test for and regulate their release.

- **Burning PFAS wastes next to Tribal lands is an environmental justice issue.** The majority of [hazardous waste facilities and polluting industrial facilities](#) in the U.S. are disproportionately located in low-income or communities of color. The Aragonite hazardous waste incinerator and landfill are adjacent to the Skull Valley Indian Reservation, inhabited by the Skull Valley Band of Goshute Indians of Utah, which is a federally recognized tribe. This region of Utah is a dumping ground for a variety of toxic wastes – with two incinerators, a hazardous waste landfill, uranium tailings disposal, and a US government nerve agent storage facility (in addition to other industries).
- **Other cities, states and the U.S Congress have acted on PFAS waste incineration.** In 2020, the [city of Cohoes, NY and the state legislature](#) passed a ban on the incineration of AFFF at the Norlite hazardous waste facility. [California passed a bill](#), expected to be signed by the Governor, that would require safe transport and storage of AFFF until the California Environmental Protection Agency identifies a safe disposal technology. And, the [National Defense Authorization Act of 2020](#) included requirements for PFAS destruction at incinerators for the military disposal of AFFF.

Given the serious public health and environmental justice concerns regarding the incineration and landfilling of PFAS-containing AFFF, as well as the acknowledgement by Ecology of both the uncertain effectiveness of these technologies in destroying PFAS compounds and the possible generation of additional related compounds that might be released; a more prudent, conservative approach is warranted. Both the Department of Defense and EPA have issued grants and incentives for engineers to develop advanced technologies to more safely destroy PFAS. We urge you to collect the municipal stockpiles of AFFF and hold them in limited-term storage contracts until advanced technologies are scaled and validated for destruction of these wastes.

Thank you for your consideration of our request.

Sincerely,

Laurie Valeriano  
Executive Director  
Toxic-Free Future

Margie Van Cleve  
Washington State Conservation Chair  
Sierra Club, Washington State

Cc: Darin Rice, Program Manager, Hazardous Waste  
Sean Smith, Product Replacement Manager



October 1, 2020

Mr. Sean Smith  
Hazardous Waste & Toxics Reduction  
Northwest Regional Office  
Washington State Department of Ecology  
3190 160<sup>th</sup> Avenue SE  
Bellevue, WA 98008-5452

Re: Aqueous film forming foam (AFFF) collection and disposal plan

Mr. Smith:

The American Chemistry Council (ACC) supports the Department's plan for the disposal of aqueous film forming foam (AFFF) containing per- and polyfluoroalkyl substances (PFAS) at the Clean Harbor facility in Aragonite, Utah. The available data indicate that thermal destruction under appropriate conditions of temperature, retention time, and mixing outlined by the Department<sup>1</sup> is an effective means for destroying PFAS. The Department's plan is consistent with the information collected by the US Environmental Protection Agency.<sup>2</sup> As described by the Department, moreover, the Aragonite facility can effectively manage the products of the incineration process, including hydrogen fluoride and potential byproducts of incomplete combustion.

ACC believes that this AFFF disposal project can make a significant contribution to our understanding of the thermal destruction of PFAS. We encourage the Department to conduct sampling and analysis at the facility, using appropriate analytical techniques and in partnership with Clean Harbors and federal agencies, to maximize the value of this effort. We further encourage the Department to evaluate all available options for the handling, disposal, and treatment of AFFF containing PFAS as it explores future state activities.

Please feel free to contact me at [srisotto@americanchemistry.com](mailto:srisotto@americanchemistry.com) or at 202-249-6727 if you have questions.

Sincerely,

***Steve Risotto***

Stephen P. Risotto  
Senior Director

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<sup>1</sup> State Environmental Policy Act - Determination of Nonsignificance. SEPA Environmental Checklist. July 2016.

<sup>2</sup> [https://www.epa.gov/sites/production/files/2019-09/documents/technical\\_brief\\_pfas\\_incineration\\_ioaa\\_approved\\_final\\_july\\_2019.pdf](https://www.epa.gov/sites/production/files/2019-09/documents/technical_brief_pfas_incineration_ioaa_approved_final_july_2019.pdf)





October 1, 2020  
Sean Smith  
WA Department of Ecology  
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**RE: Ecology Aqueous Film Forming Foam Collection Program (SEPA# 202004521)**

The American Petroleum Institute (API), the American Fuel & Petrochemical Manufacturers (AFPM), and the Western States Petroleum Association (WSPA), herein referred to as “the Associations,” offer for your consideration the following comments in relation to the Washington Department of Ecology’s decision to pursue incineration as the disposal option for firefighting foam concentrate.

API is the primary trade association of America’s oil and natural gas industry representing companies involved in all aspects of the oil and natural gas industry, including exploration, production, refining, transportation, distribution, and marketing of petroleum and petroleum products.

AFPM is a national trade association representing nearly all U.S. refining and petrochemical manufacturing capacity. AFPM members produce the fuels that drive the U.S. economy and the chemical building blocks integral to millions of products that make modern life possible.

WSPA is a non-profit trade association that represents companies that explore for, produce, refine, transport and market petroleum, petroleum products, natural gas, and other energy supplies in Washington and four other western states.

Collectively, the Associations represent member companies that utilize firefighting foam to respond to, and prevent, large petrochemical tank fires.

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Through a safe disposal program for firefighting foam<sup>1</sup>, the WA Department of Ecology (the “Department”) worked with local fire departments and other first responders with stockpiles of firefighting foam containing per- and polyfluoroalkyl substances (PFAS) to collect and safely dispose of this material. The Department has selected to incinerate these materials at the Clean Harbors facility in Aragonite, Utah as described in their Determination of Nonsignificance<sup>2</sup>.

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<sup>1</sup> <https://ecology.wa.gov/Waste-Toxics/Reducing-toxic-chemicals/Addressing-priority-toxic-chemicals/PFAS/Toxics-in-firefighting>

<sup>2</sup> <https://apps.ecology.wa.gov/separ/Main/SEPA/Document/DocumentOpenHandler.ashx?DocumentId=97538>

The Associations support the Department's proposed plan to dispose of the PFAS containing firefighting foam concentrate at the Clean Harbors facility in Aragonite, Utah. When conducted under appropriate conditions, including temperature and residence time, thermal destruction has been shown to be an effective means for destroying the PFAS of concern in firefighting foam<sup>3</sup>. As described by the Department's Determination of Nonsignificance, the Aragonite facility can effectively manage the products of the incineration process, including hydrogen fluoride and potential byproducts of incomplete combustion.

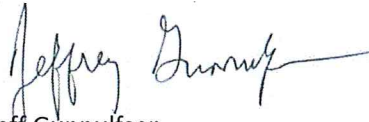
While the Associations support the Department's decision to use the Clean Harbors facility in Aragonite, Utah as the disposal option for the collected firefighting foam, we also would like to encourage the state to continue to evaluate the available science and data regarding the disposal and destruction of PFAS waste and PFAS containing firefighting foam. Under appropriate circumstances, landfilling, deep-well injection, solidification/encapsulation, and thermal destruction at facilities other than Aragonite facility should continue to be viable options for disposal. These methods have been demonstrated as effective solutions for managing a variety of wide waste-types under contemporary regulations and provide flexibility for stakeholders to responsibly manage their waste in a manner protective of the environment and human health.

Lastly, the Associations believe that this is an opportunity to further advance the understanding of the thermal destruction of PFAS containing firefighting foam. We encourage the Department to make public, any data or information about operating parameters and emissions collected during the project.

The Associations appreciate the opportunity to provide feedback on this important issue. If you have any immediate questions, please contact Timothy Steffek of API at (202) 682-8155 or via email at [SteffekT@api.org](mailto:SteffekT@api.org).



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<sup>3</sup> <http://www.crwi.org/textfiles/dod20.pdf>



**Catherine Reheis-Boyd**  
President

October 1, 2020

Via Email: [sean.smith@ecy.wa.gov](mailto:sean.smith@ecy.wa.gov)

Mr. Sean Smith  
WA Department of Ecology  
3190 - 160th Ave. SE  
Bellevue, WA 98008-5452

**RE: Ecology Aqueous Film Forming Foam Collection Program (SEPA# 202004521)**

Dear Mr. Smith,

The Western States Petroleum Association (WSPA) appreciates the opportunity to provide comments on Washington Department of Ecology's (Ecology) decision to pursue incineration as the disposal option for firefighting foam concentrate. WSPA is a non-profit trade association representing companies that account for the bulk of petroleum exploration, production, refining, transportation and marketing in the five western states, including Washington.

WSPA supports Ecology's SEPA determination of non-significance decision to incinerate the stockpiles of AFFF concentrate it has collected as an effective means to disposal, of AFFF. This disposal option has been determined to be protective of human and environmental health in that incineration currently poses the least risk to both. We appreciate the thorough analysis conducted examining land disposal, long-term storage and innovative destructive technology options to arrive at this recommendation.

Reinforcing WSPA's support of this disposal option to incinerate the stockpiles of AFFF concentrate and therefore maximize the destruction of the foam's PFAS molecules is collectively the use of the remotely located Clean Harbor's RCRA incinerator in Aragonite Utah, high combustion temperatures and process, and the final disposition location.

WSPA encourages Ecology to continue evaluating the best available science to ensure the most cost-effective, environmentally sound and adequately protective, disposal and destruction of PFAS Waste and PFAS containing firefighting foam options.

WSPA also encourages Ecology to adhere to the established regulatory process when making considerations for disposal option for the private sector and to make incineration performance data publicly available to help inform all stakeholders interested in this topic.

If you have any questions regarding our comments, please contact me or Bob Poole at (805) 833-9760 or via email at [bpoole@wspa.org](mailto:bpoole@wspa.org).

Sincerely,



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October 1, 2020

**VIA E-MAIL ONLY**

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**Re: Comments on Ecology's Determination of Nonsignificance and  
Environmental Checklist under SEPA #202004521 for Ecology's Aqueous  
Film-Forming Foam Collection Program**

To Whom It May Concern:

Beveridge & Diamond, P.C. submits these comments on the Department of Ecology's ("Ecology's") Determination of Nonsignificance ("DNS") under the State Environmental Policy Act ("SEPA") regarding the environmental impacts of the collection of Per- and polyfluoroalkyl substance ("PFAS") containing aqueous film-forming foam ("AFFF"), its transport and disposal. In its DNS, Ecology selected incineration of PFAS-containing AFFF materials, over other methods of management and/or disposal, as its preferred alternative.

Beveridge & Diamond is a law firm that represents, among others, clients in the waste handling and disposal industries, who have an interest in Ecology's DNS decision. These comments were developed based on review of peer-reviewed literature as well as regulatory policy decisions and guidance from federal agencies and other jurisdictions. Where applicable, literature sources have been cited.

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### **A. Summary of Comments on Ecology's DNS.**

In its DNS, Ecology selected incineration of PFAS-containing bulk AFFF materials as its preferred disposal method as opposed to utilizing other methods of management. While we are not questioning incineration as a proven waste management technology, we are concerned that Ecology has not recognized the current uncertainties and concerns with incineration for processing large volumes of PFAS in bulk AFFF stockpiles. Given these uncertainties and concerns, the DNS is premature and insufficiently supported by science, which continues to evolve in this area. Moreover, Ecology's SEPA Checklist fails to analyze several fundamental aspects of the AFFF Collection Program as required by the statute. Accordingly, Ecology should reconsider its DNS based on the information provided in this comment letter.

*First*, the information disclosed in the SEPA Checklist is not reasonably sufficient to evaluate the proposal's environmental impacts, including its cumulative impacts, possible alternatives, and mitigation measures. *Second*, there is limited information and uncertainty as to the efficacy of large-scale incineration of PFAS-containing AFFF material. *Third*, consistent with the lack of real-world testing, no scientific consensus exists as to what procedures and practices should be followed during the incineration process to ensure that PFAS emissions are controlled to an insignificant level. *Fourth*, the uncertainties regarding PFAS incineration as a disposal method are highlighted by the number of planned and ongoing studies intended to address the efficacy and potential limitations of incineration for large-scale PFAS processing. *Fifth*, Ecology has identified mitigation measures in an attempt to limit adverse environmental impacts from incineration of PFAS-containing AFFF materials; however, these measures are unrelated to the control of PFAS-related emissions and/or have not been identified clearly in the record, rendering public comment on the issue futile.

*Last*, and notably missing in Ecology's DNS and SEPA Checklist is a meaningful analysis of alternatives, including a no action alternative and other management and disposal options. It is unclear from the available record whether Ecology has satisfied the requirements under SEPA to evaluate a range of alternatives and explain why incineration of PFAS-containing AFFF would have insignificant environmental impacts as compared to other alternatives.

### **B. Ecology Must Justify Its DNS.**

SEPA's "action-forcing" procedures are designed to ensure that government agencies conscientiously and systematically consider environmental values and consequences in their decision-making processes.<sup>1</sup> SEPA's policies of full disclosure and consideration of environmental values apply to Ecology's AFFF Collection Program and require Ecology to duly consider environmental factors before a determination of no environmental significance can be

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<sup>1</sup> RCW 43.21C.030.

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made.<sup>2</sup> For this reason, SEPA's threshold determination process compels Ecology to determine and document the environmental impacts of its proposed actions so that adverse consequences may be avoided, mitigated or, at the very least, consciously chosen.<sup>3</sup>

A threshold determination of a proposal's environmental significance necessitates preliminary environmental analysis in the form of a checklist that records actual consideration of environmental factors.<sup>4</sup> Under SEPA:

A threshold determination shall not balance whether the beneficial aspects of a proposal outweigh its adverse impacts, but rather, shall consider whether a proposal has any probable significant adverse environmental impacts under the rules stated in this section. For example, proposals designed to improve the environment, such as sewage treatment plants or pollution control requirements, may also have significant adverse environmental impacts.<sup>5</sup>

When issuing a SEPA threshold determination, Ecology is required to demonstrate that it considered "information reasonably sufficient to evaluate the environmental impact of a proposal."<sup>6</sup> This analysis is required for non-project proposals, like Ecology's AFFF Collection Program, for which Ecology must address "the probable impacts of any future project action the proposal would allow."<sup>7</sup> According to Ecology guidance, non-project review should consider the "big picture" and include a comprehensive analysis that addresses "cumulative impacts, possible alternatives, and mitigation measures."<sup>8</sup> SEPA also requires the evaluation of a no-action alternative.<sup>9</sup>

### **C. Ecology's DNS Does Not Adequately Address Potential Adverse Impacts of Large-Scale Incineration of PFAS-Containing AFFF Materials.**

A SEPA DNS must be based on consideration of direct, indirect, and cumulative impacts of the proposed action, and shall not limit its consideration of impacts to only those aspects within its jurisdiction.<sup>10</sup> Ecology's SEPA review failed to sufficiently address the following potential adverse impacts:

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<sup>2</sup> *Gardner v. Pierce Cty. Bd. of Comm'rs*, 27 Wn. App. 241, 245 (1980); *Juanita Bay Valley Cmty. Ass'n v. City of Kirkland*, 9 Wn. App. 59, 65 (1973).

<sup>3</sup> RCW 43.21C.020(2).

<sup>4</sup> WAC 197-11-315(1).

<sup>5</sup> WAC 197-11-330(5) (emphasis added).

<sup>6</sup> WAC 197-11-335; *see also* WAC 197-11-100(2).

<sup>7</sup> *Spokane Cty. v. E. Wash. Growth Mgmt. Hrg's Bd.*, 176 Wn. App. 555, 579 (2013).

<sup>8</sup> WASH. DEP'T OF ECOLOGY, STATE ENVIRONMENTAL POLICY HANDBOOK 43 (2018), <https://ecology.wa.gov/DOE/files/4c/4c9fec2b-5e6f-44b5-bf13-b253e72a4ea1.pdf>.

<sup>9</sup> *See id.* at 37.

<sup>10</sup> WAC 197-11-060(4)(b); WAC 197-11-330(4).



### 1. Incineration of PFAS-Containing AFFF Materials Is an Uncertain Method of Destruction.

Under SEPA, the impact of an action is more likely to be significant when it “involves unique and unknown risks to the environment.”<sup>11</sup> The same properties that make PFAS-containing AFFF commercially desirable (e.g., fire suppression) present difficulties when it comes to destroying PFAS—through incineration or otherwise. Uncertainties exist as to whether modern incinerators can fully destroy all of the PFAS in bulk AFFF loads. Other problems include the potential formation of by-products from incineration of bulk AFFF materials.<sup>12</sup>

Thus, a potential downside of incineration is that, rather than destroy PFAS, incomplete incineration may lead to the distribution of PFAS and/or other chemicals into the environment.<sup>13</sup> Protocols to sample emissions for PFAS and the analytical methods for measuring PFAS in the air are also still under development.<sup>14</sup> The result is that little is known regarding large-scale incineration of PFAS-containing AFFF, which has led to uncertainty as to whether incineration is an effective method for disposal.<sup>15</sup> The Environmental Protection Agency (“EPA”) recognizes as much, noting earlier this year that “[t]he effectiveness of incineration to destroy PFAS compounds . . . is not well understood.”<sup>16</sup>

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<sup>11</sup> WAC 197-11-330(3)(e)(iv).

<sup>12</sup> CRAIG PATTERSON, U.S. EPA, MANAGING PFAS IN SPENT ADSORPTION MEDIA (2020) (recognizing uncertainty regarding PFAS incineration by-products); Tasha Stoiber et al., *Disposal of Products and Materials Containing Per- and Polyfluoroalkyl Substances (PFAS): A Cyclical Problem*, CHEMOSPHERE, at 7 (2020) (“Laboratory experiments have not addressed the full scope of potential PFAS byproducts that could form during the combustion of PFAS wastes in commercial or municipal incinerators.”); *AFFF Disposal*, DEP’T OF DEF., SMALL BUS. INNOVATION RES./SMALL BUS. TECH. TRANSFER (2017), <https://www.sbir.gov/sbirsearch/detail/1254657> (AFFF incineration “will have to manage several significant challenges,” including “the high-temperature chemistry of PFOS and PFOA has not been characterized, so there is no precedent to predict products of pyrolysis or combustion, temperatures at which these will occur, or the extent of destruction that will be realized; -many likely byproducts will also be environmentally unsatisfactory . . . or toxic.”).

<sup>13</sup> Significant New Use Rules on Certain Chemical Substances, 77 Fed. Reg. 48,858, 48,861 (Aug. 15, 2012) (“[P]erfluorinated products may be released to the environment from incomplete incineration.”); U.S. EPA, TECHNICAL BRIEF: PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS): INCINERATION TO MANAGE PFAS WASTE STREAMS 2 (2020), [https://www.epa.gov/sites/production/files/2019-09/documents/technical\\_brief\\_pfas\\_incineration\\_ioaa\\_approved\\_final\\_july\\_2019.pdf](https://www.epa.gov/sites/production/files/2019-09/documents/technical_brief_pfas_incineration_ioaa_approved_final_july_2019.pdf) (“EPA TECHNICAL BRIEF”) (expressing concern regarding PFAS “media-to-media transfer or environmental release”).

<sup>14</sup> See Presentation by Jeff Ryan, EPA Office of Research and Development, EPA PFAS Air Emission Measurements: Activities and Research 13 (May 23, 2019) (recognizing that accepted standards for PFAS emissions measurement “do NOT exist”); Stoiber et al., *supra* note 12, at 8.

<sup>15</sup> EPA TECHNICAL BRIEF, *supra* note 13, at 2.

<sup>16</sup> *Id.*

## 2. No Scientific Consensus Exists as to the Necessary Temperature and Pressure for Destruction of PFAS-Containing AFFF Materials.

Ecology conditioned its DNS on the specifications for how the PFAS-containing AFFF will be incinerated.<sup>17</sup> SEPA requires Ecology to explain how those mitigation measures result in no probable significant impact to the environment.<sup>18</sup> PFAS-incineration studies have raised questions about:

- Whether current incineration temperatures are adequate<sup>19</sup>
- Whether current holding times are adequate<sup>20</sup>
- Whether substantial pressure, alongside other conditions, is necessary<sup>21</sup>
- Whether laboratory-scale tests are representative of conditions at large-scale facilities<sup>22</sup>

Ecology did not address this lack of scientific consensus regarding various conditions of PFAS incineration. To adequately assess the environmental impacts associated with its proposal, Ecology should explain how the conditions at which it will incinerate the PFAS-containing AFFF support a determination that the proposed incineration program will not have a significant effect on the environment.

## 3. Incineration Studies and Technological Developments Regarding PFAS-Containing AFFF Materials Are Ongoing.

The uncertainties regarding incineration as a disposal method are highlighted by the number of planned and ongoing studies intended to address the efficacy and potential limitations of incineration. The federal government has made numerous calls for additional research regarding PFAS incineration and, in particular, AFFF incineration.<sup>23</sup> For example, EPA and the

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<sup>17</sup> See, e.g., WASH. DEP'T OF ECOLOGY, DETERMINATION OF NONSIGNIFICANCE 2 (2020) ("ECOLOGY DNS") ("Ecology is requiring [exposure of] the PFAS foam to temperatures in excess of 1000°C withhold [sic] times of two seconds or more.").

<sup>18</sup> WAC 197-11-350.

<sup>19</sup> See, e.g., PATTERSON, *supra* note 12 (asking "[w]hat minimum conditions (temperature, time) are needed to adequately destroy PFAS"); John Horst et al., *Understanding and Managing the Potential By-Products of PFAS Destruction*, in GROUNDWATER MONITORING & REMEDIATION 4 (2020); Stoiber et al., *supra* note 12, at 10.

<sup>20</sup> PATTERSON, *supra* note 12; Stoiber et al., *supra* note 12, at 10.

<sup>21</sup> See, e.g., Horst et al., *supra* note 19, at 4 ("The various constant pressure simulations suggest that without substantial pressure, temperatures consistent with literature observations of thermal destruction of PFAS will result in a phase change and volume expansion, typically observed as steam discharge from an incinerator stack.").

<sup>22</sup> Horst et al., *supra* note 19, at 4; Stoiber et al., *supra* note 12, at 8–9.

<sup>23</sup> E.g., STRATEGIC ENVIRONMENTAL RESEARCH AND DEVELOPMENT PROGRAM, FY 2021 STATEMENT OF NEED: IMPROVED UNDERSTANDING OF THERMAL DESTRUCTION TECHNOLOGIES FOR MATERIALS LADEN WITH PER- AND

Department of Defense are currently studying the threshold question of the effectiveness of incineration in destroying PFAS compounds.<sup>24</sup> The Department of Defense is also seeking to conduct future research regarding chemical processes resulting from PFAS incineration, and the fate and transport properties of PFAS incineration, including products of incomplete combustion.<sup>25</sup> Lastly, the federal government appears to question whether incineration will prove a viable large-scale method of destruction, as it recently solicited research for non-thermal methods of AFFF destruction that are scalable to current disposal needs.<sup>26</sup>

#### 4. The Studies Referenced in the SEPA Checklist Do Not Support Ecology's DNS.

Ecology states that it “conducted a literature review of relevant studies, reports, guidance, and documents related to PFAS-containing firefighting foam disposal and its impact upon the environment.”<sup>27</sup> Ecology appears to have based its determination primarily on an EPA technical brief that was released earlier this year and on studies in 2005 and 2014 of incineration of treated fabric and municipal solid waste containing perfluorooctanoic acid (“PFOA”). These resources are inadequate to serve as a basis for the DNS given (1) the level of uncertainty on the effectiveness of the incineration of PFAS pervading EPA’s technical brief and (2) the relevance of the two studies as applied to bulk incineration of PFAS-containing AFFF.<sup>28</sup> Moreover, the additional studies referenced by Ecology highlight that too many uncertainties exist regarding the effectiveness of bulk AFFF incineration to destroy all the PFAS contained in the foams. For example, one group of researchers surveyed the existing literature regarding PFAS incineration

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POLYFLUOROALKYL SUBSTANCES (2019); U.S. EPA, EPA PFAS ACTION PLAN: PROGRAM UPDATE (2020), [https://www.epa.gov/sites/production/files/2020-01/documents/pfas\\_action\\_plan\\_feb2020.pdf](https://www.epa.gov/sites/production/files/2020-01/documents/pfas_action_plan_feb2020.pdf).

<sup>24</sup> Presentation by Ms. Maureen Sullivan, Deputy Assistant Secretary of Defense, Briefing to Congress on Best Practices for Cleanup Technologies and Disposal of Soils, Filters, and Aqueous Film Forming Foam Containing Perfluorooctane Sulfonate (PFOS) and Perfluorooctanoic Acid (PFOA), and Required Additional Research 3 (2019); U.S. EPA, EPA PFAS ACTION PLAN: PROGRAM UPDATE 9 (2020), [https://www.epa.gov/sites/production/files/2020-01/documents/pfas\\_action\\_plan\\_feb2020.pdf](https://www.epa.gov/sites/production/files/2020-01/documents/pfas_action_plan_feb2020.pdf); *Status of EPA Research and Development on PFAS*, U.S. EPA, <https://www.epa.gov/chemical-research/status-epa-research-and-development-pfas#contamination> (last visited Sept. 30, 2020) (listing ongoing research); see also EPA TECHNICAL BRIEF, *supra* note 13, at 2 (“EPA researchers are currently studying PFAS incineration, sampling and analytical methods development, and industrial field sampling.”).

<sup>25</sup> Presentation by Ms. Maureen Sullivan, *supra* note 24, at 12.

<sup>26</sup> *Innovative Ways to Destroy PFAS Challenge*, U.S. EPA, <https://www.epa.gov/innovation/innovative-ways-destroy-pfas-challenge> (last visited Sept. 30, 2020).

<sup>27</sup> WASH. DEP’T OF ECOLOGY, SEPA ENVIRONMENTAL CHECKLIST 3 (2020).

<sup>28</sup> See EPA TECHNICAL BRIEF, *supra* note 13, at 2 (“The effectiveness of incineration to destroy PFAS compounds and the tendency for formation of fluorinated or mixed halogenated organic byproducts is not well understood.”); P.H. Taylor et al., *Investigation of Waste Incineration of Fluorotelomer-Based Polymers as a Potential Source of PFOA in the Environment*, CHEMOSPHERE (2014) (studying whether municipal solid waste and/or medical waste in incineration of commercial fluorotelomer-based polymers at end of life is a potential source of PFOA); Takahiro Yamada et al., *Thermal Degradation of Fluorotelomer Treated Articles and Related Materials*, CHEMOSPHERE (2005) (investigating the thermal degradation of textiles containing PFOA).

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and concluded, this year, that the optimal conditions for complete PFAS destruction are unknown and “[m]uch more research is needed on the PFAS breakdown species that could form as a result of incomplete combustion.”<sup>29</sup> Therefore, “[t]he fate of PFAS under the current operating conditions of commercial incinerators is largely unknown.”<sup>30</sup>

However, rather than address the lack of scientific consensus and significant uncertainties related to the incineration of PFAS-containing AFFF—and the potential environmental harms associated with them—Ecology asserted that “[r]esearch indicates that incineration at high enough temperatures for a long enough hold times is capable of breaking the PFAS molecules.” This is misleading for at least three reasons. First, it does not indicate what temperature the research has concluded is “high enough.”<sup>31</sup> Second, it does not address whether Ecology’s proposed temperature (and other conditions) achieve the conditions necessary for breaking PFAS molecules. And third, it does not address whether harmful by-products may be formed and released into the environment after breaking the PFAS molecules.

“An agency must generally prepare an EIS if the environmental effects of a proposed agency action are highly uncertain.”<sup>32</sup> Without sufficient studies of large-scale AFFF incineration, and accepted methods of conducting such studies, numerous uncertainties exist regarding Ecology’s preferred method of disposal. Accordingly, and based on the limited literature review discussed in its analysis, Ecology’s determination is not sufficient to support its unqualified determination that PFAS incineration will not have a probable significant adverse impact on the environment.

##### **5. The Efficacy of Ecology’s Mitigation Measures Cannot Be Verified.**

In the DNS and SEPA Checklist, Ecology notably recognizes that its AFFF disposal plan presents a high likelihood of probable significant adverse environmental impacts. Accordingly, Ecology proposed measures to “protect or conserve plants, animals, fish, or marine life.”<sup>33</sup> Ecology also acknowledges that “PFAS foam incineration can cause air emissions . . . . The deposition can . . . be taken up by biota including humans, potentially negatively impacting their

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<sup>29</sup> Stoiber et al., *supra* note 12, at 8.

<sup>30</sup> *Id.* at 9.

<sup>31</sup> Upon review of Ecology’s reference materials and other literature, it appears instead that no consensus exists. In fact, Ecology appears to implicitly acknowledge as much. Its DNS claims that 1000°C is sufficient—or at least all it requires—while the SEPA Checklist claims that the AFFF may be exposed to 1300°C. Ecology claims that 1300°C “maximize[s] PFAS destruction.” WASH. DEP’T OF ECOLOGY, SEPA ENVIRONMENTAL CHECKLIST 2 (2020). If 1300°C maximizes PFAS destruction, what occurs at 1000°C? Ecology does not explain.

<sup>32</sup> *Nat’l Parks & Conservation Ass’n v. Babbitt*, 241 F.3d 722, 731 (9th Cir. 2001), *abrogated on other grounds by Monsanto Co. v. Geertson Seed Farms*, 561 U.S. 139 (2010); *Int’l Longshore & Warehouse Union, Local 19 v. City of Seattle*, 176 Wn. App. 512, 525 (2013) (“Because [the National Environmental Policy Act] is substantially similar to SEPA, we may look to federal case law for SEPA interpretation.”).

<sup>33</sup> WASH. DEP’T OF ECOLOGY, SEPA ENVIRONMENTAL CHECKLIST 10 (2020).

growth and development.”<sup>34</sup> The measures identified by Ecology to “limit,” not avoid, impacts include compliance with “relevant local, state, and federal regulations and law,” and unspecified “conditions” that “will be set on the hazardous waste contract to ensure the maximum destruction of the PFAS molecule.”<sup>35</sup>

Ecology does not explain how reliance on local, state, or federal regulations will prevent adverse impacts, and nor could Ecology offer an explanation since PFAS emissions are not currently regulated under laws like the federal Clean Air Act.<sup>36</sup> Ecology similarly does not disclose the terms of the hazardous waste contract, thereby depriving the public of a meaningful opportunity to comment on the efficacy of those conditions in avoiding an adverse environmental impact.<sup>37</sup> Furthermore, Ecology has not cited to any studies confirming that residential communities and nearby ecologically sensitive areas, such as the Cedar Mountain Wilderness Area, are unlikely to be impacted by potential PFAS air emissions from the incineration of AFFF.<sup>38</sup> Finally, Ecology also has not evaluated whether “maximum destruction of the PFAS molecule” is sufficient to prevent adverse impacts from related PFAS emissions in the context of large-scale incineration of AFFF.

The issues outlined above are precisely the kind of environmental impacts that Ecology must address under SEPA. Further, given that Ecology’s decision-making here is likely to establish “precedent for future actions with significant effects,” additional analysis of probable adverse environmental impacts from PFAS incineration is warranted.<sup>39</sup>

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<sup>34</sup> *Id.* at 11.

<sup>35</sup> *Id.* at 10.

<sup>36</sup> “PFAS are not currently regulated under the Resource Conservation and Recovery Act; the Clean Water Act; nor the Clean Air Act.” WASH. DEP’T OF ECOLOGY, PER- AND POLY-FLUORINATED ALKYL SUBSTANCES CHEMICAL ACTION PLAN (PFAS CAP) – 2019 UPDATES: REGULATIONS 5 (2019), [https://www.ezview.wa.gov/Portals/\\_1962/Documents/PFAS/Regulations-2019-PFAS-CAP.pdf](https://www.ezview.wa.gov/Portals/_1962/Documents/PFAS/Regulations-2019-PFAS-CAP.pdf). Similarly, Utah does not regulate PFAS or PFAS-related emissions.

<sup>37</sup> It is possible that the “conditions” referred to by Ecology relate to the incineration temperature and hold time, and the management of leachate in the off-site disposal of incineration byproducts, as mentioned in the DNS and SEPA Checklist. However, given the complexity of the disposal plan as presented by Ecology and lack of scientific consensus regarding the effectiveness of incineration as a disposal method for PFAS, these conditions alone do not warrant a finding of no probable adverse environmental impact at this stage.

<sup>38</sup> “Air serves as an important transport media for PFAS, allowing PFAS to disperse in all wind directions, contributing to global dispersion, and leading to localized PFAS deposition to soils and surface water in the vicinity of emission sources . . . . Long-range transport processes are responsible for the wide distribution of neutral and ionic PFAS across the earth as evidenced by their occurrence in biota, surface snow, ice cores, seawater, and other environmental media in remote regions.” INTERSTATE TECHNOLOGY & REGULATORY COUNCIL, TECHNICAL/REGULATORY GUIDANCE: PER- AND POLYFLUOROALKYL SUBSTANCES 76 (2020) (cited in Ecology’s SEPA Checklist); *see also* WASH. DEP’T OF ECOLOGY, PER- AND POLY-FLUORINATED ALKYL SUBSTANCES CHEMICAL ACTION PLAN (PFAS CAP) – 2019 UPDATES: NEW FATE AND TRANSPORT CHAPTER 7 (2019), [https://www.ezview.wa.gov/Portals/\\_1962/Documents/PFAS/Fate-Transport-2019-PFAS-CAP.pdf](https://www.ezview.wa.gov/Portals/_1962/Documents/PFAS/Fate-Transport-2019-PFAS-CAP.pdf) (“Once in the air, PFAS can travel large distances before deposition.”).

<sup>39</sup> WAC 197-11-330(3)(e)(iv).

#### **D. Ecology Does Not Meaningfully Analyze Alternatives That Could Reduce Adverse Environmental Impacts.**

To fulfill SEPA's mandate to "[s]tudy, develop, and describe appropriate alternatives," Ecology must conduct an analysis of alternative methods that could have less adverse environmental impacts and could achieve Ecology's objectives of safely disposing of AFFF and protecting the environment.<sup>40</sup> Analysis of alternatives requires that agencies conduct comparative analysis of those alternatives for the purpose of assisting the ultimate decision-making process.

Ecology should undertake a more thorough analysis of alternatives for managing Washington's PFAS-containing bulk AFFF stockpiles. Those alternatives should include a more thorough analysis of alternative management and destruction technologies, as well as disposal in both Subtitle D and Subtitle C landfills. Especially where landfills are either closed systems, meaning no off-site discharge of leachate, or utilize additional leachate treatment technologies, long-term disposal of AFFF at landfills can be safely conducted in the same manner as the ongoing disposal of a range of other hazardous and non-hazardous wastes at those sites. In addition, Ecology should consider various treatment technologies that are commonly used with land disposal to further immobilize and contain contaminants such as PFAS, including stabilization, solidification, micro-encapsulation, and macro-encapsulation.

- A recent study showed that stabilization and solidification is a "highly effective treatment technique" for immobilizing PFAS-contaminated soil, showing reduced leaching by over 99.9%.<sup>41</sup>
- Scholars recently observed that stabilization and solidification is "a cost-effective remediation technology for the sustainable management of PFAS contaminated soil."<sup>42</sup>
- In Michigan, under a similar program, Class B AFFF liquids will be collected "from local fire departments and transport[ed] . . . to [a] licensed hazardous waste facility . . . where it will be solidified and disposed of on site."<sup>43</sup>
- Ecology has provided guidance to the public indicating that disposal of "unused PFAS-containing foam" can be done in accordance with the State's Dangerous Waste

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<sup>40</sup> RCW 43.21C.030(e).

<sup>41</sup> Mattias Söregård et al., *Laboratory-Scale and Pilot-Scale Stabilization and Solidification (S/S) Remediation of Soil Contaminated with Per- and Polyfluoroalkyl Substances (PFASs)*, J. HAZARDOUS MATERIALS (2021).

<sup>42</sup> Nanthi Bolan, *Remediation of Poly- and Perfluoroalkyl Substances (PFAS) Contaminated Soils – To Mobilize or to Immobilize or to Degrade?*, J. HAZARDOUS MATERIALS (2021).

<sup>43</sup> Press Release, Mich. Dep't of Env't, Great Lakes & Energy, Michigan Program to Collect, Dispose of PFAS-Containing Firefighting Foam Surpasses 30,000 Gallons (June 17, 2020), [https://www.michigan.gov/pfasresponse/0,9038,7-365-86513\\_96296-532156--,00.html](https://www.michigan.gov/pfasresponse/0,9038,7-365-86513_96296-532156--,00.html).

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Regulations, Chapter 173-303 WAC.<sup>44</sup> The Dangerous Waste regulations do not require incineration of such waste.

Finally, Ecology has an obligation to give meaningful consideration to the “no action” alternative for managing these materials as other new technologies are being developed.

#### **E. Conclusion**

Despite the well-recognized uncertainties with respect to the incineration of PFAS-containing AFFF materials, Ecology issued a DNS without closely studying the problem and exploring alternatives. This action was premature and unsupported by the record presented. Ecology should reconsider its DNS and undertake an updated analysis under SEPA of why the potential risks of incineration of PFAS-containing AFFF are insignificant. Such analysis should include a meaningful discussion of the benefits and risks of alternatives for managing PFAS-containing bulk AFFF stockpiles, including disposal in both Subtitle D and Subtitle C landfills, and disposal using available solidification, stabilization and encapsulation technologies.

In submitting these comments, Beveridge & Diamond reserves the right to supplement, amend, or otherwise submit additional comments to Ecology on any issues related to this DNS and the related SEPA Checklist.

Thank you for your consideration of these comments. If you or your colleagues have questions about this comment or require additional information, feel free to contact me at (206) 315-4811 or [dweber@bdlaw.com](mailto:dweber@bdlaw.com).

Regards,



David C. Weber

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<sup>44</sup> *Toxics in Firefighting Law*, WASH. DEP'T OF ECOLOGY, <https://ecology.wa.gov/Waste-Toxics/Reducing-toxic-chemicals/Addressing-priority-toxic-chemicals/PFAS/Toxics-in-firefighting#foam-replacement> (last visited Sept. 30, 2020).

## FW: WA STATE PFAS DISPOSAL PLAN DOCUMENTS

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From: Smith, Sean D. (ECY) (sdsm461@ecy.wa.gov)

To: [REDACTED]

Date: [REDACTED]

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**From:** Doris Cellarius <dorisc@cellarius.org>

**Sent:** Wednesday, September 23, 2020 11:53 AM

**To:** Smith, Sean D. (ECY) <sdsm461@ECY.WA.GOV>

**Subject:** FW: WA STATE PFAS DISPOSAL PLAN DOCUMENTS

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### COMMENTS ON WASHINGTON STATE PLANS TO INCINERATE PFAS STOCKS

Washington is widely known as a state that protects the environment. It has been a national leader in stopping the use of PFAS for firefighting. Its plan to send its AFF stocks contaminated with PFAS to Utah's Aragonite incinerator is therefore disappointing and sets a bad



example for other states. This could enable other states to say “Incineration is the best solution. It is what Washington state is doing.”

Incineration is really not the best solution! It does not completely destroy PFAS. It is known to pass members of the PFAS family on to other media - as this Chemosphere article describes: “Disposal of products and materials containing per- and polyfluoroalkyl substances (PFAS): A cyclical problem .

<https://doi.org/10.1016/j.chemosphere.2020.127659>

“Incineration of PFAS-containing wastes can emit harmful air pollutants, such as fluorinated greenhouse gases and products of incomplete combustion, and some PFAS may remain in the incinerator ash. Volatile PFAS are emitted into the air from landfills and wastewater treatment plants, and research is urgently needed on the potential presence of PFAS compounds in air emissions from commercially run incinerators. Monitoring of waste streams for PFAS, stopping PFAS discharges into water, soil and air and protecting the health of fence-line communities close to the waste disposal sites are essential to mitigate the impacts of PFAS pollution on human health.”

The attached EPA Technical Brief “PFAS Incineration” describes chemical reformulation problems that can occur

when PFAS are incinerated and the current lack of necessary measurement methods:

“ The effectiveness of incineration to destroy PFAS compounds and the tendency for formation of fluorinated or mixed halogenated organic byproducts is not well understood.”

Clean Harbors makes claims to destroy PFAS that it cannot back up with documented testing.

In studying the responses to the SEPA Checklist and looking at the permit for the Aragonite incinerator (<https://deq.utah.gov/waste-management-and-radiation-control/rcra-part-b-hazardous-waste-permit-clean-harbors-grassy-mountain-llc> ) I see no evidence that Utah has adopted regulatory standards or conducted stack tests to assure that PFAS in AFFF foams will be destroyed as Clean Harbors claims. There is presently no EPA requirement for a temperature that assures PFAS destruction and there are no federal standards for how to test for PFAS in air.

The Clean Harbors Waste Analysis Plan ( DSHW-2019-003422.pdf – attached) does not address PFAS. It does address, and furans PCBs, dioxins, but PFAS are the most difficult contaminants to destroy.

Another concern is that the violations noted in Aragonite's Compliance History for April 8 2020 ( DSHW-2014-018229.pdf) indicate that recent waste management practices do not inspire confidence. Things could go seriously wrong in the handling of the PFAS wastes.

The attached National Academies of Sciences report (25856.pdf) presents the views of some of the nation's most important scientists who study PFAS.

'Understanding, Controlling, and Preventing Exposure to PFAS: Proceedings of a Workshop—in Brief' National Academies of Sciences, Engineering, and Medicine; Division on Earth and Life Studies; Environmental Health Matters Initiative

On page 4 the shortcomings of incineration are discussed. Rula Deeb , a session leader, stating "There are no destruction methods that are fully demonstrated in the field yet as capable of addressing PFAS in impacted media. " She argued that without knowing the byproducts of incineration we cannot be assured it is safe. She and others expressed enthusiasm for the development of better PFAS destruction technologies.

I suggest the Department of Ecology reconsidered the option of holding the AFF stocks in a secure and monitored storage site. This the alternative was considered but not not selected: "Storing their PFAS wastes until the

alternative destruction technologies being developed by the Department of Defense and SERDP are available for use. “ This seems a better way to protect vulnerable communities – and likely people everywhere – as PFAS travel in the air and have now contaminated people and animals as far away as the Arctic.

When the Washington legislature is asked to fund disposal for the additional thousands of gallons of firefighting foam that businesses, airports, and manufacturing facilities they would like to dispose of, but do not qualify for, it would be good for the state to have used currently appropriated funds in the most environmentally protective manner.

Doris Cellarius

Portland, Oregon



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## Understanding, Controlling, and Preventing Exposure to PFAS: Proceedings of a Workshop in Brief (2020)

### DETAILS

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# Proceedings of a Workshop

IN BRIEF

August 2020

## Understanding, Controlling, and Preventing Exposure to PFAS Proceedings of a Workshop—in Brief

### INTRODUCTION

Per- and polyfluoroalkyl substances (PFAS) are a large group of manufactured chemicals used for the past 80 years to make products resistant to heat, water, stains, and grease. As a few examples, PFAS have been used in manufacturing and in products such as coatings for nonstick cookware, stain-resistant carpets, and waterproof rain jackets and have been added to grease-fighting cleaning products, adhesive packaging, and heat-resistant firefighting foams. Most PFAS are highly persistent compounds given the strength of the carbon-fluorine bond and thus resist degradation in the natural environment. Once in the environment, they can contaminate soil and water and eventually end up in food and drinking water. There is evidence that human exposure to PFAS is widespread.

The workshop *Understanding, Controlling, and Preventing Exposure to PFAS*, held in Washington, DC, on September 26–27, 2019, provided a venue for discussing opportunities for reducing exposures to these chemicals. More than 100 experts from government, communities, academia, and the private sector shared their perspectives through presentations and moderated discussions. Although discussions touched on the potential health effects of PFAS exposures, the focus of the 1.5 day workshop was on opportunities to understand and prevent PFAS exposures rather than on elucidating their health effects.

The workshop was organized by the Workshop Planning Committee on Perfluoroalkyl and Polyfluoroalkyl Substances in the Environment—a Systems Approach to Exploring Exposure and Identifying Opportunities for Leadership as the first event of the Environmental Health Matters Initiative (EHMI),<sup>1</sup> a program that spans the major units of the National Academies of Sciences, Engineering, and Medicine to facilitate multisector, multidisciplinary exchange around complex environmental health challenges. Jonathan Samet, Colorado School of Public Health, opened with an overview of EHMI. Given the initiative's focus on opportunities for action, the workshop's structure was designed to highlight priorities for the field and elicit suggestions for concrete actions to advance these priorities. Presentations and discussions were informed by the sharing of pre-meeting and audience questionnaire results.

This Proceedings of a Workshop—in Brief provides the rapporteurs' high-level summary of the topics and suggestions for potential actions to address challenges surrounding PFAS exposures, as discussed at the workshop itself. Additional details and ideas can be found in materials available online, including videos and pre-meeting questionnaire input provided to attendees.<sup>2</sup> The reader is encouraged to use this document to gain insights into potential opportunities for action but should not view the ideas as consensus conclusions or recommendations of the National Academies of Sciences, Engineering, and Medicine.

Jennifer Field, Oregon State University, set the stage for the workshop with an overview of PFAS properties, use, and remediation. PFAS include many compounds whose chemistry gives them both oil-repelling and water-repelling properties, a unique combination that has proven useful—and commercially valuable—in a wide array of applications

<sup>1</sup> See <https://www.nationalacademies.org/ehmi> (accessed July 30, 2020).

<sup>2</sup> See <http://nas-sites.org/envirohealthmatters/pfas-workshop> (accessed July 30, 2020).

going back to the 1940s.<sup>3,4,5,6</sup> Although biological and even chemical processes do not easily degrade PFAS, they can transform and persist in humans and in the environment in various forms. “[The] carbon-fluorine bond is one of the shortest and strongest in nature,” said Field. “That gives rise to many of the properties that have brought our attention to the problem.”

As chemical analysis has advanced, scientists have learned more about how PFAS behave and have developed tools for detecting them. However, Field pointed to important gaps, particularly with regard to making detection methods feasible, accessible, and cost-effective. Looking forward, she emphasized that coordinated research efforts are needed to overcome current barriers and better understand PFAS contamination, its sources, and its alternatives, and to identify and implement remediation processes. Participants delved into these topics throughout the workshop’s three panel discussions.

## UNDERSTANDING HUMAN EXPOSURE TO PFAS

Exposure encompasses what people are exposed to in their environment and how much is being absorbed into their bodies. Understanding human exposure is important in mitigating health effects, yet there are substantial data gaps regarding which PFAS people are exposed to, at what level, from which sources, and through which routes and pathways. Participants discussed current knowledge and key gaps, and how those gaps might be closed.

### Current State of Knowledge

Field discussed possible pathways of exposure. Humans can be exposed through use of products that contain PFAS. They can also be exposed to PFAS as they migrate from waste streams at a manufacturing site. Through those pathways, PFAS can contaminate soil, water, food, and air. “What we’re seeing is a lot of cycling,” she said, adding that, from a remediation standpoint, “the scale of these things [is] really quite large.” An estimated 6 million people in the United States have drinking water that exceeds the U.S. Environmental Protection Agency’s (EPA’s) health advisory level of 70 nanograms per liter, she noted.<sup>7</sup> Although analytical technology is maturing, available tests are not sufficient to cover all PFAS in all types of materials, she said, leading to unevenness in data quality.

Antonia Calafat, U.S. Centers for Disease Control and Prevention (CDC), discussed findings from the National Health and Nutrition Examination Survey (NHANES), which annually collects data from about 5,000 people in 15 counties. NHANES studies measure compounds in participants’ blood and urine and have shown that human exposure to PFAS is widespread. Although these studies revealed a decrease in levels of specific compounds, such as perfluorooctanesulfonic acid (PFOS) after manufacturing changes were implemented in the early 2000s, legacy compounds are still present and are even detectable in people born years after these changes. One significant gap in these studies, Calafat noted, is that targeted testing for some specific compounds of interest (e.g., substances within the GenX class<sup>8</sup>) in blood—which provides more reliable results than testing urine—has been rather limited, leading to a dearth of quantitative human exposure information on these compounds.

Thomas Webster, Boston University School of Public Health, discussed studies of human exposure, which provide insights about the importance of various PFAS sources. For people who live in areas with highly PFAS-contaminated water, water is clearly a primary source of exposure. For the broader public, other routes of exposure have received less attention but are likely important, he said. Diet is a source of human exposure, with PFAS potentially entering food through a variety of pathways, including bioaccumulation, food contact materials, and food processing. Nonstick pans are not thought to be a major contributor, but Webster suggested further study may be warranted. Although dietary perfluorooctanoic acid (PFOA) and PFOS exposure has been

“The chemicals of concern [...] get into the food supply, they get into the compost, they get into the environment, they get into people.” – Mike Belliveau

<sup>3</sup> Krafft, M. P. and Reiss J. G. 2015. Selected Physicochemical Aspects of Poly- And Perfluoroalkylated Substances Relevant to Performance, Environment and Sustainability-Part One. *Chemosphere* 129:4-19.

<sup>4</sup> Buck, R. C., J. Franklin, U. Berger, J. M. Conder, I. T. Cousins, P. de Voogt, A. A. Jensen, K. Kannan, S. A. Mabury, and S. P. J. van Leeuwen. 2011. Perfluoroalkyl and Polyfluoroalkyl Substances in the Environment: Terminology, Classification, and Origins. *Integr Environ Assess Manage* 7:513.

<sup>5</sup> Wang, Z., I. T. Cousins, M. Scheringer, and K. Hungerbühler. 2013. Fluorinated Alternatives to Long-Chain Perfluoroalkyl Carboxylic Acids (PFCAs), Perfluoroalkane Sulfonic Acids (PFASs) and Their Potential Precursors. *Environ. International* 60:242-248.

<sup>6</sup> Erik Kissa. 1994. Fluorinated Surfactants: Synthesis, Properties, Applications. *Polymer International* 36(1):101-101.

<sup>7</sup> Hu, et al. 2016. Detection of Poly- and Perfluoroalkyl Substances (PFASs) in U.S. Drinking Water Linked to Industrial Sites, Military Fire Training Areas, and Wastewater Treatment Plants. *ES&T Letters*.

<sup>8</sup> GenX is a trade name for the PFAS compound developed as a replacement for perfluorooctanoic acid (PFOA) and is used informally to refer to fluorochemical byproducts of that compound’s manufacture.

demonstrated,<sup>9</sup> Webster emphasized that more research is needed on other PFAS and noted that an ongoing study<sup>10</sup> by the U.S. Food and Drug Administration may help address this gap. Other potentially important routes of human exposure include inhalation of volatile compounds,<sup>11</sup> ingestion of dust, and dermal absorption, such as through personal care products.<sup>12</sup> However, product labeling issues have impeded study of these potential routes.

### Potential Actions to Fill Exposure Research Gaps

Panelists Michael Focazio, U.S. Geological Survey; Christopher Higgins, Colorado School of Mines; Rainer Lohmann, The University of Rhode Island; Laurel Schaidt, Silent Spring Institute; and Anthony Spaniola, Need Our Water (NOW) joined Field, Calafat, and Webster for an open discussion of strategies to address knowledge gaps. John Adgate, Colorado School of Public Health, and Elsie Sunderland, Harvard University, moderated the discussion. Some attendees noted concerns regarding PFAS toxicity, but the health implications of PFAS exposure were not a focus of the workshop.

#### Characterizing Current Human Exposures

In light of shifts in PFAS manufacturing and use, many participants stressed the need to determine the types and the characteristics of PFAS to which people are being exposed. Much of the available data on human exposure to PFAS stems from studies of PFOS and PFOA, types of PFAS that have now been phased out by U.S. manufacturers. Far less data is available on newer compounds such as GenX PFAS. To fill this gap, Webster, Calafat, Adgate, and others called for enhanced biomonitoring (studies of human exposures based on measurements in, for example, blood and urine). Webster and Adgate suggested a comprehensive study to examine temporal and geographic trends systematically in human exposures to PFAS. “We need a total PFAS exposure study,” said Webster. “No one has ever done that. It would be a great thing to do.”

Participants discussed the implications of studies showing substantial amounts of unidentified organofluorines (the common chemical structure in PFAS in blood, environmental media, and consumer products).<sup>13,14</sup> While all PFAS are organofluorines, non-PFAS organofluorines also exist; Webster argued that characterizing the unidentified organofluorines is the single most important scientific question in the field right now. Experts had different views on whether research resources would be better allocated to untargeted studies of total human exposure to organofluorine (which would provide a big picture of PFAS exposure and could inform mitigation of PFAS as a class of chemicals) or to targeted studies of human exposure to specific compounds (which could inform mitigation measures focused on individual compounds in the class). Higgins favored quantifying specific compounds, while Lohmann and Sunderland emphasized the value of measuring total organofluorines to provide a baseline measurement of overall PFAS exposure.

“There are very substantial amounts of unidentified organofluorines found in human blood, environmental media, and in consumer products. [...] The single most important scientific question in the field right now is to figure out what this stuff is.” – Thomas Webster

#### Tracing Sources and Routes of Exposure

To complement biomonitoring and better understand sources and pathways of human exposure, participants also stressed the need for broader environmental monitoring. In particular, Field, Calafat, and Webster underscored the need to investigate non-water pathways of exposure, which they see as likely underappreciated due to limited availability of data.

<sup>9</sup> Vestergren R., Cousins I. 2015. Human dietary exposure to per- and poly-fluoroalkyl substances (PFASs). In: Rose M & Fernandes A. Persistent organic pollutants and toxic metals in food.

<sup>10</sup> See <https://www.fda.gov/science-research/fda-grand-rounds/analysis-and-polyfluoroalkyl-substances-pfas-foods-analytical-method-development-challenges-and> (accessed July 30, 2020).

<sup>11</sup> Makey, C. M., T. F. Webster, J. W. Martin, M. Shoeib, T. Harner, L. Dix-Cooper, and G. M. Webster. 2017. Airborne precursors predict maternal serum perfluoroalkyl acid (PFAA) concentrations. *Environ Sci & Technol* 51(13):7667-7675. PMID: 28535063.

<sup>12</sup> Schultes, L., R. Vestergren, V. Kristina, E. Westberg, T. Jacobson and J. P. Benskin. 2018. Per- and polyfluoroalkyl substances and fluorine mass balance in cosmetic products from the Swedish market: implications for environmental emissions and human exposure. *Environ. Sci.: Processes Impacts* 20:1680-1690.

<sup>13</sup> Miyake, Y., N. Yamashita, M. So, P. Rostkowski, S. Taniyasu, P. K. S. Lam, and K. Kannan. 2007. Trace analysis of total fluorine in human blood using combustion ion chromatography for fluorine: A mass balance approach for the determination of known and unknown organofluorine compounds. *Journal of Chromatography A* 1154(1-2):214-221.

<sup>14</sup> Yeung, L. W. Y., Y. Miyake, P. Li, S. Taniyasu, K. Kannan, K. S. Guruge, and P. K. S. Lam, Nobuyoshi Yamashita. 2009. Comparison of total fluorine, extractable organic fluorine and perfluorinated compounds in the blood of wild and perfluorooctanoate (PFOA)-exposed rats: Evidence for the presence of other organofluorine compounds. *Analytica Chimica Acta* 635(1):108-114.



Field and Webster emphasized the need for a better understanding of how PFAS get into the diet. Although studies have demonstrated bioaccumulation in fish and transfer from food contact materials, less is known about food processing as a potential pathway, Webster said. Higgins pointed out that dietary exposure pathways are likely complex; farmlands can be contaminated from the use of biosolids as fertilizer or from the use of contaminated water sources. Participants also noted the need to understand inhalation and dermal exposures, for example, through personal care products. “We need more work on inhalation and dermal exposures, and we need to really be doing exposure studies of the newer PFAS,” said Webster. Reflecting on the gaps related to sources and exposure pathways, Thomas Burke, Johns Hopkins University, emphasized the need for a systems approach to assessing human exposure, going beyond biomonitoring to listening to communities to understand how exposures may occur.

### *Expanding Research Capabilities*

Participants suggested ways to expand capabilities for characterizing human exposure to PFAS and their effects, including providing necessary research funding; developing standards, methods, and models; and enabling collaboration and coordination. Field, Webster, and others called for the development of additional analytical chemistry standards and methods, including methods to analyze new compounds

and methods for measuring PFAS in a wider variety of substances. George Daston, Proctor & Gamble, suggested that computational methods could be valuable for identifying compounds for which standards are lacking via unsupervised chemical analysis approaches. Webster and Focazio highlighted the importance of developing models that link PFAS exposures in humans with sources and routes of exposure because existing models do not always apply to PFAS. For example, existing bioaccumulation models, which are based on Kow (the octanol and water partition coefficient), do not work when applied to PFAS, Webster noted.

Field, Higgins, and Calafat stressed that the complexity of the research questions necessitates a collaborative, interdisciplinary approach augmented by data-sharing and cross-sector dialogue. “One of the things that I think has been most encouraging is there has been some effort toward large scale collaborative efforts,” said Higgins. “The more of that—where you can bring people in with different sorts of expertise [...]—the better.” Field suggested that funding agencies can help support this approach by incentivizing collaboration rather than competition through their grant awards. Samet and others expressed support for holistic approaches, such as a total exposure study or integrative exposure assessment, and Williams and Samet noted that it would be valuable for such efforts to be informed by an understanding of the specific types of exposure research that would best enable decision-making.

“This is a very complex issue...so the ability to work collaboratively with a lot of different people, I think, is important.” – Christopher Higgins

“Understanding PFAS is certainly [...] going to require a multidisciplinary team.” – Antonia Calafat

## ADDRESSING PFAS CONTAMINATION

Where PFAS are present in the environment, what can be done to contain them, destroy them, or limit people’s exposure? The workshop’s second panel focused on current practices and opportunities for improving the treatment of PFAS-contaminated media, such as water and soil. In this panel and throughout the workshop, participants also considered how to communicate with communities who are affected by PFAS contamination.

### **Current State of Knowledge**

Rula Deeb, Geosyntec Consultants, gave an overview of approaches to dealing with PFAS-contaminated media. PFAS contamination is a complex challenge because PFAS are often present as mixtures, can transform into different compounds, and can be present in high volumes in a variety of environmental media. Most technologies are designed to remove PFAS (e.g., from water) or contain them in place (e.g., in soil); incineration is currently the only approach used to destroy them. For PFAS removal, Deeb noted that available technologies are often not able to remove PFAS completely compared to other contaminants. Although destruction would be ideal, PFAS are inherently difficult to destroy. “These compounds are meant to put out fires and to be stable under very extreme conditions, so it’s going to take very extreme conditions to break them down,” said Deeb. “There are no destruction methods that are fully demonstrated in the field yet [as] capable of addressing PFAS impacted media.” She added that treatment efforts are hindered by a lack of a federal maximum contaminant level (MCL) for PFAS or other mechanisms to require cleanup.

### **Potential Actions to Improve Treatment Capabilities**

Samet and Philip Johnson, The Heinz Endowments, moderated a discussion of strategies to improve treatment capabilities. Deeb was joined by panelists Jason Dadakis, Orange County Water District; Detlef Knappe, North Carolina

State University; Linda Lee, Purdue University; Andrea Leeson, U.S. Department of Defense and Kurt Pennell, Brown University.

### *Monitoring Contamination*

PFAS contamination is found in a variety of environmental media but is most actively monitored and treated in drinking water. Although Higgins, Martha Rudolph, Colorado Department of Public Health & Environment, and others cautioned against focusing on PFAS in drinking water at the expense of examining the full range of exposure sources, other participants offered concrete suggestions for improving water monitoring. In particular, they suggested three water sources—public water systems, private wells, and source water—should be regularly tested for PFAS.

Because most Americans consume water from public water systems, testing could provide valuable information on how well current water treatment systems protect the public from PFAS exposures. However, Lee and Schaidler cautioned that such assessments can be biased if they only test for a limited number of PFAS; in addition, tests that are only focused on testing finished (drinkable) water do not necessarily help to identify the source of the PFAS. Focazio underscored the importance of private wells, which represent the water supply for about 40 million Americans, but acknowledged that well water is difficult to monitor and test as it is hard to track private well use.

Other participants, including Knappe and Burke, stressed the need for monitoring PFAS “upstream” in addition to drinking water supplies. Doing so can help inform treatment approaches and also yield insights on sources of PFAS contamination and how PFAS behave in various media. Specifically, Lee, Pennell, and Knappe stressed the need to investigate PFAS sources, including potential emissions from the technologies used to remove or destroy PFAS; how compounds might interact; how long PFAS persist in various media; and how they move. “We may be spending a lot of money installing a treatment technology that removes some PFAS, but if the water source isn’t well characterized, we may be missing another part of the problem,” said Knappe.

“Technologies that we’re relying upon right now for dealing with PFAS impacted media [...] are just merely removing PFAS from one environmental stream [and] concentrating it into another, so we have to still deal with that concentrated stream.”  
– Rula Deeb

“It may be 10 years before we come up with [destruction] technologies that are effective and safe [...] and in the meantime, we’ll do containment. We’ll do pump and treat, dig and haul [...] the idea there is to protect the public and reduce the exposure.” – Kurt Pennell

“It seemed like the news from the treatment session was kind of dismal. I would say it’s not. We’ve made a tremendous amount of progress, I think, in a very short term.” – Andrea Leeson

### *Containing Contaminants*

Participants discussed the importance of protecting the public when PFAS contamination is discovered. Knappe and Pennell emphasized that it is crucial to keep the PFAS from spreading, perhaps, through such strategies as treating polluted water or moving polluted soil to a facility, like a lined landfill, from which it (and any byproducts of containment strategies) cannot migrate back into the environment. Others focused on ways to reduce human exposure to contaminated media. Deeb noted that the EPA has not set a MCL for PFAS in water, despite its authority to do so under the Safe Drinking Water Act. She suggested that better coordination and guidance among state governments would be helpful for informing mitigation activities while waiting for EPA to set a MCL. Lee argued for a dual strategy of containment (to address known problems now) and destruction (for which it will take time to develop technologies).

“The practice of doing incineration without knowing exactly what we’re doing is very concerning. [...] We don’t fully understand all of the reaction products and byproducts that are formed.” – Detlef Knappe

“[We need to] make sure that whatever we come up with, we’re not making the problem worse by developing these other byproducts that could be toxic, that we don’t know anything about.” – Kurt Pennell

“It’s not just [...] getting to the destructive technologies, but also developing the tools to correctly and accurately identify the byproducts and the mechanisms that are involved before we can fully validate the technology and stamp it as safe.”  
– Rula Deeb

### *Destroying PFAS*

To enable actual removal of PFAS from the environment, rather than only containing or moving them, many participants stressed the need for better methods to destroy PFAS. Although incineration is a common method of destruction, Lee and Knappe noted that little is known about the chemical interactions that occur during incineration of

PFAS or what risks they may pose. Knappe suggested that incineration may be a viable destruction technology but urged that it should be done carefully with appropriate pollution control measures. Leeson and Deeb expressed optimism about alternatives to incineration that are being developed, although Deeb, Knappe, and Pennell stressed the importance of identifying and mitigating the byproducts of any such technology.

### *Expanding Treatment Capabilities*

Participants discussed who would pay for research and technology development to enhance treatment capabilities and options for funding cleanup efforts. In terms of cleanup, Knappe posited that rate payers will likely bear the cost burden in the short term. Dadakis suggested manufacturers could be held financially and legally responsible, and Deeb suggested the government should be responsible for ensuring access to clean water when the polluter cannot be identified. For both cleanup and technology development, Pennell suggested that philanthropic organizations that have an interest in specific areas, such as water, could be a source of funding. For research funding, participants pointed to agencies, such as EPA, National Science Foundation, and National Institutes of Health, in particular the National Institute of Environmental Health Sciences (NIEHS). Leeson noted that the U.S. Department of Defense is investing heavily in PFAS remediation solutions, with a total funding level of close to \$75 million. Dadakis suggested that quantifying potential co-benefits of PFAS remediation could help bolster research support and inform the selection of approaches. Leeson and Andrea Amico, Testing for Pease, underscored the need for coordination among funding organizations to avoid duplication of efforts and to make progress, and Leeson and Linda Birnbaum, former NIEHS director, said there have been efforts to facilitate cross-talk among federal agencies that are funding work to advance methods for PFAS remediation.

“It’s really important for the organizations doing the funding to be talking [to each other].” – Andrea Leeson

### *Communicating with Communities*

A number of participants stressed the need to take action and communicate with communities based on available information, even if it is incomplete. “While everybody determines more studies and more science to do, communities aren’t getting the action that they need, and I feel like we know a lot and we should see a lot more action,” said Amico. Pennell and Rudolph said that exposed communities remain frustrated with the lack of answers as to how they can protect themselves and their families. For instance, granular activated carbon water filters are often mentioned as a solution that residents can implement, but Lee, Knappe, and Pennell expressed uncertainty about the effectiveness of this expensive short-term solution.

“I don’t think we have a good answer yet for the homeowner on how to treat their water or where to live.” – Andrea Leeson

Burke urged that the communication should go both ways, with scientists working to educate the public on what is known about PFAS exposures, health effects, and treatment and listening to communities about their experiences and concerns. From the community perspective, Spaniola said, “It’s really critical for the scientific community to engage in an ongoing and proactive dialogue with community members [...] Help us understand where you, in the scientific community, have issues. And allow us to help you find solutions.”

Participants explored the public’s role in three main areas: monitoring water, monitoring PFAS exposure in the body, and increasing transparency regarding PFAS content in consumer products. Pennell suggested that people would benefit from access to “some type of system where they can get their water tested.” Dadakis underscored the importance of being transparent with water customers and noted that professional associations have useful guidance for utilities; Johnson argued that homeowners should also be provided with guidance on actions they can take. Lee cautioned that it is important to convey the limitations of water monitoring when communicating with the public, as “the maps can be misleading,” for example, by giving the impression that PFAS contamination is not present in places where it simply has not been assessed.

A second issue is access to tests to detect PFAS exposure at an individual level. Providing a public perspective, Amico described limitations in testing access. Steve Korzeniowski, FluoroCouncil, American Chemistry Council (ACC), also described how it is “basically impossible” for people to know the level of PFAS in their own blood because testing is expensive and largely inaccessible, and Birnbaum noted the challenge of knowing what to test for given the many compounds in this chemical class.

“They were exposed...without their consent and now they have to fight tooth and nail to get a blood test result to know how much exposure they had? It just seems incredibly wrong [...] We don’t have all the answers yet, but not testing them is not the right answer.” – Andrea Amico

Amico implored for more access to testing despite the knowledge gaps regarding the interpretation of test results, as this testing would at least allow people to compare their levels with others in highly exposed communities. Birnbaum agreed that relative exposure understanding has value and said that testing could potentially highlight some “options for what they could do to reduce their exposure going forward.” Representing a different public health view, Lynn Goldman, George Washington University, who previously served as Assistant Administrator for Toxic Substances at the EPA, argued that the value of testing is diminished in the absence of information about health effects or clear guidelines regarding how people can protect themselves. Testing without this context could do “more harm than good,” she suggested, with test results merely raising concern without offering helpful guidance.

## PREVENTING PFAS EXPOSURE

In light of the difficulty of remediating persistent chemicals once they are in the environment, another approach to reducing exposures is to prevent the release of these chemicals in the first place. To this end, the workshop’s third session focused on strategies to reduce PFAS use. Carla Ng, University of Pittsburgh, and Holly Davies, Washington State Department of Health, provided an overview to frame the discussion. They were joined by panelists Mike Belliveau, Environmental Health Strategy Center; Elizabeth Harriman, Toxics Use Reduction Institute; Steve Korzeniowski, FluoroCouncil, ACC; and Meredith Williams, California Department of Toxic Substances Control, for a discussion moderated by Jonathan Samet, Colorado School of Public Health, and Patricia Mabry, HealthPartners Institute.

### Current State of Knowledge

Ng offered criteria for identifying and prioritizing opportunities to eliminate PFAS from products. She outlined two critical distinctions: first, whether the product is essential for health and safety and the functioning of society; and second, whether there are alternatives to PFAS that are technically and economically feasible. On the basis of those factors, the use of PFAS in a product can be categorized as either nonessential, essential, or substitutable.<sup>15</sup> Ng said PFAS can be “easily” omitted from nonessential uses—what she called “the low-hanging fruit”—and replaced with alternatives where it is substitutable. Although eliminating PFAS from essential products with no alternatives is harder, she noted that “essentiality is not permanent” as alternatives continue to be discovered and developed.

Davies outlined how alternatives assessments can be used to identify, compare, and select safer alternatives to PFAS for new products. As opposed to risk assessment, which focuses on quantifying hazards associated with exposures, “the idea of alternatives assessment is to reduce risk by reducing intrinsic hazard,” Davies said. Many tools are available for informing alternatives assessments.<sup>16,17,18</sup> Determining whether PFAS are necessary, as discussed by Ng, is integral to this process. Key considerations in an alternatives assessment include performance, cost, availability, and exposure, although manufacturers, purchasers, and regulators may consider different factors and have different priorities. The process

“We can work on developing ways to try and get rid of [PFAS]...but unless we...stop putting it into our environment, the levels in our environment will continue to go up and this problem will be around not only for our children and our grandchildren, but for their grandchildren.” – Linda Birnbaum

“I think the priorities should be to not produce these chemicals in the first place because we end up with this conundrum. Once we have it, all solutions seem to be somewhat imperfect.”  
– Detlef Knappe

“We need to [...] understand the true cost of letting this get so out of control. [...] The cost of cleaning this stuff up or dealing with it once it’s out in the environment is exponentially more than the cost of controlling it in the beginning.” – Workshop participant

“We have to identify when the functionality is actually critical, and when it’s just a ‘nice to have.’ I think that’s an important conversation.” – Carla Ng

“We should [ensure] that the benefits that we’re getting from [a] particular product [...] outweigh the cost—not just the money, but the cost.”  
– Martha Rudolph

“Manufacturers can make, and people can buy, other products that might be just as bad—and that’s just a challenge we have of encouraging the use of safer alternatives.” – Holly Davies

<sup>15</sup> Cousins, I. T., G. Goldenman, D. Herzke, R. Lohmann, M. Miller, C.

A. Ng, S. Patton, M. Scheringer, X. Trier, L. Vierke, Z. Wang and J. C. DeWitt. 2019. The concept of essential use for determining when uses of PFASs can be phased out. *Environmental Sci: Processes Impacts* 21:1803-1815.

<sup>16</sup> National Research Council. 2014. *A Framework to Guide Selection of Chemical Alternatives*. Washington, DC: The National Academies Press. <https://doi.org/10.17226/18872>.

<sup>17</sup> Interstate Chemicals Clearinghouse. IC2 Alternatives Assessment Guide. Available at [http://theic2.org/alternatives\\_assessment\\_guide](http://theic2.org/alternatives_assessment_guide).

<sup>18</sup> Association for the Advancement of Alternatives Assessment. Available at <https://www.saferalternatives.org>.

may identify preferred alternatives, or it may determine that the alternatives are no safer than PFAS. Davies added that there are also likely to be unknowns, especially given how large and diverse the PFAS class of chemicals is and the lack of hazard information for many compounds. Finally, the feasibility of alternatives may vary for different places or for different goals, for example, in accordance with a locality's practices and rules for waste disposal, fire codes, or energy efficiency.

### Potential Actions to Prevent PFAS Exposure

Participants discussed opportunities to address challenges related to identifying where PFAS are used, determining where they may be eliminated, and adopting safer alternatives. Participants also explored the drivers behind PFAS use and suggested ways to address these drivers through both regulatory and non-regulatory means.

"I understand [proprietary information] protects information about competitors. The problem is it doesn't protect the public." – Jennifer Field

"Which exact chemicals are being used, how much is being used, what is the concentration? [...] It's hard to [detect] [...] specific compounds when we don't know which compounds to look for." – Holly Davies

### *Understanding PFAS Production and Use*

Because the exact chemical composition of products is often protected as confidential business information, retailers, consumers, and researchers typically lack information about PFAS use and potential sources of environmental contamination. "We don't have the information of how [many] organoflourines are being produced each year, and where they're going," said Birnbaum. "[It] is important for us to understand the size of the problem and the scope of the problem, because these chemicals essentially will never go away." Several participants pointed out that greater transparency and data sharing related to PFAS production and use would have the dual benefit of enabling exposure research and facilitating efforts to reduce human exposures. Field and Davies underscored the challenge of conducting analytical chemistry on a target that is unclear and constantly changing. "Product compositions seem to change faster than we can get research done," said Davies. Field, Webster, and Lohmann emphasized that data on PFAS production are critical to both measuring human exposures and assessing PFAS in the environment.

Field pointed out that researchers could potentially take a "reverse engineering" approach to determine products' chemistry composition or reconstruct historical PFAS use, but she said that such studies would likely be expensive and noted that they would ultimately be paid for by taxpayers. Birnbaum, Daston, Harriman, and others pointed to the role of industry in providing information on PFAS production and its use in materials and products. "Some sort of extraordinary measures in terms of transparency is necessary," Harriman said. Referencing the ACC's long-range planning, Daston noted that "this idea of inventorying production and use of chemicals [...] is at the top of their agenda. It will be a difficult task, but [...] the chemical industry is the right player because of their knowledge of what is produced and how it is used." He urged companies to prioritize PFAS chemicals in such efforts. Pointing to a January 2019 webinar organized by the Interstate Chemicals Clearinghouse,<sup>19</sup> Korzeniowski said industry is "certainly willing to help point folks in the right direction about what's used" and referenced efforts the chemical industry has made to describe general uses of PFAS, for example, as surfactants. However, he noted that although some data is available on historical PFAS use and on global manufacturing for some compounds, "what we don't have is current use, because producers don't share that." He added that actual data for individual end uses is "basically impossible to get."

### *Mechanisms for Disclosure of PFAS Use*

Participants discussed regulatory and non-regulatory mechanisms for encouraging or requiring the disclosure of details about PFAS production and use. Several participants suggested state and federal governments could exercise their authority to force disclosure, and Davies and Belliveau noted that policymakers have the power to mandate disclosure and labeling. For example, Goldman noted the EPA could obtain information on production and use under the Lautenberg Chemical Safety Act. Williams said that California's Safer Consumer Products program may provide relevant authority, and Belliveau, Davies, and Mark Rossi, Clean Production Action, added that relevant legislation is also being considered or enacted in other states. Ng, Belliveau, Williams, and Harriman stressed that transparency should extend through the entire life cycle, reflecting the use of PFAS in the manufacturing process and in the final product, and Burke, Rudolph, and Ng added that it is also important to consider waste management for PFAS-containing products. Williams said

"We really have to take a life cycle view to understand what's going on during production and what's being released, [as well as] what's [in] the waste streams being released." – Carla Ng

<sup>19</sup> See [http://theic2.org/ic2\\_webinar\\_the\\_pfas\\_universe](http://theic2.org/ic2_webinar_the_pfas_universe) (accessed July 30, 2020).

that manufacturers can face barriers in understanding their full supply chains and suggested that a consortium approach could help reduce these barriers. Highlighting the role of retailers, Belliveau suggested a REACH-like<sup>20</sup> approach in which information is required to be sent both up and down the supply chain, and noted that a rule pending in Maine advances this idea by requiring manufacturers to disclose their use of certain PFAS chemicals in consumer products sold in the state.<sup>21</sup>

Davies added that companies in Europe are required to provide information on products that contain substances deemed to be of “very high concern” when requested. However, other participants cautioned that simply allowing consumers to know when PFAS are in a product is not necessarily sufficient to help them make informed decisions. Spaniola emphasized that “when consumers are buying products, they need to know what’s in them and what the impacts are.” Rather than simply a “right to know” what is in a product, Daston argued that consumers should have a “right to understand” the full array of benefits and risks it brings.

### *Mechanisms for Limiting PFAS*

Participants discussed regulatory and non-regulatory mechanisms for limiting PFAS use or environmental contamination. At the federal level, Harriman said PFAS “are unregulated at this point.” Although EPA has proposed a Significant New Use Rule (SNUR) pertinent to PFAS in new products, Korzeniowski noted that the SNUR does not address imported products, and Belliveau added that it only requires notification, rather than actually restricting use. Davies noted that Washington State has a new law to encourage the use of safer alternatives, one of several state efforts that could lead to reductions in PFAS use, or at least increase disclosure. Deeb urged more coordinated guidance for states and said that the uneven regulatory landscape across the states “really complicates treatment, and it complicates taking information from one system in one state and extrapolating it to another.” On the other hand, in the context of incentivizing the use of alternatives, Davies noted that “one size does not fit all,” given that there are local differences in rules relevant to PFAS-containing products, such as fire codes and waste disposal.

Actions can affect the use of PFAS in products produced in the United States, but Lee, Korzeniowski, Belliveau, and others noted that manufacturers in China and other countries are still likely to continue using these chemicals. “This is a global problem,” said Lee, urging that “we have to do something to prevent products being imported into the [United States].”<sup>22</sup>

Even without actual PFAS bans, Belliveau suggested a “firm direction” from governments could nudge industry to develop and adopt alternatives. In addition, nongovernmental organizations, including standard setting and certification bodies, can and have played a leading role in reducing PFAS use. For instance, Belliveau noted that one of the leading organizations that promotes composting now restricts residual organofluorine content in compostable products they certify, thus driving manufacturers to remove PFAS from their compostable food packaging.<sup>23</sup> This precedent, he suggested, could set an example for other industries.

“What do labels and warning statements really accomplish? What we’ve labeled as ‘right to know’ has not been a success. What we have to have is a ‘right to understand.’” – George Daston

“If we set a firm direction that this is where we need to go, and government says ‘we’re presuming we’re going to get there,’ this will unleash [...] the best competitive instincts in American business to solve these problems and get those products on to market.” – Mike Belliveau

“Basically there is nothing in life that has no risk. But I think what we need to be looking at is balancing the benefits from the risk.” – Linda Birnbaum

“We have learned the lesson the hard way about persistent substances over and over again, and what I hope is that we can start to not make similar mistakes.” – George Daston

“We have these brands that imply good things, because that’s what companies do to sell products. [...] People don’t understand, in fact, that these properties [...] come with a cost of exposure of people and the environment.” – Jonathan Samet

<sup>20</sup> Registration, Evaluation, Authorisation and Restriction of Chemicals. See [https://ec.europa.eu/environment/chemicals/reach/reach\\_en.htm](https://ec.europa.eu/environment/chemicals/reach/reach_en.htm) (accessed July 30, 2020).

<sup>21</sup> Maine Department of Environmental Protection, Chapter 890, Designation of PFOS as a Priority Chemical. See <https://www.maine.gov/dep/rules/#2072687> (accessed July 30, 2020).

<sup>22</sup> On February 20, 2020, EPA proposed a supplemental Significant New Use Rule that would require notifying the EPA before importing long-chain PFAS as part of surface coatings on articles. See <https://www.epa.gov/assessing-and-managing-chemicals-under-tsca/prepublication-version-proposed-supplemental-significant> (accessed July 30, 2020).

<sup>23</sup> Biodegradable Products Institute, Fluorinated Chemicals, see <https://bpiworld.org/Fluorinated-Chemicals> (accessed July 30, 2020).

### *Advancing Alternatives*

Several participants posited that people may come to different conclusions regarding when PFAS are essential or which alternatives are feasible. “Who decides what’s essential?” Korzeniowski asked; “Is it the market, or it is us, as scientists?” Williams said that such decisions should incorporate a wide range of viewpoints, including retailers, regulators, and communities affected by PFAS contamination, and added that considerations of functionality should include the function of the PFAS in both the end product and the manufacturing process.

“We need to effectuate an orderly transition away from extremely persistent chemicals, and the chemistries that create them.” – Mike Belliveau

Participants discussed the roles of materials manufacturers, product manufacturers, retailers, and consumers in driving demand for PFAS-containing products (or the adoption of alternatives). Belliveau argued that “the customer is queen” in a market economy and predicted that consumers will create an “increasing market incentive to move toward safer alternatives.” On the other hand, Ng cautioned against overemphasizing the role of consumer demand, given that consumers lack the chemistry knowledge to understand the properties that give products their functionality and the potential downsides. Samet underscored the importance of effective public outreach to help consumers consider what is “essential” as they weigh the costs of PFAS use and exposure against the messages they receive from brands about product functionality.

Korzeniowski said that many manufacturers “have responded to the consumers,” but stressed that performance and functionality matter. “It’s perfectly acceptable to do alternative assessments [...] but [...] some of these chemistries provide very significant benefits, and we should acknowledge that,” he said. For example, what level of risk is acceptable if firefighting foams are less effective without PFAS? Davies stressed the value of partnerships between industry and users, such as firefighters, to understand the performance requirements. Similarly, Goldman suggested bringing “the pollution prevention community together with the public health and medical community” to facilitate productive exchange around PFAS-containing medical waste and the feasibility of alternatives in medical products.

Defining safer alternatives presents another challenge. Rossi suggested seeking ways to “help elevate and get more alignment on how we define what a safer alternative is.” Birnbaum suggested that alternatives should be selected on the basis of their ability to degrade in the environment into harmless byproducts. Another participant stressed the need to consider equity of potential impacts as PFAS are phased out or alternatives are adopted. Participants also discussed some specific alternatives, in particular fluoropolymers. While acknowledging that they are persistent because they are designed to be durable, Korzeniowski said fluoropolymers have the right properties for a number of applications. However, Belliveau, Ng, and Birnbaum cautioned that polymers can also potentially degrade and release chemicals of concern into the environment.

### *Encouraging Innovation*

Ng, Williams, and Belliveau underscored the need to perform alternatives assessments and drive the discovery or development of effective PFAS replacements. As part of this, Belliveau urged a major initiative to invest in “green manufacturing” with environmentally sustainable materials. Darrell Boverhof, the Dow Chemical Company, said there is a need for sustainable processes at every stage of the life cycle, from developing PFAS-free product ideas to managing PFAS-containing production waste. Williams suggested that policymakers should partner with economists to develop “a very thorough economic analysis of the markets and the incentives and disincentives” for green manufacturing. Davies and Belliveau suggested states should expand economic development programs with grants aimed at enabling and incentivizing businesses to switch their production methods to being PFAS free. Belliveau added that federal government leadership will be required to scale these efforts.

## SUMMARY

Throughout the two-day workshop, attendees from industry, government, academia, and PFAS-affected communities discussed gaps and opportunities in understanding and addressing PFAS chemicals. Participants surfaced numerous ideas for better understanding PFAS production, use, and exposure through expanded research efforts, as well as action on the part of industry and governments. They also identified opportunities to address PFAS contamination where it is already present in the environment and strategies to curtail future PFAS exposures by limiting the production and use of these chemicals. Those potential actions, which are presented in the preceding text, are summarized in Table 1.

**TABLE 1** Potential Actions Suggested By Individual Workshop Participants to Understand and Address PFAS Chemicals

Area of Focus	Potential Actions	Possible Actors <sup>a</sup>
Understanding PFAS production and use	Collect and share information on PFAS production and use, including the types and amounts of PFAS in materials and products extending across the full life cycle from supply chain through waste disposal	Researchers Industry Retailers Government
	Exercise authority to require disclosure of PFAS production and use	Government (state authorities and U.S. EPA)
	Use a “reverse engineering” approach to determine products’ chemistry composition or reconstruct historical PFAS use	Researchers
Characterizing human exposures	Conduct biomonitoring studies, such as untargeted studies of total organofluorine exposure and targeted studies to characterize exposure to specific compounds	Researchers Industry Research Funders
	Conduct a comprehensive study to systematically examine exposure in populations at different times and places	Researchers
Identifying sources and routes of exposure	Conduct environmental monitoring studies, especially for newer PFAS compounds	Researchers
	Test public water, private wells, and water sources	Utilities Researchers Communities
	Investigate non-water routes of exposure, especially dietary and dermal exposures	Researchers
	Characterize PFAS sources, including potential emissions from treatment strategies	Researchers
	Characterize how compounds interact, how long PFAS persist in various media, and how it moves	Researchers
	Listen to communities to understand how exposures may occur	Researchers Communities
Expanding exposure research capabilities	Provide funding for studies and tool development	Research funders (government and philanthropic)
	Develop standards, methods, and models for characterizing human exposures and linking them with sources and routes of exposure	Researchers Standards-setting bodies Model developers Technology developers
	Facilitate and incentivize collaboration and coordination to support holistic, interdisciplinary research	Researchers Research funders
Addressing contamination	Reduce exposure to contaminated media	Responsible Industry Government
	Use containment strategies to keep PFAS from spreading	Industry Government
	Coordinate exposure guidance among states	State governments Federal government
	Establish a maximum contaminant level (MCL) for PFAS	U.S. EPA
	Establish and validate methods to characterize and mitigate byproducts of any PFAS destruction technology	Researchers
	Investigate PFAS incineration byproducts and develop appropriate controls to prevent the release of harmful byproducts	Researchers
	Develop safer alternatives to incineration	Researchers
Expanding mitigation capabilities	Provide funding for studies and tool development	Research funders (philanthropic and government, specifically DOD, NIH/NIEHS, NSF, EPA)
	Coordinate research investments	Government
	Provide funding for cleanup of contaminated media	Industry Government Philanthropic organizations
Communicating with communities	Facilitate two-way communication between researchers and communities	Non-Governmental Organizations
	Share information on PFAS contamination, along with guidance on actions homeowners can take	Utilities State governments
	Communicate about PFAS content in products and the full array of benefits and risks	Industry (e.g., consumer product) Government
Reducing PFAS use	Differentiate between essential, nonessential, and substitutable PFAS uses in products and manufacturing processes	Communities Retailers Regulators
	Engage in productive exchange to understand performance requirements and benefits and risks of PFAS and proposed alternatives	Industry Users (e.g., firefighters, medical community) Pollution prevention community
	Engage in productive exchange to establish criteria for assessing alternatives	Industry Researchers Government Consumers
	Create bottom-up incentives to develop and adopt safer alternatives	Consumers
	Assess markets and incentives for green manufacturing	Economists Policymakers
	Invest in green manufacturing through economic development programs and grants	States Federal government Foundations
	Set standards for PFAS content in products	Government Non-governmental standard setting and certification bodies
	Set a firm direction for reducing PFAS use and adopting alternatives	Government
	Establish rules regarding imports of PFAS-containing products	Government

<sup>a</sup>Actors have been inferred where attendees did not explicitly identify actors.

Note: This table lists potential actions attributed to individual workshop participants in the text above, grouped by similarity, as topics were discussed from different angles at different points during the workshop. This table does not include all actions mentioned by participants. These actions are not consensus conclusions or recommendations of the National Academies.



**DISCLAIMER:** This Proceedings of a Workshop—in Brief was prepared by Anne Johnson, Marilee Shelton-Davenport, and Ellen Mantus as a factual summary of what occurred at the workshop. The statements recorded here are those of the individual workshop participants and do not necessarily represent the views of all participants, the committee, or the National Academies.

**REVIEWERS:** To ensure that this Proceedings of a Workshop—in Brief meets institutional standards of quality and objectivity, it was reviewed in draft form by **Darrell Boverhof**, The Dow Chemical Company; **Rula Deeb**, Geosyntec Consultants; **Rainer Lohmann**, The University of Rhode Island; **Jonathan Samet**, Colorado School of Public Health; **Tom Webster**, Boston University School of Public Health; and **Xiaoying Zhou**, California Environmental Protection Agency. The review comments and draft manuscript remain confidential to protect the integrity of the process.

PFAS workshop planning committee members are **Jonathan M. Samet** (*Chair*), Colorado School of Public Health; **John L. Adgate**, Colorado School of Public Health; **Rula Deeb**, Geosyntec Consultants; **Elizabeth Harriman**, University of Massachusetts, Lowell; **Philip R. Johnson**, The Heinz Endowments; **Patricia L. Mabry**, HealthPartners Institute; and **Elsie Sunderland**, Harvard University.

#### ABOUT THE ENVIRONMENTAL HEALTH MATTERS INITIATIVE

From the air we breathe to the water we drink, our health is defined by our natural environment. Environmental health issues like air and water pollution affect everything from our quality of life to the prevalence of a variety of illnesses. We bring together leaders from various sectors to share their insights on how to solve our most pressing environmental health challenges. Our goal is to have experts leave our convening events with new ideas, connections, and partnerships so they may be better equipped to innovate and develop environmental health solutions in their respective fields.

Standing committee members are **Thomas A. Burke** (*Chair*), Johns Hopkins University Bloomberg School of Public Health; **Darrell Boverhof**, The Dow Chemical Company; **George P. Daston**, Procter & Gamble; **Ana V. Diez Roux**, Dornsife School of Public Health at Drexel University; **Linda J. Fisher**, DuPont; **Estelle Geraghty**, Esri; **Lynn R. Goldman**, George Washington University's Milken Institute School of Public Health; **Daniel S. Greenbaum**, Health Effects Institute; **Gavin Huntley-Fenner**, Huntley-Fenner Advisors; **Philip R. Johnson**, The Heinz Endowments; **Beth Karlin**, See Change Institute; **Jennifer McPartland**, Environmental Defense Fund; **Devon C. Payne-Sturges**, Maryland Institute for Applied Environmental Health at the University of Maryland School of Public Health; **Amy Pruden**, Virginia Tech; **Martha E. Rudolph**, Colorado Department of Public Health & Environment; **Jonathan M. Samet**, Colorado School of Public Health; and **Deborah L. Swackhamer**, University of Minnesota.

Liaisons are **Francie Abramson**, Target; **John Balbus**, National Institute of Health (NIH)/National Institute for Environmental Health Sciences; **Linda Birnbaum**, NIH/National Institute for Environmental Health Sciences; **Patrick Breysse**, Centers for Disease Control and Prevention; **Elizabeth Cisar**, The Joyce Foundation; **Natasha DeJarnett**, National Environmental Health Association; **Zach Freeze**, Walmart; **Richard Fuller**, Pure Earth; **David Fukuzawa**, The Kresge Foundation; **Carlos Gonzalez**, National Institute of Standards and Technology; **Al McGartland**, U.S. Environmental Protection Agency; **Ansje Miller**, Health & Environmental Funders Network; **Gary Minsavage**, Exxon-Mobil Corporation; **Jennifer Orme-Zavaleta**, U.S. Environmental Protection Agency; **Surili Patel**, American Public Health Association; **Geoffrey S. Plumlee**, U.S. Geological Survey; **Karl Rockne**, National Science Foundation; **John Seibert**, U.S. Department of Defense; **Robert Skoglund**, Convestro; **Joel Tickner**, Green Chemistry & Commerce Council (GC3); **Juli Trtanj**, National Oceanic and Atmospheric Administration; and **Jalonne White-Newsome**, The Kresge Foundation.

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COMPLIANCE HISTORY for the  
**Clean Harbors Aragonite, LLC**  
facility  
(formerly Safety-Kleen (Aragonite), Inc.,  
Laidlaw Environmental Services (Aragonite), Inc.,  
and Aptus, Inc.)

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Clean Harbors-Owner

**ACTION:** **NOTICE OF VIOLATION** issued April 8, 2020

**ISSUES:** Failing to comply with Standard Operating Procedures (SOPs) incorporated by reference as part of the Waste Analysis Plan (WAP)

- Inaccurately reporting the heat content of waste samples
- Failing to notify and/or timely notify the Director of vent openings
- Failing to notify and/or timely notify the Director of baghouse bypasses
- Failing to comply with the Quality Assurance Plan (QAP) in the WAP
- Failing to properly categorize wastes and/or document the categorization of wastes according to the WAP
- Using a profile for a waste stream from one source of generation for a different waste stream from a different source of generation
- Failing to complete all required incineration analyses; and failing to assign the correct incineration chemistries to containers to be incinerated
- Failing to submit 72-hour delay-in-repair notices; and failing to conduct an inspection
- Failing to ensure training was completed within six months of the date of hire; failing to properly document all training; and failing to conduct all necessary training
- Blocking the access to an emergency shower/eye wash
- Failing to note discrepancies on manifests; failing to resolve and/or document manifest discrepancy resolutions; and failing to use a manifest for a rejected load shipped off site
- Failing to report all PCB samples on an “as received” or “wet weight” basis
- Failing to properly track spent carbon in the waste tracking system
- Holding rejected wastes on-site for longer than 60 days
- Failing to place a green barcode or a green acceptance mark on containers that have been accepted and placed into storage
- Improperly storing containers of flammable liquids in areas not equipped for such storage
- Failing to properly segregate incompatible wastes
- Failing to unload a transport vehicle carrying containers within ten days of being received at the facility
- Failing to maintain sufficient aisle space in the refrigerated trailer
- Failing to accurately track wastes; failure to accurately show wastes tracked at the facility in the Division’s access to the waste tracking system; and failing to properly resolve containers that were lost
- Failing to store containers of waste on pallets
- Failing to maintain the level of waste in the large bulk solids tanks at or below the dividers between the tanks
- Failing to ensure that a registered professional engineer certify that each sludge tank and bulk solids tank can safely manage hazardous waste
- Failing to take corrective action to reduce the oxygen concentration in the hydrocarbon vent system when it exceeded 5%; and failing to document the cause of the high oxygen

concentration

Operating the vacuum pump and dilution air fan when the combustion air flow was less than 12,000 acfm; failing to maintain the allowable natural draft openings (NDOs) in the bulk solids enclosure; and failing to operate the bulk solids enclosure at a negative pressure

Exceeding the backup carbon adsorption system carbon bed life

Exceeding the maximum allowable feed rate of mercury

Failing to determine the incineration parameters for a container of waste prior to incineration; and failing to determine the PCB concentrations of PCB items that were incinerated

Failing to properly label a container of hazardous waste in a satellite accumulation area

Holding containers of accumulated hazardous waste on-site for longer than 90 days; and failing to maintain containers of hazardous waste closed

Incinerating mercury-containing wastes that are prohibited from incineration

RESOLUTION: pending

### Clean Harbors-Owner

ACTION: **NOTICE OF VIOLATION** issued April 17, 2014

ISSUES: Recording inaccurate times when the carbon adsorber is in use.

Failing to submit reports of emergency vent openings and baghouse bypasses within seven days.

Accepting and managing water reactive wastes.

Failing to document the waste characterization procedure for each waste.

Failing to properly characterize “waste that inhibits analysis.”

Grouping wastes together that are not of the same waste type for sampling and determination of incineration parameters.

Failing to note deficiencies on the inspection logs, failing to generate and reference work orders, failing to conduct some of the daily and weekly inspections, and failing to document some of the inspections.

Failing to provide all of the required training.

Failing to submit a report of a fire within fifteen days.

Failing to note manifest discrepancies on the manifest, failing to attempt to reconcile a manifest discrepancy, and failing to submit a letter describing the discrepancy and attempts to reconcile it.

Failing to document when the reject determination was made for materials to be rejected, failing to preserve the date the reject determination was made, failing to identify wastes in reject status on the *Drum Reject Report*, storing rejected wastes in Building E-3, failing to update the date of the waste tracking activity code when a rejected waste is shipped off-site, failing to capture wastes that are initially rejected, but later accepted, on the *Drum Reject Report*, and failing to make the determination of acceptance within 60 days of receipt for wastes that are initially rejected and later accepted.

Storing incoming vans of containers in areas other than east of the container storage buildings.

Failing to copy and file the tracking history and other information prior to untracking wastes in the waste tracking system.

Failing to maintain a database of all required equipment, failing to maintain drawings that show the approximate location of each piece of equipment, and failing to mark all of the equipment.

Failing to maintain a history of the movement of each container, failing to track wastes in real time so that their location is known at any time, and failing to notify the Director within 30 days of making changes to the waste tracking system for containers that have been lost.

Storing cyanide-bearing wastes in Building E-2, and storing oxidizers in Building E-6.

Storing compressed gas cylinders in Building E-5 for more than 24 hours.

Placing incompatible waste or materials in the same container, and failing to perform compatibility testing prior to comingling any liquids or sludges.

Failing to unload transport vehicles within ten days of being received.

Failing to stack containers neatly, wrapped, or both, to provide stability.

Failing to automatically shut down the vacuum pump on the robberoller when the LEL of the combined dilution air and vacuum pump vent reaches 60%.

Placing wastes with a pH of greater than 12.5 into tank T-324.

Filling the small sludge storage tank above the compliance limit.

Failing to maintain the tank farm secondary containment systems free of cracks and gaps.

Failing to annually monitor the positive pressure sections of the vent system.

Failing to replace the carbon in the carbon adsorber after 1,066 hours of use.

Failing to seal the crane bay man door during backup operations.

Failing to calibrate monitoring instruments.

Failing to enter the correct DOT information on the manifest for a rejected hazardous waste.

Failing to obtain the signature and date on the manifest from the transporter of a rejected waste, failing to sign as the designated facility on the manifest for the return shipment of rejected waste, and failing to send a copy of the manifest to the facility that returned the rejected waste to the generator within 30 days of delivery.

Failing to submit an Exception Report when it has not received a signed copy of the manifest for rejected waste within 45 days.

Combusting hazardous wastes with waste codes prohibited from combustion.

RESOLUTION: A **STIPULATION AND CONSENT ORDER** was signed on May 30, 2019. It covered violations from the April 17, 2014 NOV, as well as violations documented from inspections in FY2014, FY2015, FY2016, FY2017 and FY2018. It includes a penalty of \$330,000.00.

#### Clean Harbors-Owner

ACTION: **NOTICE OF VIOLATION** issued June 17, 2013

ISSUES: Collecting samples that were not representative of the waste being sampled and not obtained in accordance with required sampling procedures.

Failing to clean up spilled material.

Failing to notify the Director of an emergency vent opening and baghouse bypass; and failing to submit reports of vent openings within seven days.

Failing to follow the Standard Operating Procedures for the cyanide and sulfide screens.

Failing to document the waste characterization procedure for each waste.

Failing to have an inventory list for each labpack; and by failing to determine the incineration parameters from the lab pack inventory sheets.

Failing to properly characterize “waste that inhibits analysis.”

Failing to properly characterize “debris.”

Failing to generate work orders for deficiencies found on inspections; failing to document repairs through the work order system; failing to properly track work completed on work orders; and failing to inspect and/or document inspections.

Failing to provide all of the required training.  
 Having fire doors that were blocked and fusible links that were compromised.  
 Failing to submit a report to the Director for a fire near the front wall of the kiln.  
 Failing to note manifest discrepancies on the manifest, failing to attempt to reconcile a manifest discrepancy with the generator or transporter, and failing to notify the Director of the unmanifested waste or discrepancy and attempts to reconcile it.  
 Failing to maintain the berms in the container storage area in good repair; and failing to maintain the epoxy coating on the container storage containment system floor.  
 Holding rejected wastes for longer than 60 days, failing to properly document that waste that was initially rejected and later accepted was done so within 60 days of receipt of the waste; failing to document rejected wastes in the waste tracking system and when the rejection determination was made; and failing to properly label containers of rejected wastes.  
 Failing to maintain a history of the movement of each container from the time it is placed into the container management areas until it is either incinerated or manifested offsite, and failing to track all wastes in real time so that their location is known at any time.  
 Holding infectious wastes on site longer than seven days without refrigeration.  
 Failing to maintain the level in tank T-312 at or below the compliance limit.  
 Failing to take corrective actions for oxygen concentrations above five percent in the hydrocarbon vent system; and failing to document the causes of the elevated oxygen concentrations and the corrective actions taken.  
 Failing to annually calibrate the bulk solids vent flow switch.  
 Accumulating hazardous wastes in containers for longer than 90 days; failing to mark each container with the date upon which each period of accumulation began, failing to mark each container with the words "Hazardous Waste," failing to maintain containers closed except when it is necessary to add or remove waste, and failing to transfer hazardous waste from a container that begins to leak to a container that is in good condition.

RESOLUTION: A **STIPULATION AND CONSENT ORDER** was approved by the Utah Solid and Hazardous Waste Control Board on November 13, 2014. It includes a penalty of \$71,155.00.

[Clean Harbors-Owner](#)

ACTION: **NOTICE OF VIOLATION** issued April 16, 2012  
 ISSUES: Failing to maintain and operate instruments to ensure measurements taken are accurate.  
 Failing to follow the Standard Operating Procedure for Physical Description of Wastes.  
 Failing to document the waste characterization procedure for each waste.  
 Failing to sample and analyze "routine wastes."  
 Failing to properly characterize "waste that inhibits analysis."  
 Failing to note deficiencies on the inspection logs, failing to properly complete work orders, failing to inspect and/or document inspections, and failing to report problems that will take longer than 72 hours to remedy.  
 Failing to provide all of the required training.  
 Failing to report a fire on the kiln front wall.  
 Failing to note significant manifest discrepancies on the manifest, failing to properly cross reference manifests for loads of rejected wastes, failing to resolve manifest discrepancies with the generator, and failing to notify if the discrepancy is not resolved within 15 days.

Holding rejected wastes for longer than 60 days, and failing to properly document rejected wastes in the waste tracking system.

Failing to record the location of each container and to maintain a history of the movement of each container from the time it is placed into the container management areas until it is either incinerated or manifested offsite, and failing to track all wastes in real time so that their location is known at any time.

Failing to record the signature of the person performing instrument calibrations.

Failing to mark each container with the date upon which each period of accumulation began, failing to mark each container with the words "Hazardous Waste," failing to maintain containers closed except when it is necessary to add or remove waste, and failing to transfer hazardous waste from a container that begins to leak to a container that is in good condition.

RESOLUTION: A **STIPULATION AND CONSENT ORDER** was signed on May 2, 2013. It includes a penalty of \$85,017.00.

### Clean Harbors-Owner

ACTION: **NOTICE OF VIOLATION** issued June 29, 2010

ISSUES: Accepting and managing pyrophoric wastes at the facility.

Failing to use the same waste analysis procedures for wastes generated on site by Aragonite as wastes accepted from off-site sources.

Failing to check that the warning signs on the perimeter fence are legible, failing to check that the temperature in the refrigerated trailers is less than or equal to 40°F, failing to complete an annual inspection of the closed vent system, failing to complete an annual inspection of the carbon adsorption vessels, failing to include instruments to be checked on a daily basis; failing to have the supervisor sign off that the instrument is in good working order, and failing to monitor the hydrocarbon vent system carbon canisters.

Failing to conduct the Material Handler "Quals" and to document them in the individual training records.

Failing to note significant discrepancies on the manifest, failing to copy the manifest tracking number from the old manifest to the *Special Handling and Additional Information Block* of the new manifest and indicate that the shipment is a rejected waste from the previous shipment when a waste is rejected, and failing to copy the manifest tracking number from the new manifest to the manifest reference line in the *Discrepancy Block* of the old manifest when a waste is rejected.

Failing to measure the temperature before and after combining representative samples of the wastes to be mixed when conducting the compatibility test.

Failing to maintain a database of all required equipment, failing to maintain drawings that show the approximate location of each piece of equipment, and failing to mark all equipment with a tag containing a unique equipment identification number.

Storing wastes with a flash point less than or equal to 140°F in a bulk solids tank.

Failing to notify the Executive Secretary of a Class 1 modification and/or failing to submit a modification request to the Executive Secretary prior to implementing a Class 2 or a Class 3 modification.

Failing to annually measure the VOC concentrations in the closed vent system, failing to annually monitor the duct work section between the vacuum pump dilution air fan and the combustion air plenum, and failing to maintain the Natural Draft Openings allowed during normal operations.

Failing to maintain containers closed except when it is necessary to add or remove waste.

Storing hazardous wastes restricted from land disposal for longer than one year.  
RESOLUTION: A **STIPULATION AND CONSENT ORDER** was signed on September 26, 2011. It includes a penalty of \$78,048.00.

### Clean Harbors-Owner

**ACTION:** **NOTICE OF VIOLATION and COMPLIANCE ORDER** issued March 3, 2008  
**ISSUES:** Failing to operate the waste management areas in a manner that minimizes the possibility of fires and releases of hazardous waste constituents; failing to investigate and determine the causes of the incidents; and failing to implement corrective measures to prevent future occurrences.

Accepting and managing pyrophoric wastes at the facility.

Failing to clearly document the waste characterization procedure from the Waste Analysis Plan which applies to each waste stream accepted at the facility.

Failing to inspect, sample, and analyze “routine wastes” and failing to determine the incineration chemistry from analyses of the samples.

Failing to ensure that an inventory list accompany each lab pack, and accepting lab packs for storage and/or treatment before any load discrepancies have been adequately resolved.

Failing to ensure the generator supply a picture or a detailed written description of the waste stream for “wastes that inhibits analysis”; failing to inspect the contents of each container or each bulk load for physical appearance; failing to provide a detailed written description to waste acceptance personnel so that they can easily determine if the waste matches the profile; failing to estimate the percentages of each type of material in the waste; failing to use a matrix, that lists the various materials and the corresponding incineration parameters for each of these materials, along with the percentages of each type of material, to develop an overall estimate of the incineration parameters for the waste; and failing to collect and analyze a representative sample of the material in containers that contain more than four ounces of a material that could be analyzed to determine appropriate management and storage of the waste.

Failing to monitor all incoming waste shipments for radioactivity; and failing to conduct daily calibration checks; and failing to take and record three measurements of each sample; and failing to take and record the background reading each sampling day prior to each sample event.

Failing to conduct the ignitability screen and/or failing to heat samples to 140°F when conducting the ignitability screen.

Determining corrosivity for waste management decisions using pH paper, and failing to determine accurate pH measurements of incoming wastes.

Failing to obtain the proper laboratory certification for analyzing wastes at the facility.

Failing to conduct weekly inspections of the LEL and oxygen meters to ensure that the instruments are operable.

Failing to clear the cylinder storage area of vegetation.

Failing to maintain documentation of training; failing to maintain a current organization chart which specifies the names of the people that fill the job titles in the Personnel Training Plan; and failing to provide Training Program Descriptions which specify the training requirements for a person to be able to fill specific duty areas.

Blocking fire doors so that they could not completely close automatically in a fire emergency.

Failing to clean up spill areas.

Failing to submit a written report to the Executive Secretary within 15 days after fires and discharges in areas where waste management occurs.

Recording negative results in the lab notebook for tests that were not being performed.

Storing wastes in areas prohibited from storage; and failing to maintain the required aisle space.

Failing to maintain the LEL/O<sub>2</sub> monitors/alarms in the decant and repack rooms in Building E4 in good repair.

Holding rejected wastes on site for longer than 30 days; failing to specify the location of all rejected wastes in the computerized waste tracking system; and failing to clearly show that the material is to be rejected and when this determination was made.

Failing to properly mark wastes which have been accepted; moving containers from the receiving and holding areas to the storage or processing areas before the waste has been accepted; storing wastes which have not yet been accepted in areas not designated for such storage; and storing wastes which have not yet been accepted for longer than ten days in Row A of Buildings E2, E3, E6, and E7.

Identifying containers which have not been repacked or consolidated as “REPACK” or “CONS.”

Failing to affix a barcode label to each container.

Failing to maintain a database of all required equipment; failing to maintain drawings that show the approximate location of each piece of equipment; and failing to mark all equipment with a tag containing a unique equipment identification number.

Storing liquids with a flash point of less than or equal to 140°F in container management areas other than Buildings E6 and E7.

Storing cyanide or sulfide bearing wastes and oxidizers in container management areas other than the bays in Buildings E-1 and E-5; and storing potentially incompatible wastes together in the container management areas.

Failing to transfer the hazardous waste from a container that is not in good condition or begins to leak, to an acceptable container as soon as possible.

Failing to sample containers under fume exhausters in Building E5.

Failing to mark cylinders that are moved to the cylinder storage area prior to acceptance with the document and item number; and failing to clearly identify the rack as having cylinders that are not yet accepted.

Failing to record the location of each container and to maintain a history of the movement of each container from the time it is placed into the container management areas until it is either incinerated or manifested offsite; failing to update the waste tracking database by no later than the following business day when bulk materials are accepted and unloaded, and within two business days each time a transfer is made; and failing to track all wastes in real time so that their location is known at any time.

Failing to stack containers neatly and in a manner that will not cause them to fall or leak; stacking containers more than one pallet high in the receiving and holding areas of Building E5; and failing to store containers on pallets.

Failing to store infectious waste sharps in leak-proof, rigid, puncture-resistant containers which are taped closed or tightly lidded to preclude loss of contents.

Failing to label containers of infectious waste that are not red or orange with the international biohazard sign and an appropriate biohazard label.

Failing to store infectious waste at or below 40°F when it was on site for longer than seven days.

Failing to incinerate infectious waste within 30 days after collection from the generator.

Failing to ground containers during decant operations.



Failing to provide an interlock to automatically shut off the vacuum pump that decants a container to a direct burn tanker when the LEL of the combined dilution air and vacuum pump vent reaches 60% LEL.

Failing to place drums inside the drum direct burn glove box and seal and vent the glove box prior to opening the drums or feeding to the kiln.

Failing to maintain a vacuum in the drum pumping station glove box; and failing to place tubes supplying nitrogen in the opening of containers of flammable liquid.

Failing to ground containers holding flammable liquids at the drum pumping station prior to and while waste is being fed to the kiln.

Storing wastes with a flash point less than or equal to 140°F in the bulk solids tanks; and failing to measure the Lower Explosive Limit of wastes placed in the bulk solids tanks.

Failing to maintain the level of the blend liquids Tanks T-303 and T-312 below the compliance limit.

Failing to document the cause of the elevated oxygen concentrations in the hydrocarbon vent system; and failing to document the corrective actions taken.

Failing to annually test to demonstrate that the bulk solids building meets the criteria for a permanent total enclosure; and failing to annually measure the required minimum flow during backup operation.

Failing to maintain the flow of combustion air above 12,000 acfm when the vacuum pump/dilution air fan are operating.

Exceeding the maximum permitted feed rates of metals to the incinerator.

Failing to record and preserve the history of containers before they were “untracked” in the waste tracking system.

Accumulating hazardous waste in containers for longer than 90 days; failing to mark each container with the date upon which each period of accumulation began; failing to mark each container with the words “Hazardous Waste;” failing to maintain containers closed except when it is necessary to add or remove waste; and failing to transfer hazardous waste from a container that begins to leak to a container that is in good condition or manage the waste in some other way to remedy the leak.

RESOLUTION: A **STIPULATION AND CONSENT ORDER** was signed on December 16, 2009. It includes a penalty of \$519,697.00.

[Clean Harbors-Owner](#)

ACTION: **NOTICE OF VIOLATION and COMPLIANCE ORDER** issued December 15, 2006

ISSUES:

- Failing to unload transport vehicles carrying containers within ten days of being received at the facility
- Failing to record the location and movement history of each container placed in the container storage areas, and track these wastes in real time so that their location is known at any time
- Failing to record and preserve the history of a container before that container is “untracked” in the waste tracking system
- Placing incompatible wastes or materials in the same container
- Failing to flush the drum pumping system before pumping waste that was not compatible with the last waste pumped
- Placing reactive cyanides in tank T-404B
- Improperly labeling and dating containers, having open containers, and accumulating wastes in containers that were leaking
- Holding rejected wastes on site for longer than 30 days, failing to specify the location of all

- rejected wastes in the waste tracking system, and failing to document when a waste was determined to be rejected
- Failing to place barcode labels on each container
- Failing to attempt to reconcile a manifest discrepancy with the generator and failing to notify the Executive Secretary when the discrepancy was not resolved within 15 days
- Failing to store infectious waste at or below 40°F when it was onsite for longer than seven days
- Failing to incinerate infectious waste within 30 days after collection from the generator
- Failing to properly code containers of infectious waste
- Conducting the radioactivity screen with the sample bottle closed and conducting the ignitability screen without heating the sample to 140°F
- Failing to provide an automatic interlock to shut off the vacuum pump that decants a container to a direct burn tanker
- Failing to submit a written report to the Executive Secretary within 15 days after the explosion in the drum pump station
- Failing to prepare and submit a complete biennial report by March 1, 2006
- Failing to close the shredder area clean up door, and failing to close and seal the crane bay man door during backup operations
- Failing to sample containers under fume exhausters in Building E5
- Failing to mark all equipment with a tag containing a unique equipment identification number
- Failing to document inspections of the emergency showers and eyewashes in the drive through direct burn station and the truck unloading building
- Failing to maintain emergency equipment as necessary to assure its proper operation in time of emergency

RESOLUTION: A **STIPULATION AND CONSENT ORDER** was signed on October 5, 2007. It includes a penalty of \$147,389.00.

#### Clean Harbors-Owner

- ACTION: **NOTICE OF VIOLATION and COMPLIANCE ORDER** issued December 8, 2005
- ISSUES:
- Failing to record and preserve the history of a container before that container is “untracked” in the waste tracking system
  - Holding rejected wastes on site for longer than 30 days, by failing to properly identify and specify the location of rejected wastes in the waste tracking system; and by failing to document when a waste was determined to be rejected
  - Improperly labeling and dating containers, and having open containers
  - Failing to ensure that containers are stacked neatly and in a manner that will not cause them to fall or leak
  - Failing to record the location and movement history of each container placed in the container storage areas, and track these wastes in real time so that their location is known at any time
  - Failing to place the required warning signs on the infectious waste storage unit
  - Failing to store infectious waste at or below 40°F when it is on-site for longer than seven days
  - Failing to incinerate infectious waste within 30 days after collection from the generator
  - Failing to properly code containers infectious waste
  - Failing to use the debris matrix for characterization of debris for incineration parameters
  - Failing to factor in specific information when characterizing certain wastes for incineration

parameters; and by failing to document how the incineration parameters were determined  
 Failing to clearly document the waste characterization procedure from the Waste Analysis  
 Plan which applies to each waste stream accepted at the facility  
 Failing to prepare laboratory quality assurance reports as required  
 Failing to document the laboratory TCLP room temperature  
 Failing to place a unique barcode label on each container  
 Storing wastes which have not yet been accepted at the facility in an area not designated for  
 such storage  
 Failing to vent the bulk solids building, shredder, and small sludge tank to the carbon  
 adsorption system during backup operations  
 Failing to maintain a database of all required equipment, failing to maintain drawings that  
 show the approximate location of each piece of equipment, and failing to mark all  
 equipment with a tag containing a unique equipment identification number  
 Failing to maintain emergency equipment as necessary to assure its proper operation in time  
 of emergency  
 Failing to maintain a firebreak around the facility, and by failing to maintain the emergency  
 evacuation exits on the south side of the facility  
 Failing to maintain the required signs on the perimeter fence  
 Filling the small sludge tank above the compliance level

RESOLUTION: A **STIPULATION AND CONSENT ORDER** was signed on October 18, 2006. It includes a penalty of \$37,293.00.

#### Clean Harbors-Owner

ACTION: **NOTICE OF VIOLATION and COMPLIANCE ORDER** issued February 4, 2005  
 ISSUES: Placing incompatible waste or other material in the same container  
 Failing to unload transport vehicles carrying containers within ten days of being received at  
 the facility  
 Failing to attempt to reconcile a manifest discrepancy with the generator and failing to notify  
 the Executive Secretary when the discrepancy was not resolved within 15 days  
 Holding rejected wastes on site for longer than 30 days, and failing to properly identify  
 waste to be rejected in the waste tracking system  
 Storing hazardous wastes restricted from land disposal for more than one year  
 Storing compressed gas cylinders in areas not permitted for such storage  
 Failing to secure compressed gas cylinders to prevent falling, and failing to use appropriate  
 measures to protect compressed gas cylinder valves from physical damage  
 Accumulating hazardous waste in containers for longer than 90 days, improperly labeling  
 and dating containers, having open containers, and failing to accumulate hazardous waste  
 in containers  
 Failing to ensure that containers are stacked neatly and in a manner that will not cause them  
 to fall or leak and by exceeding the stacking height limitations  
 Failing to record the location and movement history of each container placed in the container  
 storage areas, and track these wastes in real time so that their location is known at any  
 time  
 Storing wastes in areas prohibited from storage in the permit  
 Failing to store infectious waste at or below 40°F when it is on-site for longer than seven  
 days  
 Failing to ensure that infectious waste is contained in containers that are securely sealed to

prevent leakage of the waste during storage and handling  
 Failing to use the information from the waste profile and the Infectious Waste Matrix for characterization of infectious waste for incineration parameters  
 Failing to clearly document the waste characterization procedure from the Waste Analysis Plan which applies to each waste stream accepted at the facility  
 Failing to have inventory sheets for lab packs accepted at the facility  
 Failing to place a unique barcode label on each container and appropriately marking containers which have been accepted  
 Storing wastes which have not yet been accepted at the facility in an area not designated for such storage  
 Failing to indicate the date waste was first placed into temporary storage and storing wastes for longer than 10 days in the temporary storage areas  
 Failing to clearly mark or label wastes manifested to another facility as transfer wastes  
 Failing to annually monitor the sections of the closed vent system operated under positive pressure  
 Failing to maintain a database of all required equipment, failing to maintain drawings that show the approximate location of each piece of equipment, and failing to mark all equipment with a tag containing a unique equipment identification number  
 Blocking a fire door so that it could not completely close automatically in a fire emergency  
 Failing to maintain emergency equipment as necessary to assure its proper operation in time of emergency  
 Failing to provide an interlock to automatically shut off the robberoller vacuum pump when the vent reaches 60% LEL  
 Failing to maintain and operate the robberoller vent in a manner that minimizes the possibility of a fire or explosion  
 Failing to minimize the possibility of fires in the drum dumping system  
 Filling the small sludge tank above the compliance level

**RESOLUTION:** A **STIPULATION AND CONSENT ORDER** was signed on September 29, 2005. It includes a penalty of \$114,912.00.

Clean Harbors-Owner

**ACTION:** **NOTICE OF VIOLATION and COMPLIANCE ORDER** issued March 3, 2004  
**ISSUES:** Exceeding the mercury emission standard  
 Failing to attempt to reconcile a manifest discrepancy with the generator and failing to notify the Executive Secretary when the discrepancy was not resolved within 15 days  
 Holding rejected wastes on site for longer than 30 days  
 Failing to have inventory sheets for lab packs accepted at the facility  
 Storing flammable liquids in building E-2  
 Failing to transfer hazardous waste from a container that is leaking to a container that is in good condition or manage the waste in some other way to remedy the leak  
 Failing to include the name of the individual who packaged the containers and provided the certifications of the contents of containers of infectious waste  
 Placing incompatible waste in tank T-404B  
 Failing to record the location and movement history of each container placed in the container storage areas, and track these wastes in real time so that their location is known at any time  
 Incinerating a drum of arsenic trioxide

Blocking a fire door so that it could not close automatically in a fire emergency  
Having open containers more than three feet from the ventilation hood  
RESOLUTION: **STIPULATION AND CONSENT ORDER** signed on April 4, 2005. It includes a penalty of \$21,536.00.

#### Clean Harbors-Owner

ACTION: **NOTICE OF VIOLATION** issued March 31, 2003  
ISSUES: Placing reactive sulfides into tank T-308  
Failing to record in the PI system when the plant was on waste  
Failing to record the location and movement history of each container accepted in the container storage areas, and track these wastes in real time so that their location is known at any time; and failing to update the waste tracking system within two business days of making a transfer between tanks  
Exceeding the direct burn feed rate limit  
Accepting water reactive wastes  
RESOLUTION: **STIPULATION AND CONSENT ORDER** signed November 4, 2003. It includes a penalty of \$2,536.00.

#### Safety-Kleen-Owner

ACTION: **NOTICE OF VIOLATION** issued March 26, 2002  
ISSUES: Filling the small sludge tank above the compliance level  
Failing to ensure that wastes to be rejected do not remain on-site for more than 30 days  
Failing to record the location of each container accepted in the container storage areas, and track these wastes in real time so that their location is known at any time  
Exceeding the sludge feed rate limit  
RESOLUTION: **STIPULATION AND CONSENT ORDER** signed September 12, 2002. It includes a penalty of \$5,900.00.

#### Safety-Kleen-Owner

ACTION: **NOTICE OF VIOLATION** issued June 1, 2001  
ISSUES: Exceeding the permitted feed rate of cadmium to the incinerator  
Storing used oil fuel (VFS Distillate) from the Safety-Kleen East Chicago facility in the fuel oil tank and burning it in the incinerator when the incinerator did not meet all of the operating conditions for burning hazardous waste  
Failing to record the location of each container accepted in the container storage areas, and track these wastes in real time so that their location is known at any time  
Accepting pyrophoric wastes  
Placing incompatible wastes or materials in the same container and failing to document any evaluation of the compatibility of the absorbent with the liquid  
Failing to immediately submit to the Executive Secretary a letter describing a manifest discrepancy which was not resolved within 15 days after receiving the waste, and describing any attempts to reconcile the discrepancy

Overfilling one of the direct burn vessels  
Filling the small sludge tank to overflowing  
Failing to limit the heat content of containers fed to the incinerator to 4.76 MMBtu  
Failing to retain the data recorded by the PI archiving system for at least three years  
Failing to maintain systems to automatically cut off hazardous waste feed to the incinerator at a pH of less than 6.2 in the second stage packed tower effluent

RESOLUTION: **STIPULATION AND CONSENT ORDER** signed May 9, 2002. It includes a penalty of \$53,326.00. Since the violations occurred both prior to and after Safety-Kleen filing for Chapter 11 bankruptcy protection, the penalty is divided into two parts. A penalty \$5,814 for the post-petition violations will be paid within 60 days of entry into the Consent Order. A penalty of \$47,512 for the pre-petition violations will be resolved through the bankruptcy court when Safety-Kleen emerges from bankruptcy.

#### Safety-Kleen-Owner

ACTION: **NOTICE OF VIOLATION and ORDER FOR COMPLIANCE** issued August 4, 2000  
ISSUES: Using a bond to provide financial assurance for closure which exceeded the underwriting limitations of the surety issuing the bond without the necessary reinsurance agreements in place

Failing to re-establish other financial assurance for closure within the 60-day period after Frontier Insurance Company was no longer considered an acceptable surety

RESOLUTION: On August 25, 2000, Safety-Kleen entered into a Consent Agreement with EPA which allows an extended time frame for replacing the necessary financial assurance for closure. The state of Utah is a participating state in this Consent Agreement. The initial deadline for replacing financial assurance for closure was December 15, 2000, but was extended to February 28, 2001. The deadline for replacing financial assurance for closure was extended further by EPA to April 30, 2001. This deadline was extended again by EPA to September 30, 2001. Due to the events of September 11, 2001, the deadline was again extended by EPA to October 18, 2001. The deadline was again extended by EPA to November 30, 2001. Compliant financial assurance was later obtained and the issue resolved as of January 14, 2002.

#### Safety-Kleen-Owner

ACTION: **NOTICE OF VIOLATION** issued March 1, 1999  
ISSUES: Placing waste into a tank which was not nitrogen blanketed  
Exceeding the sludge feed rate limit and failing to accurately monitor and record the sludge feed rate  
Failing to record the location of each container accepted in the container storage areas, and each bulk waste managed at the facility, and track these wastes in real time so that their location is known at any time  
Failing to maintain systems to automatically cut off hazardous waste feed to the incinerator at the specified setpoints in the first stage packed tower liquid feed and the second stage packed tower effluent and by failing to correct any malfunctions of the automatic waste feed cut-off systems before restarting the incinerator  
Making changes to the facility without following the specified procedures for modifying the permit.

- Failing to have a test plan that was submitted to the Executive Secretary signed and certified as required
- Failing to retain a copy of a manifest at the facility for at least three years
- Failing to analyze the slag for methanol daily until analyses showed the treatment standards had been achieved for seven consecutive days after methanol was detected at a level above the treatment standards
- Entering the wrong generator name, address, and phone number on manifests accompanying wastes shipped by Safety-Kleen (Aragonite), Inc. for off-site treatment, storage, or disposal
- Failing to submit a certificate of hazardous waste liability insurance prior to the date of the policy expiration
- Failing to maintain documentation to demonstrate that a batch of lab packs was approved
- Failing to inform the generator in writing that they have the appropriate permits for, and will accept, the waste the generator is shipping when receiving hazardous waste from an off-site source
- Failing to resolve discrepancies prior to accepting wastes and/or by failing to clearly document the resolution of discrepancies in the operating record
- Exceeding the maximum stacking height of containers per pallet; failing to wrap or otherwise secure the containers to provide stability; and failing to place a barcode label on each container so that they could be tracked in the plant wide database

RESOLUTION: **STIPULATION AND CONSENT ORDER** signed January 7, 2000. It includes a penalty of \$21,710.00.

[Laidlaw Environmental Services- Owner](#)

- ACTION: **NOTICE OF VIOLATION** issued December 4, 1997
- ISSUES:
- Failing to operate the facility to minimize the possibility of a fire or unplanned discharge of hazardous waste constituents into the air which could threaten the environment or human health
  - Failing to adjust the closure cost estimate for inflation and submit a copy of that adjusted closure cost estimate to the Executive Secretary within the required time frames, and by failing to increase the amount of the letter of credit or obtain other financial assurance whenever the current closure cost estimate increases to an amount greater than the amount of the letter of credit
  - Exceeding the sludge feed rate limit
  - Failing to record the location of each container accepted in the container storage areas, and each bulk waste managed at the facility, and track these wastes in real time
  - Failing to maintain systems to automatically cut off hazardous waste feed to the incinerator at the specified setpoints (and associated delays if applicable) for afterburner chamber pressure, first stage scrubber feed pH, second stage scrubber feed pH, second stage scrubber effluent pH, afterburner oxygen concentration, spray dryer temperature, blend liquid feed rates, and aqueous feed rates
  - Managing containers of infectious waste that were not colored or labeled as required; storing infectious waste longer than seven days without refrigeration; and failing to treat or dispose of infectious waste within 30 days after collection from the generator
  - Failing to notify all persons on the facility mailing list for various modifications and a temporary authorization request within the required time frames; and by failing to notify

the Executive Secretary concerning a modification within seven calendar days after the change was put into effect

Failing to document through a work order the repairs made to a malfunctioning level transmitter on a hazardous waste storage tank

Failing to monitor the fumes in the carbon canister system at the required frequency

Storing hazardous waste from a hazardous waste storage tank tanker trucks in areas not authorized in the permit

Failing to place all containers in the repack workstations into storage each day by the end of each shift

Failing to annually update a waste stream profile and failing to complete all of the required waste acceptance procedures prior to accepting wastes

Failing to verify the contents of lab packs by unpacking them and comparing the contents to the load inventory sheets

Failing to transfer the hazardous waste from a container which is not in good condition or begins to leak to a container that is in good condition, and by handling and/or storing containers of hazardous waste in a manner which may cause them to leak

Failing to label or mark each container accumulating hazardous waste with the words "Hazardous Waste," failing to mark each container with the date upon which each period of accumulation began; failing to maintain containers holding hazardous waste closed except when it is necessary to add or remove waste; and accumulating hazardous waste for longer than 90 days in an area without a permit

Disposing of hazardous waste without a permit

Failing to maintain a current organization chart which specifies by name which person fills each job title listed in the Personnel Training Plan

RESOLUTION: **STIPULATION AND CONSENT ORDER** signed December 4, 1998. It includes a penalty of \$58,385.

[Rollins Environmental Services, Inc.-Owner](#)

ACTION: **NOTICE OF VIOLATION** issued December 11, 1996

ISSUES: Failing to operate the facility to minimize the possibility of a fire or unplanned discharge of hazardous waste constituents into the air which could threaten the environment or human health

Failing to record the location of each container in the container storage areas and track these wastes in real time

Failing to conduct and to document all of the required inspections; failing to inspect for all of the types of problems required; failing to provide acceptable criteria in the detailed written instructions for conducting the inspections; and failing to identify corrective actions performed when items were noted to be unacceptable

Failing to monitor the fumes in the carbon canister system at the required frequency

Failing to inform the generator in writing that they have the appropriate permits for, and will accept, the waste the generator is shipping when receiving hazardous waste from an off-site source

Storing hazardous waste in an unpermitted area east of the bulk solids tanks

Failing to unload a transport vehicle within ten days following arrival at the site

Failing to maintain a firebreak around the entire facility and to maintain an emergency evacuation route for the facility through the east gate on the south fence



Failing to maintain the level of tank T-312 at or below the compliance limit and for filling the tank to overflowing  
Accepting a prohibited waste (dry picric acid, a D.O.T. Division 1.1 explosive) and treating it without a permit; also, accepting trinitrobenzene sulfonic acid (a D.O.T. Division 1.1 explosive)  
Storing containers that have not been bar coded/accepted in a temporary storage area for longer than ten days  
Failing to sample containers under fume exhausters in buildings E-1 and E-5  
Managing containers of infectious waste that were not colored or labeled as required  
Failing to compare the actual load samples to the profile samples prior to accepting a load of waste  
Failing to identify the associated TC waste codes for a waste stream  
Failing to collect and analyze representative samples from waste streams prior to approving the waste streams for storage and/or treatment at the facility  
Failing to label or mark each container accumulating hazardous waste with the words "Hazardous Waste," and by accumulating hazardous waste for longer than 90 days in an area without a permit

RESOLUTION: **STIPULATION AND CONSENT ORDER** signed October 7, 1997. It includes a penalty of \$33,811.

[Rollins Environmental Services, Inc.-Owner](#)

ACTION: **NOTICE OF VIOLATION** issued September 18, 1995  
ISSUES: Failing to maintain systems to automatically cut off hazardous waste feed to the incinerator at a pH of less than 6.2 in the first stage packed tower liquid feed and at a carbon monoxide rolling average concentration of greater than 100 ppm  
Accepting wastes that do not conform with the manifest and failing to draw a sample from as deep a cross section as possible at each location on bulk solids loads  
Failing to notify the Executive Secretary and submit, within the required time frames, a proposed time schedule for correcting a leak from the sludge tank system  
Failing to maintain a minimum of 2.5 feet of aisle space in the drum storage area  
Canceling or terminating the liability insurance without providing prior written notice to the Board within the required time frames  
Installing and using the one-inch stainless steel tubing from the aqueous waste feed line (header D) to the repack room in building E-4 without first obtaining authorization from the Executive Secretary of the Board through the permit modification process  
Failing to notify the Executive Secretary, within the required time frames, for the March 28, 1995 spill of hazardous waste from the C header to the ground near the carbon canister system, west of the tank farm  
Failing to maintain records to document that the applicable training has been given to each individual  
Failing to manage liquid removed from sump SP627 as a hazardous waste  
Stacking containers with a capacity of fifty gallons or greater more than one high in the receiving and holding area of building E-5; failing to stack containers in storage neatly and/or wrap them to provide stability; and exceeding the capacity of 11,000 gallons in the receiving and holding area of building E-5  
Exceeding the maximum allowable feed rates for antimony and lead

Failing to equip and maintain in good operating condition at the facility all the equipment set forth in Attachment II-5

RESOLUTION: **STIPULATION AND CONSENT ORDER** signed June 10, 1996. It includes a penalty of \$40,320.

**Rollins Environmental Services, Inc.-Owner**

ACTION: **WARNING LETTER** issued April 7, 1995

ISSUES: Confined space permit not located at the entry to the work area; confined space work area not roped off; Several changes were made in the confined space permit without indication that the changes had been approved or communicated to all appropriate personnel; the job safety analysis specified continuous O<sub>2</sub>/LEL monitoring, but was done only initially; the job safety analysis specified sliding clips to be used on the ropes to protect them from being cut, none were noted being used; both observers were noted to be performing other functions and there were times when neither of the observers was in visual contact with the entrant; the attendants' respirators were laying on the ground and hanging on the end of a pole

The combustion air pressure indicator for the kiln front wall is located upstream of the damper having apparently been moved from an earlier downstream location. This would allow the kiln secondary combustion air to be cut off by closing the damper without activating the automatic waste feed cut-off (since the pressure indicator is upstream of the damper)

The high level alarm was deactivated for Tank T-310 for an unknown period of time  
A general lack of importance was noted being placed on the inspections performed on-site; lack of consistency on how inspection forms are being filled out; different opinions between inspectors on what constitutes an unsatisfactory status for the same or similar items; a tendency to not mark down deficiencies if the status has not changed over time; there is a perceived lack of knowledge on the part of the inspectors on what is the acceptable criteria for many items; there does not appear to be a consistent and timely procedure for following up on work orders and corrective action

Open containers without labels and dates were noted under hoods in the lab

Site-generated waste was transferred from a tank with a 30-day extension to the 90-day accumulation period, to a tank without the extension to the accumulation period

The maximum feed rate of solids to the kiln was exceeded

RESOLUTION: Issues satisfactorily resolved through a response from Aptus dated April 28, 1995 and subsequent permit modifications.

**Westinghouse, Inc.-Owner**

ACTION: **NOTICE OF VIOLATION** issued December 20, 1994

ISSUES: Perimeter fence signs missing or obscured

Labeling, dating, and segregation requirements not being met for containers in the "A" aisles of the container storage buildings

Open containers in the container storage building

Failing to recognize necessary corrective action required during inspections, and not promptly performing corrective actions

Incinerating wastes carrying a waste code not allowed by the permit  
Storing containerized waste bearing free liquid outside of bermed areas as specified in a temporary authorization  
RESOLUTION: **STIPULATION AND CONSENT ORDER** signed April 21, 1995. \$12,120 penalty paid May 15, 1995.

Westinghouse, Inc.-Owner

ACTION: **WARNING LETTER** issued September 8, 1994  
ISSUES: Failure to label or mark each container accumulating hazardous waste with the words "Hazardous Waste"; failure to clearly mark each container with the date upon which each period of accumulation began; accumulation of hazardous waste for longer than 90 days without first submitting, and receiving approval of the Executive Secretary for, a hazardous waste operation plan for that facility  
Site-generated wastes were not being subjected to the same waste analysis procedures as wastes accepted from off-site sources  
Operating record requirements for wastes pumped from sumps to storage tanks were not being met  
No response time tests were conducted in 1992 and 1993 for the CO and O<sub>2</sub> monitors  
No RATA was conducted following installation of a new oxygen monitor on August 1, 1993  
The Aptus Lakeville Laboratory lost their certification for RCRA metals and during this time metals data from the Lakeville lab was used by Aptus to make waste management decisions at the Aragonite facility  
On two occasions Aptus operated the low range CO monitor in the high range mode while burning waste  
RESOLUTION: Issues satisfactorily resolved through responses from Aptus dated October 7, 1994 and January 31, 1995.

Westinghouse, Inc.-Owner

ACTION: **WARNING LETTER** issued May 27, 1994  
ISSUES: Temperature conditions in the laboratory were not acceptable  
Laboratory personnel combining parts from several different methods to develop SOPs  
Fume hoods in the laboratory not adequately venting with all the instruments and reagent bottles inside; several analyses being performed on the bench-top appear to be candidates for being done under a hood/ventilation system  
The Quality Assurance function in the laboratory needs to be more independent from method development; more frequent internal data validation is necessary; more management oversight and review of daily workbooks is needed  
Laboratory standards not being maintained with a consistent expiration period  
Not all of the required laboratory QC requirements were being followed; not routinely analyzing method blanks and duplicates; method spikes/method spike duplicates need to be performed at the required frequency; tuning log and continuing calibration documentation must be maintained  
The laboratory working standards and solutions do not have the necessary information on the label to properly identify the material  
The laboratory refrigerator and freezer temperatures were not being properly maintained

The laboratory water system does not conform to Type I water specifications  
The two shifts in the laboratory are not consistent in following protocol  
There needs to be more interaction between the chemist and the field personnel so that the bench chemist knows the needs of field operations  
Temperatures of samples at the time of analysis not being taken  
Data from outside labs must be validated; these labs must use the same methods as are specified in the Waste Analysis Plan; outside labs must be Utah certified for the appropriate parameters and must submit sufficient QC information with each data package to allow for data validation  
Many of the test methods in the Waste Analysis Plan are either not adequate or are not being performed as required  
Excessive fugitive emissions being released to the atmosphere through an access on top of the deslagger chute  
The door to bulk solids tank T404A was apparently not closed as soon as possible after unloading a truck; the door was still open while shredding operations were ongoing; questions raised about the adequacy of the ventilation system in the bulk solids building  
Waste in the bulk solids tanks being piled much higher than the height of the walls of the tanks exceeding the permitted capacity  
Daily sump inspection forms have been revised from those specified in the permit

RESOLUTION: Issues satisfactorily resolved through a response from Aptus dated June 27, 1994 and subsequent permit modifications.

**Westinghouse, Inc.-Owner**

ACTION:  
ISSUES:

**NOTICE OF VIOLATION** issued March 8, 1994  
Failure to label or mark each container accumulating hazardous waste with the words "Hazardous Waste"; failure to clearly mark each container with the date upon which each period of accumulation began; accumulation of hazardous waste for longer than 90 days without first submitting, and receiving approval of the Executive Secretary for, a hazardous waste operation plan for that facility  
Exceeding the maximum allowable arsenic, cadmium, chromium, and mercury feed rates to the incinerator  
Failure to maintain the automatic waste feed cut-off system to automatically cut-off the waste feed at established setpoints for combustion air pressure, waste liquid pressure, and atomizing air pressure; failure to test, on a quarterly basis, the four signals (loss of flame, low combustion air pressure, low atomizing air pressure, and low waste liquid air pressure) which cause the Burner Management System on each burner to shut down, causing a waste feed cut-off  
Failure to record in the operating record the date(s) of treatment of wastes and the location of each hazardous waste within the facility  
Storing and/or incinerating wastes carrying waste codes not allowed by the permit  
Failure to maintain a nitrogen blanket on the sludge storage tank  
Failure to monitor and record the one hour rolling average concentration of carbon monoxide (CO) in the stack on a continuous basis  
Failure to limit the feed rate of containerized waste to a maximum of 20 containers per hour; failure to limit the thermal input to the incineration system to  $120 \times 10^6$  Btu per hour

- Failure to continuously monitor and record the feed rate of pumpable sludge; failure to monitor and record, on a periodic basis equal to the charging cycle, the feed rate of bulk solid wastes
  - Failure to include in the notification to the treatment or storage facility, the corresponding treatment standards or the applicable five-letter treatment code when the treatment standards are expressed as specified technologies
  - Failure to take manual LEL measurements at the bulk solids tanks, the sludge tank, and the "A" damper every three hours when fumes are not going to the kiln; failure to take and record manual PID (or equivalent) readings at the bulk solids tanks, the sludge tank, and the "A" damper every three hours and/or when unloading trucks, whichever is less, when the combustion air fans are off
  - Failure to inspect the leak detection system of the bulk solids tank; failure to follow the inspection schedule found in the permit; failure to record that sumps were not empty; failure to empty sumps containing material within 24 hours
  - Failure to maintain and operate monitoring equipment to measure the stack carbon monoxide level, corrected to 7% oxygen, while incinerating hazardous waste
- RESOLUTION: **STIPULATION AND CONSENT ORDER** signed June 16, 1994. \$70,000 penalty paid June 16, 1994.

[Westinghouse, Inc.-Owner](#)

- ACTION: **NOTICE OF VIOLATION** issued November 9, 1992
- ISSUES:
- Failure to maintain the level of the sludge storage tank at or below the compliance limit and for filling the sludge storage tank to overflowing
  - Failure to perform the Tank Level Instrumentation Procedure for the sludge storage tank; failure to document in the Operating Record that these tests have been completed and the results obtained for tank T-302; failure to transfer enough of the liquid contents to another tank to lower the level to the maximum operating level following the completion of the Tank Level Instrumentation Procedure for tank T-302
  - Failure to monitor the direct burn flow rate continuously during the trial burn
  - Failure to label or mark each container accumulating hazardous waste with the words "Hazardous Waste"; failure to clearly mark each container with the date upon which each period of accumulation began; accumulation of hazardous waste for longer than 90 days without first submitting, and receiving approval of the Executive Secretary for, a hazardous waste operation plan for that facility
  - Failure to change out the carbon canisters in the tank farm when the reading between the canisters exceeded 100 ppm; failure to use the correct form to record these carbon canisters readings
  - Failure to have all reports submitted to the Executive Secretary signed as required
  - Failure to conduct all of the required personnel training
- RESOLUTION: Through formal correspondence from Aptus received December 23, 1992, each of issues identified in the November 9, 1992 **NOTICE OF VIOLATION** was satisfactorily resolved. No penalty was assessed in connection with this action.

[Westinghouse, Inc.-Owner](#)

- ACTION: **NOTICE OF VIOLATION** issued July 22, 1992

ISSUES: No dates and/or labels on containers and open containers  
Failure to test all of the required parameters in the automatic waste feed cut-off system  
Failure to maintain the automatic waste feed cut-off system to automatically cut-off the hazardous waste feed to the incinerator at the specified setpoints  
Exceeding the maximum specified turndown ratio  
Incinerating wastes having waste codes not allowed by the Permit  
Exceeding the maximum allowable arsenic feed rate to the incinerator  
RESOLUTION: **STIPULATION AND CONSENT ORDER** signed February 3, 1993. \$7500.00 penalty paid February 18, 1993.

Westinghouse, Inc.-Owner

ACTION: **NOTICE OF VIOLATION** issued April 22, 1991  
ISSUES: No dates and/or labels on containers and open containers  
Disposing of hazardous waste without a permit  
Failure to use the analytical test method specified in the permit  
Failure to have a completed profile for each waste stream managed at the facility and failure to follow the specified sampling strategy  
RESOLUTION: **STIPULATION AND CONSENT ORDER** signed February 14, 1992. \$17,500 penalty paid February 28, 1992.

Westinghouse, Inc.-Owner

ACTION: **WARNING LETTER** issued January 22, 1991  
ISSUES: Improper certification statement on permit submissions  
RESOLUTION: Not Applicable

**ATTACHMENT II**

**RCRA - TSCA**

**WASTE ANALYSIS PLAN**





**WASTE ANALYSIS PLAN  
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# WASTE ANALYSIS PLAN

## 1.0 INTRODUCTION:

The following describes the methods that shall be used to manage hazardous waste regulated by the Resource Conservation Recovery Act (RCRA), waste regulated by the Toxic Substance Control Act (TSCA), and waste regulated by the Utah Administrative Code (Utah Amin. Code) R315, Environmental Quality, Solid and Hazardous Waste at the Grassy Mountain Facility, referred to hereafter as GMF or the Facility.

### 1.1. Overview

This Waste Analysis Plan (WAP) has been developed to meet the requirements of Title 40 Code of Federal Regulation (CFR) § 264.13, 40 CFR §268.7, 40 CFR § 270.14(b), 40 CFR § 761.75, 40 CFR § 61 Subpart M and Utah Rule R315-8-2.4, 40 (c). A copy of this plan and any approved revisions will be kept on file at the Facility and shall be available during compliance inspections.

This plan provides waste management procedures and documents the analyses required to safely treat, store, or dispose of the wastes accepted at the Facility. This plan describes the following:

- The methodology for accepting a generator's waste stream prior to arriving at the Facility;
- The methodology for determining the acceptability of a generator's waste stream – Verification Analysis of Incoming Waste; and
- The methodology of determining whether a RCRA waste stream has been treated to ensure compliance with the applicable land disposal restrictions (LDR), if necessary.

The term "RCRA hazardous waste" refers herein to a waste considered hazardous by the U.S. Environmental Protection Agency (EPA) because it is so defined in RCRA § 1004(5) and the implementing regulations at 40 CFR §§ 261.20 - .24 and 261.30 - .33. A "non-hazardous waste" is a waste not identified as being hazardous according to 40 CFR § 261 and/or applicable State Regulations. The term "TSCA waste" refers herein to a waste regulated by the Toxic Substances Control Act (TSCA). State regulated hazardous wastes are wastes regulated by only the State of Utah, Department of Environmental Quality, Division of Solid and Hazardous Waste, pursuant to Title R315.

The forms shown within this WAP are typical forms currently used by the Facility. These

forms may change as long as they are at a minimum equivalent to the current forms. Factors that would promulgate the development of new forms include changes in the regulations, customer needs, facility operations, company policy or other needs. In addition, these forms or documentation may be received, stored, transmitted and/or retrieved electronically in addition to, or in lieu of, hard (paper) copy.

With regards to this WAP, “suitable laboratory” means the laboratory at the Grassy Mountain Facility, and those described in the definitions in Section 1.2 below.

CHESI strives to maintain compliance with all the applicable regulations. As EPA develops new analytical methods, these methods may be used, if applicable, in demonstrating compliance with the appropriate regulation(s). However, prior to implementing a new analytical method, the Permit would have to be modified in accordance with Permit Condition I.D.3.

The Facility is a RCRA hazardous waste treatment, storage, and disposal facility (TSDF) and will continue to accept (both in bulk and containers) solid, liquid and sludge, as defined by R315-2 (40 CFR § 261), as well as TSCA regulated wastes as defined by 40 CFR § 761 and 40 CFR § 61 Subpart M, and solid, liquid and sludge non-hazardous waste, in both bulk and containers.

The wastes amenable to treatment, storage and disposal units at the Grassy Mountain Facility are generated by a variety of industries. Some of the industries/businesses generating these wastes are listed below:

- Aerospace
- Agriculture
- Asbestos Removal
- Automotive scrap recyclers
- Electronics
- Geothermal
- Laboratories
- Manufacturing
- Machine shops and automotive repair
- Metal finishing and plating
- Military
- Mining
- Municipal wastewater treatment
- Oil production, extraction, transportation, refining, processing and marketing

- Small-quantity generators
- Utilities
- Well drilling
- Site remediation activities
- State and Federal Governmental Agencies
- Transportation
- Service Industries

The facility shall manage the following major waste types:

- Non-hazardous Industrial Waste – solid, sludge, or liquid non-hazardous industrial waste shall be stored, treated, and/or landfill as required by the applicable regulation (e.g., liquid waste would be solidified prior to landfill);
- RCRA Hazardous Waste as defined in R315-2 (40 CFR § 261);
- Wastes Regulated by TSCA regulations at 40 CFR § 761 and 40 CFR § 61 Subpart M (e.g., PCB waste and asbestos); and
- Utah specific regulated wastes as defined in R315-2-10 (e.g., military nerve agents (F999 and P999)).

This WAP establishes necessary sampling methodologies, analytical techniques, and overall procedures for characterization, acceptance, storage, treatment and/or disposal of hazardous and TSCA regulated wastes accepted or generated at the facility.

This WAP establishes the following:

- The parameters for which each hazardous and/or TSCA regulated waste shall be analyzed and the rationale for selection of each parameter.
- The test methods that shall be used to test for these parameters.
- The sampling methods that shall be used to obtain a sample of the waste to be analyzed.
- The frequency with which the initial analysis of the waste shall be reviewed or repeated to ensure that the analysis is accurate and up-to-date.
- The frequency with which the analysis of the waste shall be performed to assure that the wastes or treated wastes are in compliance with the applicable treatment standards set forth in R325-13-1 of of Utah Amin. Code which incorporates 40 CFR § 268.40 - 49, by reference.

The WAP is intended to be the primary reference document for all waste analysis performed in conjunction with operation (and closure) of the facility except for groundwater which is covered by Module VII and its associated attachments. The WAP addresses the following topics:

- Waste characterization, analytical parameters and rationale (Section 2)
- Pre-acceptance procedures (Section 2)
- Incoming load procedures (Section 2)
- Test methods (Section 3)
- Waste sampling (Section 4)
- PCB Waste Management Procedures (Section 5)
- Pre-treatment procedures (Section 6)
- Treatment processes (Section 7)
- Record keeping for waste codes (Section 8)
- Analysis of treated wastes (Section 9)
- Fate of treated wastes (Section 10)
- Quality assurance and quality control (Appendix 1).

A Quality Assurance Plan (QAP) for required waste analysis is included as Appendix 1 of this WAP. The QAP describes the methods and procedures that laboratory personnel use to assure integrity of laboratory data. The QAP contains the specific procedures and practices used within the laboratory in order to ensure that the resulting data are technically sound, statistically valid, and properly documented.

This WAP is supported by Standard Operating Procedures (SOPs) including specific procedures and/or test methods. The SOPs, or test method instructions, are used by laboratory personnel as detailed instructions for performing the necessary procedures. The SOPs are incorporated by reference as part of this WAP. They are required for Utah Certification of the laboratory and shall be followed for compliance with the permit.

This WAP also anticipates that wastes will be generated on-site and will ultimately be accepted for storage and/or treatment at this facility. These wastes shall be subject to the same waste analysis procedures as wastes accepted from off-site sources except for incoming load procedures which are not required for site generated wastes.



## 1.2. Definitions

The following terms, applied within the WAP, shall have the following meaning:

- Accept, Accepted or Acceptance: When it has been determined that a waste shipment received at the Facility conforms to the approved profile (or all discrepancies have been resolved) and the Facility is willing to accept the waste for treatment, storage, and/or disposal.
- Accuracy: The closeness of a result, or the arithmetic mean of a set of results, to the true, expected, or accepted value.
- Analysis: The term "analysis" means any method by which the value of a particular parameter is determined. These methods may include laboratory procedures specified in this WAP or may rely on knowledge of the waste or the process generating the waste.
- Analyte: The substance, element or compound for which a sample is analyzed to determine its presence or quantity. Also known as an analytical parameter.
- Analytical Method: A quantitative procedure for determining the specific concentration or characteristic of an analyte or analyte group.
- Approve, Approved, or Approval: This term is used in the context of evaluating a profile. Approval of a waste stream profile occurs after all necessary evaluations and analyses have been made and when the generator is notified.
- ARA means the Assistance Regional Administrator of the Office of Partnerships, Regulatory Assistance, EPA Region 8.
- Aragonite: Clean Harbors Aragonite, LLC.
- Audit, performance: A check on the performance of analysts. Sometimes categorized as a quantitative appraisal of quality.
- Audit, system: An on-site inspection or assessment of the laboratory's control system and procedures.
- Bulk Load: The term "Bulk Load" means any individual waste shipment transported to the facility which is too large to be managed through the Container Management Building (e.g. an intermodal container, end-dump truck, tanker truck, railcar, etc.).
- Clean Harbors: Parent corporation of the Grassy Mountain facility.
- Clive: Clean Harbors Clive, LLC.
- Debris - is solid material exceeding a 60 mm (approximately 2-inches) particle size that is intended for disposal and that is a manufactured object; plant, animal matter; or natural geologic material. The following materials are not debris:

- a) Any material for which a specific treatment standard is provided in R315-13-1 of of Utah Amin. Code which incoperates Subpart D, Part 268 by reference, namely lead acid batteries, cadmium batteries, and/or air emission residues, as well as intact containers of hazardous waste that are not ruptured and that retain at least 75% of their original volume.
- b) A mixture of debris that has not been treated to the standards provided by R315-13-1 of Utah Amin. Code and other material shall be subject to regulation as debris if the mixture is comprised primarily of debris, by volume, based on visual inspection.” Examples include steel plates, pipe, concrete pieces, duct work, empty drums, glass, rocks, and sealed containers/chemical containing equipment such as: cathode ray tubes, non-PCB electrical equipment, animal wastes and parts, asbestos containing material (ACM), Tyvek® suits, rubber booties and gloves, and paper towels and/or mixtures of these.
- Director: Means the Director of the Division of Solid & Hazardous Waste.
  - EPA: Means the United States Environmental Protection Agency.
  - Generator: Generator or generators authorized representative.
  - Generator Knowledge: If generator knowledge is used to make a hazardous waste determination, information shall be available to substantiate the waste evaluation. Below are examples of information that can be used to make the waste evaluation required under R315-5-1.11 of Utah Amin. Code (which incorporates 40CFR § 262.11 by reference). Some or all, or other information can be used to make a hazardous waste determination applying generator knowledge.
    1. Generator specific process flow diagram or narrative description of the process generating the waste (should be used in most cases);
    2. Chemical makeup of all ingredients or materials used in the process that generates the waste (should be used in most cases);
    3. List of constituents that the Facility know or have reason to believe are byproducts or side reactions to the process that produces the waste;
    4. Material Safety Data sheets (MSDSs) or Safety Data Sheets (SDS) and/or product labels or substances used in the process that generates the waste;
    5. Data obtained from approved methods of sampling and laboratory analysis of waste generated from the same process using the same ingredients/materials;
    6. Data obtained from literature regarding waste produced from a similar process using the same ingredients and/or materials; and/or

7. Documentation of product specifications of input materials and output products.
- GMF: Clean Harbors Grassy Mountain, LLC Facility. When referring to facility specific test methods, "GMF-" and "SK-" as a prefix to the method number can be used interchangeably.
  - Hazardous waste: The definition of "hazardous waste" shall be as provided in R315-2-3 of Utah Amin. Code (40 CFR § 261.3).
  - Holding Time - The maximum time allowable between time of sampling and time of extraction and analysis, or both.
  - Infectious Waste means a solid waste that contains or may reasonably be expected to contain pathogens of sufficient virulence and quantity that exposure to the waste by a susceptible host could result in an infectious disease (Utah Code Annotated Title 19 Section 6 Subsection 102).
  - Incoming Load: The term "Incoming Load" refers to a load during the period starting when a waste shipment arrives at the facility through the time when a waste shipment is rejected or accepted. Incoming loads may be placed in a storage unit pending the acceptance procedure.
  - Laboratory Manager: The "Laboratory Manager" or however named by certifying agencies, refers to the individual or designee responsible for implementation of the WAP.
  - NELAP: Means the National Environmental Laboratory Accreditation Program.
  - Non-hazardous waste: "Non-hazardous waste" refers to "solid waste" as defined in R312-2-2 of Utah Amin. Code see also 40 CFR § 261.2 which is not also "hazardous waste" as defined in R315-2-3 of Utah Amin. Code (40 CFR § 261.3).
  - Parameter: The term "parameter" is a specific material property, such as pH, specific gravity, viscosity, etc.
  - Particle size: The largest dimension of a portion of a waste.
  - PCB(s): The term "PCB(s)" refers to polychlorinated biphenyls (PCB(s)) or PCB Item(s) as defined in 40 CFR § 761.
  - PCB Waste: Means any waste (e.g. mixture of liquid, solid, or sludge etc. or any PCB-containing item) that contains PCBs regulated for disposal under 40 CFR § 761.
  - Post-treatment: The period following treatment of a waste is referred to as "Post-treatment"

- Pre-acceptance: The period in which a waste stream's acceptability for storage and treatment at the facility is evaluated, is referred to as "pre-acceptance." This is the same as the Profile Approval Period.
- Precision: The agreement or repeatability of a set of replicate results among themselves or agreement among repeated observations made under the same conditions.
- Pre-treatment: The term "Pre-treatment" refers to the period between acceptance and treatment of the waste.
- Profile: Means the electronic or other document that describes a waste or waste stream.
- Radioactive: A "Radioactive" material shall be any Byproduct or Source Material licensable by the Utah Division of Radiation Control or the NRC, or any waste found to have a count rate as measured one inch from the surface that exceeds background by three times or more.
- Receive or Received: Means when waste passes into the fenced portion of the facility.
- Representative sample: Means a sample exhibiting average properties of the whole waste.
- Suitable Laboratory: A "suitable laboratory" is an analytical laboratory which, after review of its Quality Assurance Plan (QAP), meets the minimum quality assurance requirements as specified in the GMF QAP. Any non-Clean Harbors laboratory must also provide the QA/QC documentation for the analytical results it provides which must include analytical methods used. A Suitable Laboratory is one of the following:
  - A laboratory certified by the State of Utah Bureau of Laboratory Improvement;
  - A NELAP approved lab; or
  - A lab approved by the Director in writing.
- Screening Method: A semi-quantitative procedure for determination of the specific concentration, or characteristic of an analyte or analyte group.
- Waste Stream: Waste stream means a waste that is, or can be, identified as a line item on the Uniform Hazardous Waste Manifest from the same source of generation and delivered with the same load. Identical materials with the same waste profile number, that are listed on separate manifest line items only because of container size or type are considered to be the same waste stream.
- Waste Treatment Stream: Means wastes that exhibit similar characteristics such that

if shipped together, they could be placed on the same line item on the Uniform Hazardous Waste Manifest.

•

## **2.0 WASTE CHARACTERIZATION, ANALYTICAL PARAMETERS AND RATIONALE:**

The following sections describe the procedures that are followed for approving a waste stream for management at the facility. This includes the pre-acceptance procedures, incoming load procedures, and procedures for resolving discrepancies that may occur upon receipt of the waste.

### **2.1. Profile Submission/Review Process**

The waste profile evaluation process is used to prescreen waste prior to its acceptance at the Facility. The Profile Evaluation process may be accomplished at this Facility, another CHESI Facility or another location, or upon arrival of the shipment prior to acceptance. To initiate the PE process, the waste generator must submit a Clean Harbor's Waste Material Profile Sheet. The Waste Material Profile Sheet, commonly referred to as the "Profile" must be submitted in paper form or using an electronic format for each new waste stream being considered for management at the Facility. The Profile Form requests information from the generator such as name, address, contact person, EPA ID number, generating process, common name of the waste, DOT shipping name, hazardous class, chemical constituents and concentrations. In addition, the form requests regulatory information such as whether the waste is a regulated radioactive waste, infectious waste, RCRA waste, TSCA waste, or State waste. In addition, the profile shall be signed or electronically signed by the generator or his representative.

The following information may also be required, depending on the type of waste:

- Pertinent chemical and physical data on the example Waste Material Profile Sheet form;
- Land disposal restriction notification and/or certification form(s) for state and/or Federal wastes that are restricted from land disposal.
- A representative sample and chain-of-custody, if required. A representative sample may not be required if the Facility determines that the pre-acceptance documentation provides sufficient information to maintain compliance with permit and operational conditions and obtaining a sample would not aid in the disposal decision process. Waste generators are referred to R315-50-6 of the Utah Admin. Code (40 CFR §261,

Appendix I) for the appropriate sampling procedure. This sample may be obtained upon arrival of the initial shipment of waste prior to acceptance.

- The Facility may need other supporting documentation such as additional analytical results, MSDS, SDS, manufacturer's technical fact sheets, product ingredient listing, etc.
- If the waste is in the form of a lab pack, the generator shall describe the volume and the contents of the container(s). The generator of the lab pack shall supply the appropriate Land Disposal Restriction (LDR) notification/certification form for lab packs.
- For hazardous waste to be treated in stabilization tanks or placed in the Surface Impoundment: a Certification from the Generator that the waste at the point of generation does not contain greater than or equal to 500 parts per million weight (ppmw) volatile organic compounds (VOCs) is required. The Waste Profile Sheet may be used by the generator to make this certification.
- For incinerator residue wastes from Aragonite that are to be treated and/or disposed, the Facility may use the analysis of the waste sampled under the Aragonite WAP in lieu of conducting the analyses identified in Tables C-1 or C-2. A physical description shall be provided so that a visual inspection of the load can be made upon arrival.
- For RCRA listed wastes with constituents of concern having numeric LDR treatment standards (found in R315-13-1 of Utah Admin. Code (which incorporates 40 CFR § 268.48 by reference)) and the generator certifies that the waste meets the numerical treatment standards, the Facility may either perform laboratory analytical tests on a sample of the waste to demonstrate that the waste meets the numerical treatment standard or the waste generator can supply laboratory analytical test results that meets the numerical treatment standard. Analyses shall be done by a suitable laboratory.
- For TSCA regulated PCBs wastes, the generator shall include a certification that the waste has not been deliberately diluted from an original PCB concentration of >50 ppm or deliberately mixed with soil in order to avoid the incineration requirements of 40 CFR. §761.60(a). The specific source of the waste, waste description, original PCB concentration and other chemical constituents of the waste shall also be reported by the generator.

Samples of the following waste types are not required during the profiling or waste characterization process:

- Lab Packs including, but not limited to, discarded containers of laboratory chemicals, waste, lab equipment, lab clothing, debris from lab spills or clean up, and floor

sweepings packed in accordance with R315-8-14.10 of the Utah Admin. Code (40 CFR § 264.316).

- Empty Containers.
- Contaminated trash and debris (i.e. contaminated paper, glass, wood, metal, rubber, plastic, cardboard, etc.).
- Single source emergency spill material from a known source.
- Commercial products or chemicals that are off-specification, outdated, unused, contaminated or banned. This also includes products voluntarily removed from the market place by manufacturer or distributor in response to allegation of adverse health effects associated with product use.
- Asbestos-Containing Waste.
- Beryllium-Containing Waste.
- Waste produced from the demolition, dismantling, or renovation of industrial process equipment or facilities. These may include equipment, crushed drums, disassembled tanks, large construction debris, concrete, wood, etc.
- Debris as defined by R315-13-1 of the Utah Admin.Code, which incorporates 40 CFR Part § 268.2 by reference. These materials shall be visually inspected after receipt but before shipment acceptance in order to ensure that the waste meets the definition of debris.
- Controlled substances regulated by the Federal Government including illegal drugs and/or materials from clandestine labs.
- Materials designated for storage only and subsequent shipment off-site (transfer to another facility).
- Wastes that are visually identifiable through an inspection process (e.g., cathode ray tubes, batteries, fluorescent light tubes, filters, and filter cartridges, wire, tubing, paper products, metal sheeting and parts, crushed glass, piping, etc.).
- Contaminated personnel protective equipment (PPE) – This includes gloves, tyveks, respirator cartridges, clothing, etc.
- On-site generated waste, unless otherwise required. Site-generated wastes include rainwater from collection sumps, rainwater from truck wash sumps, rainwater from trenches, spill clean-ups, etc, as long as these wastes are managed as a hazardous waste.
- PCB Waste such as transformers, capacitors, PPE, wooden planks, concrete, asphalt, rags, empty containers, steel pieces, miscellaneous building debris, etc.

The Waste Material Profile form supplies initial information about the generator's waste generating process/activity, volume and waste characteristics, handling procedures, and

shipping information. For restricted wastes, the LDR notification/certification form(s) provide notification and/or certification by the generator or the owner/operator of a treatment facility as to whether the waste is subject to land disposal restrictions specified in R315-13-1 of Utah Admin. Code which incorporates 40 CFR § 268 by reference. LDR forms are not required for unrestricted wastes.

## **2.2. Profile Approval**

The Laboratory Manager or designee shall evaluate the acceptability of each waste stream. This decision to accept or reject a profiled waste stream shall be based upon the following information:

- Waste profile information, analytical (physical and chemical) information, and/or LDR notification/certification information;
- Waste management methods available at the Facility;
- Conditions or limitations of existing permit conditions and regulations;
- Capability to manage the waste in a safe and environmentally sound manner;
- Facility management's technical experience and judgment.

Once a decision has been made, a letter or electronic correspondence (e.g., e-mail, etc.) shall be sent to the generator or agent informing him/her that the waste is acceptable at the facility. The letter or electronic correspondence shall contain the profile or waste identification number. The letter also informs the generator that the waste requires annual re-characterization if any significant changes occur in the waste stream.

## **2.3. Annual Profile Recertification**

A generator's waste profile shall be re-certified annually. For an annual recertification, the generator must certify that the waste generation process has not changed. If the generator indicates that the waste generation has changed, the waste shall be re-profiled.

If the generator notifies the Facility that the waste generation process has changed (e.g., when the raw materials to the process have changed), or, if the Facility has reason to suspect that the waste is in nonconformance with profile documentation, then the generator must reprofile the waste. Facility profiles for site generated wastes are exempt from the annual requirement.

If it is found that a waste arrives at the Facility after the profile has expired and it is found the



profile was current when the material was shipped by the generator, then the material may be accepted by the Facility without first obtaining a re-certification since the profile was current at the time of shipment.

#### **2.4. Waste Shipment without Approved Profile**

If a waste shipment arrives at the Facility without an approved profile, the Facility may receive the waste, after that the generator is contacted and a Profile is completed to ascertain whether the Facility could accept the waste for management. If such wastes arrive at the Facility, the waste will either remain in the custody of the transporter or be placed into a permitted storage location according to the United States Department of Transportation (DOT) descriptions while pre-acceptance procedures are completed and the profile for the waste is approved and the waste officially accepted. If the waste is placed into storage, the container will be clearly marked with the words "Awaiting Profile Approval."

If the generator can not provide a Waste Profile form in a paper or electronic format or the generator doesn't have analytical results for the waste, or is not able to characterize the waste by process knowledge, one of the following will then occur:

- Reject the load back to the generator; or
- A sample of the waste shall be obtained, laboratory analysis performed, and the results evaluated. Based on the analytical results one of the following actions shall be taken:
  1. Reject the waste back to the generator;
  2. Reject the waste and send it to an appropriate TSDF; or
  3. Accept the load for management at the Facility and record the waste profile information.

#### **2.5. Waste Verification Process (Fingerprint Analysis)**

When a shipment of hazardous and/or TSCA regulated waste arrives at the Facility, the Facility will inspect, sample and analyze the waste as described in this section. The waste acceptance process shall accomplish the following :

1. Identify the chemical and physical waste characteristics of the waste shipment and compare the result to the profile information and manifest information; and
2. To ensure the proper disposition of the waste to treatment, storage, and/or disposal.

At a minimum, the fingerprint analysis shall consist of the parameters listed in Table C-1 and

where applicable, Table C-2. For TSCA regulated wastes, the finger print analysis will consist of the parameters listed in Table C-1, C-2 where applicable, and Table C-3. Materials to be transferred off-site without treatment or processing at the Facility are not required to be sampled or analyzed.

#### 2.5.1 Waste Receiving Procedures

Waste receiving procedures shall begin when a shipment of waste arrives at the GMF. Upon arrival, the truck shall be weighed. The receiving staff shall review manifest and accompanying paper work for completeness to verify that the waste has an acceptable profile at the Facility and that the waste codes are listed with the information on the profile. Wastes that are subject to the Land Disposal Restriction contained in R315-13-1 of Utah Admin. Code which incorporates 40 CFR § 268 by reference shall be accompanied with a form or document from the generator (or treater) notifying the Facility of the appropriate treatment standard and all applicable prohibitions which are required to be met. In the event regulations allow for a one-time submittal of the LDR form, submittals will not be required for each shipment of the same waste, as long as the nature of the waste has not changed. If this completeness review shows that information is needed (e.g., waste profile number, waste codes, LDR form, signatures, etc.), the generator shall be contacted. If the generator cannot provide the necessary information, the load shall be rejected.

Waste shipments that have arrived at the Facility are will not be accepted until such time that the Facility makes a final decision regarding waste acceptability. All waste shall be treated

All bulk solid waste loads shall be visually inspected and documented by the receiving staff to verify that the contents of the load conform with the waste description contained on the profile. In addition, all bulk waste loads shall be sampled except for large bulk volumes of the same waste received from one source (e.g., contaminated soil from major remedial action). For these shipments, at least 10 percent of the loads shall be randomly selected, and sampled, and analyzed according to Table C-6.

#### 2.5.2 Incoming Load Sampling

For a single waste stream shipped in multiple containers from a single generator, all containers shall be visually inspected and a minimum of 10% of the total number of containers in the shipment shall be sampled in order to verify that material delivered to the facility have the same characteristics as that identified in the profiling process. Fractions of containers shall be rounded to the next whole number of containers. For wastes contained in multiple containers with a count of less than ten, a minimum of one container shall be sampled. Vacuum or tank type trailers shall be routinely sampled though one of the top ports. For volumes that do not allow sampling throught the top port, the sample may be taken from a valve. A manifested vacuum trailer acid load with a suspected pH of less than 3

may be initially sampled through the valve on the tanker to protect the sampler and the operator from exposure to potentially hazardous fumes. Tank sediments shall be sampled from the bottom of the valve when the material cannot be sampled by other means. If the vacuum truck is compartmentalized, each compartment shall be sampled.

RCRA characteristic (D codes) and listed (F, K, U and P codes) wastes shall be sampled on the initial load, and annually thereafter, to verified the analyses outlined on Table C-1 as well as the applicable analysis of parameters found in Table C-2. RCRA listed wastes, where the generator certifies that a particular chemical meets a treatment standards, shall be analyzed annually to verify the generator certification. Alternatively, the generator may provide laboratory analysis demonstrating that the waste constituent meets the LDR criteria. If GMF is treating the constituents of concern, the verification process may be completed on the treated waste as described in Section 7.2.2 of this Attachment. If there is reason to believe that the characteristics of the waste have changed, then additional analysis listed in Table C-2 may be required. This shall ensure that the wastes or treated wastes are in compliance with the applicable treatment standards set forth in R315-13-1 of Utah Admin. Code which incorporates 40 CFR §§ 268.40 - .49 by reference. Analysis provided by Aragonite, for incinerator residue from the Aragonite incinerator, can be used in lieu of performing analysis required by this Attachment such as incoming load samples and annual recertification samples. A visual verification that the waste matches the profile description shall be made on all loads, as necessary, upon arrival at the facility. If the waste is approved for management at the facility, a unique identification number shall be assigned to the waste stream. This number shall be used to identify the waste through the subsequent stages of the waste management process.

Waste samples shall be collected in accordance with the sampling protocols specified by the most current versions of EPA SW-846 and by the American Society of Testing Materials (ASTM) standards. The methods and equipment used for sampling waste materials may vary with the form and consistency of the waste materials to be sampled.

Sampling of vacuum trucks, tank trucks, or containers (e.g., drums, cartons, buckets, etc.) varies depending on the nature of the waste material. For liquid (flowable) type of materials, the sampling device of choice is a Coliwasa unit, tubing, or other appropriate sampling devices such as weighted bottles or bomb samplers. For solid (non-flowing) wastes that arrive in dump trucks, roll-off bins or containers (e.g., drums, tri-wall boxes, super-sacks, etc.), the device of choice is a scoop or shovel but could include other devices as described in SW-846 or ASTM.

### 2.5.3 Containers Of Waste That Are Not To Be Opened

Due to the toxicity of the following waste streams, shipments of these waste types are not required to be opened at the Facility provided that the generator furnishes documentation (which may include photographic documentation) and certification that the containers contain no free liquids and that the container(s) are at least 90 percent full.

- Nerve agent residues/wastes from military and chemical agents (e.g. F999 and P999 waste codes)
- Waste containing Beryllium; and
- Any other waste deemed to pose a significant occupational hazard to the Facility employees due to its toxicity. With such waste, appropriate approval must be obtained from the Director or ARA for TSCA regulated wastes.

#### 2.5.4 Waste That Is Not To Be Sampled and Analyzed

The following shipments or types of wastes are not required to be sampled and analyzed by the Facility:

- Lab Packs including, but not limited to, discarded containers of laboratory chemicals, waste, lab equipment, lab clothing, debris for lab spills or clean up, and floor sweepings packed in accordance with R315-14.10 of the Utah Admin. Code (40 CFR § 264.316).
- Empty Containers.
- Contaminated trash and debris (i.e. contaminated paper, glass, wood, metal, rubber, plastic, card board, etc.).
- Single source emergency spill material from a known source.
- Commercial products or chemicals that are off-specification, outdated, unused, contaminated, or banned. This also includes products voluntarily removed from the market place by the manufacturer or distributor in response to allegation of adverse health effects associated with product use.
- Asbestos-containing waste.
- Beryllium-containing waste (for example, from machining operations).
- Wastes that are visually identifiable through an inspection process (e.g., cathode ray tubes, batteries, fluorescent light tubes, filters, and filter cartridges, wire, tubing, paper products, metal sheeting and parts, crushed glass, piping, etc.).

- Waste produced from the demolition, dismantling, or renovation of industrial process equipment or facilities. These may include equipment, building materials, crushed drums, disassembled tanks, large construction debris, concrete, wood, etc.
- Waste from a remedial project in which the sampling and analysis plan was approved by a federal or state agency (e.g., Comprehensive Environmental Response Compensation and Liability Act (CERCLA), or state equivalent or a project funded by one or more potentially responsible parties, etc.) as long as the analysis was conducted by a suitable laboratory.
- On-site generated waste, unless otherwise required. The site-generated wastes include rainwater from collection sumps, rainwater from truck wash sumps, rainwater from trenches, spill clean-ups, etc.
- Debris as defined by R315-13-1 of Utah Admin. Code (40 CFR § 268.2 by reference). These materials shall be visually inspected after receipt but before shipment acceptance in order to ensure that the waste meets the definition of debris.
- Controlled substances regulated by the Federal Government including illegal drugs and/or materials from clandestine labs.
- Materials designated for storage and subsequent shipment off-site (transfer to another facility). If it is determined that the Facility will process a waste previously designated for storage and transfer, the waste shall be sampled and analyzed accordingly, prior to any treatment or disposal activities.
- Contaminated personnel protective equipment (PPE) – this includes, gloves, tyveks, respirators cartridges, clothing, etc.

In addition to these exceptions, the Facility may waive sampling and analysis where the pre-acceptance information is sufficient to ensure compliance with permit conditions and operational constraints of the treatment process; and any one of the following conditions exist:

- Obtaining a sample poses an unnecessary hazard of acute or chronic exposure of Facility employees to carcinogenic, mutagenic, neoplastigenic, teratogenic, or sensitizing materials; or
- A representative sample cannot be reasonably obtained, such as filter cartridges, large pieces of contaminated material (i.e. concrete, metal, wood), or contaminated debris.

#### 2.5.5 Samples Taken at Aragonite or Clive

The analytical results from incoming load samples taken at Aragonite or Clive or other Clean Harbors locations can be used in lieu of taking samples of the waste when it arrives at the

Facility. The analysis shall be performed using methods specified in this Attachment. The results of the analysis can be sent to GMF prior to the arrival of the first shipment or with the first shipment. Example: Aragonite receives a waste and then ships it to GMF for management. When the waste arrives at GMF, it may be accepted without taking additional incoming load samples provided the analytical results conform with the approved profile.

#### 2.5.6

A sample of waste taken by the generator or designee, in the presence of a Clean Harbors employee and sent to a suitable laboratory with chain-of-custody, the analysis of that sample can be used as a pre-acceptance sample and as the incoming load sample. The waste stream shall have an approved profile issued by GMF. The facility taking the samples shall follow the same or more stringent sampling methods as prescribed in this Attachment. In these cases, the shipment shall be inspected for general conformance with the manifest and profile as previously described. The unopened containers will be visually inspected for container integrity. The sampling and analysis of the materials in Section 2.54 above are not required unless requested by the Facility. These materials are not required to be sampled because they present extraordinary health and safety hazards (e.g., asbestos), exhibit unusual or impractical sampling and analytical complications, and /or are of such a nature that their contents are known in sufficient and reliable chemical and physical detail that sampling and analysis is not warranted (e.g., out of date commercial products, waste from a remediation project).

Sample(s) from incoming waste shipments that have arrived at the Facility shall be analyzed for the parameters listed in Table C-1. The Facility may require additional analysis based on the information provided during the profiling process. The decision to perform additional analysis shall be based on the following:

- Profile information;
- Results of the fingerprint analysis;
- Knowledge of the generator and/or the waste generating process;
- Limits on targeted waste management units;
- Conditions and limitations of existing permits and regulations;
- Experience of facility management in determining the need to know more information; and

- Any additional documentation obtained for the waste stream, including information that the waste is subject to the land disposal regulations contained in R315-13-1 of Utah Admin. Code which incorporates 40 CFR § 268 by reference.

Table C-2 lists some of the additional analyses that may be required. The results of the fingerprint analysis or waste verification analysis shall be documented and maintained at the facility. The results may be documented on a paper form or electronically. Once the analysis is complete, the Facility shall review the information and make a decision on whether to accept or reject the incoming waste shipment. Waste verification analysis are not required for wastes that will be transferred to another TSDF.

Once the Facility has reviewed the waste profile, incoming waste shipping documents (e.g. manifest) and the waste verification analysis (fingerprint analysis), a decision shall be made to accept or reject the waste load. This decision shall be based on the following information:

- Manifest information;
- Load inspection;
- Sample comparison, if applicable;
- Analytical results;
- Profile documentation obtained, such as MSDS, product ingredient(s), pre-acceptance analysis, etc.;
- Land disposal restriction notification/certification information;
- Facility management's judgment.

Incoming waste load(s) shall only be accepted for treatment, storage, or disposal on condition that the load information (e.g., the manifest information, load inspection, finger print analysis, etc.) is consistent with the profile information (e.g., waste description, analytical, LDR notification/certification form, etc.).

Incoming waste loads shall be subject to further evaluation if they experience any of the following:

- There is a difference between the quantity or type of waste designated on the manifest or shipping papers and the quantity or type of waste the facility actually receives;
- The manifest contains other incorrect, pertinent information;
- The fingerprint test results are not consistent with the profile information and/or pre-evaluation test data;

- Other incorrect manifest information;
- The load does not match sample description, or the fingerprint results are not consistent with the results contained in the profile.

These loads are considered non-conforming waste loads. In this case, the generator and/or his designee shall be contacted as soon as practical for additional information or to clarify information contained in the waste profile, on the manifest, and/or land disposal restriction notification/certification form, if applicable. Depending on the nature of the information, changes may be made to the manifest at the direction of the generator or his designee, the profile may be amended, or the waste may be recharacterized and a new profile created. The load of waste may be staged in a permitted storage area at the Facility while the Facility is working on clarifying or rectifying the problem with the non-conforming load. The additional information shall be reviewed and the Facility shall make a decision regarding the non-conforming loads acceptability.

## **2.6. Special TSCA Waste Receiving Procedures**

The following are special procedures for receiving TSCA regulated PCB waste. In the case of loads (manifests) of PCB waste in drums or portable tanks, at least 10 percent of the containers in each PCB waste stream (waste profile) shall be sampled prior to final disposal. After the load has been accepted, but before further processing, all PCB waste containers shall be opened for visual inspection for physical appearance. Containers on a manifest that have the same profile, but appear on a different line due to different container type, may be composited prior to analysis, providing the individual samples are similar in physical appearance.

For bulk PCB waste shipments, one in every ten loads of a given PCB waste stream shall be sampled, rather than 10% of the total loads received. Once ten loads have been received (and one of them has been sampled), the count starts over, and at least one of the next ten loads shall be sampled. The sampling crew is responsible for determining whether a given waste stream has been sampled within the last 10 loads. This may be done by either manual (paper) or electronic (computer database) tracking of the number of loads of a particular waste stream that have been received. The samplers shall sample the first load of every day that the waste stream is received and then the 11<sup>th</sup>, 21<sup>st</sup>, etc. load if that many are received in one day. , If inconsistencies are documented during the receiving process the sampling frequency shall be increased..

Most PCB-containing equipment, which is received for disposal at the facility, has already



been drained and flushed and had sorbent added. However, some PCB containing equipment (transformers and hydraulic equipment) may require draining and/or flushing. Sorbent material shall be added to the equipment prior to disposal. All draining and flushing of equipment shall occur at the PCB Storage Area of the Facility. Upon completion of these processes, the PCB-containing equipment shall be transported to a TSCA-permitted disposal cell.

Drained PCB containing electrical equipment received by the Facility shall be inspected to determine if it has indeed been drained before it is landfilled. All PCB articles on each line item of each manifest shall be opened to check for the presence of free-flowing liquids. For equipment such as transformers, the "opening" will be done by removal of inspection plates or access hatchways, and then visually inspecting the interior area exposed. The inspection shall also verify that a sorbent material has been adequately added to absorb any remaining liquids. A minimum quantity of sorbent, approximately equal to 5% of the fluid capacity of the article, should be present. If liquids are present or if sorbent has not been adequately added to absorb any remaining liquids (> 5% of the fluid capacity of the article), the articles shall be further drained and sorbent added as needed. PCB waste equipment and articles, which are to be drained, shall be taken to the PCB Storage Area, and drained within designated areas, all of which are within secondary containment. Once in place in the drainage location, all valves or petcocks shall be fully opened and allowed to stand open for at least 30 minutes over a Drain Vat. If there are drain plugs or caps, rather than valves, they will be removed to allow drainage to occur. Articles may be inverted, elevated at a slant, rotated, or otherwise moved to enhance drainage out of complex internal geometries. Large transformers without drain plugs or valves shall be drain with the use of a "stinger". PCB articles shall be allowed to drain until any "stream" or "flow" of liquid has ceased, and only an occasional drip remains. Flushing shall then take place as specified by 40 CFR §761.

Finally, all valves shall be closed and drain plugs replaced, to insure no further dripping or leakage after the PCB article is removed from the drainage area. Sorbents shall be added through the inspection ports, to absorb liquids which may remain in the article, in an amount approximately equal to 5% of the fluid capacity of the article.

Not all PCB articles have inspection ports or drain valves or plugs. For such equipment, such as large, detachable ceramic PCB containing bushings which are known or suspected to contain liquids, other more-destructive means of opening may be employed. All PCB articles which are known or suspected to contain free liquids (except for *de minimis* quantities such as vials) shall be opened by drilling, cracking or breaking a hole in the ceramic with a hammer, or other means to open up cavities which may contain liquids. As

stated above, PCB articles shall be allowed to drain for at least 30 minutes, and rotated, inverted, etc. to assist in draining complex geometries. If multiple, isolated cavities are apparent, then multiple openings shall be made. When possible, sorbent shall be added to absorb liquids which could not be drained. The PCB articles will then be routed to the landfill for disposal.

For all PCB articles described above, any free liquids remaining around the drain ports or openings created, which might drip off of the article while in storage, shall be wiped off with absorbent toweling. Those PCB articles which have been forcefully opened, cannot be re-sealed, hence, some long-term weepage from the openings may be unavoidable. In addition, some oil staining of the exterior surface of the articles in the immediate area of the drain ports is considered normal and may remain. Sorbent pads or toweling shall be wrapped or packed around any unsecured openings or valves known to be incompetent, to prevent releases to the environment while present at the facility. Such wrapped articles shall be routed to a landfill cell for disposal within 24 hours after completion of the inspection/draining process, or be stored in a PCB container for disposal. The Facility shall use best efforts to complete the inspection/draining process, including the resolution of disputes with generators, as quickly as practicable.

For those unsecured PCB articles described in the preceding paragraph (e.g., those wrapped or packed with sorbent pads), the 24-hour period allowed for disposal shall be deemed to start when the article is removed from within the secondary containment area within the PCB Storage warehouse. The time and date of removal from secondary containment shall be recorded on the records described below; unless a specific notation is made otherwise, the “time of removal from secondary containment” shall be considered as the time recorded when the article is removed from the PCB Drain Vats.

A record shall be kept indicating the actions taken on each line item (e.g., group of PCB articles), the technician performing those actions, and the date the article(s) was/were handled. Also, the initials of the technician performing the inspection, draining and flushing, etc. of each article shall be placed on each article using indelible markers, prior to transport to the landfill for disposal.

## **2.7. Waste Containing Asbestos Special Handling Procedures**

The handling and disposal of asbestos is regulated under 40 CFR § 61 Subpart M of the Clean Air Act. Specifically, 40 CFR § 61.154 contains requirements for periodic cover, dust control, recordkeeping, fencing, signs, etc. All asbestos-containing PCB wastes are also

subject to these requirements. Specific requirements include:

- Posting of specified warning signs on security fences;
- Daily cover (or once each 24-hours if operating continuously) of the asbestos waste, if there are any visible emissions air from the site. Cover shall be non-asbestos-containing material, at least six inches (6") thick, or a sprayed-on resinous material.
- Certain reporting and recordkeeping requirements also apply.

Drummed, bagged or boxed friable asbestos could contain a free liquid from the application of water as wetting agent during asbestos abatement activities of the generator. The purpose of this section is to provide the guidelines for handling a friable asbestos container with obvious free liquids. It is intended to minimize the random or systematic opening of containers of friable asbestos. For regulatory and health and safety considerations care shall be taken when opening containers of friable asbestos, even when utilizing personal protective equipment (PPE). For any management of containers of friable asbestos at the Facility, employees shall wear the standard Level C PPE. The following procedure shall be used to determine if free liquid is present:

- Loads of containerized friable asbestos shall be visually observed by site samplers or container management unit personnel to ascertain if any of the containers contain free liquids. This means that any bag or box visible to the samplers or container management personnel shall be observed to ascertain if any indication of liquids are present. Wet cardboard on the bottom of boxed waste or "pooled" liquid at the bottom of bagged wastes are examples of visual indications of free liquids in the container.
- If no containers, which can be physically observed for a load, visually indicate the presence of liquids associated with the load, the load will be released to disposal. This includes bagged material received in bulk containers (e.g., dump trucks, roll-off boxes, etc.).
- If any container is identified as "potentially" containing free liquids through visual inspection process described in paragraph 1, the container shall be opened, with care taken to assure no visible emissions occur, and the liquid shall be drained into a drum, spill pan or other collection device. The drained container shall be properly disposed and the liquid shall be analyzed for the applicable tests in Table C-1 to confirm that it is water. A successful confirmation of water will allow the liquid to be solidified and disposed in a TSCA-approved cell. A failed confirmation of water (i.e., specific gravity greater than 1.1 or less than 0.9 or observed oil sheen) shall result in the collected liquid fraction being shipped off-site for alternate disposal.

## 2.8. Discrepancies

Discrepancies are as defined by R315-8-5.4 of Utah Admin. Code (40 CFR §264.72). There are three basic types of discrepancies, variation in weight, piece count, or type. Discrepancies are as follows:

- For bulk waste (e.g., end dumps, roll-off bins, tank trucks, etc), a discrepancy is when the actual weight of bulk shipments varies more than  $\pm 10\%$  of the weight shown on the manifest;
- For piece count (e.g., containers), a discrepancy is when the number of containers on the load does not match the number of containers listed on the manifest.
- For type (e.g. bulk and containerize waste), a discrepancy is when fingerprint analysis as specified in Table C-1 is not within the tolerance limits specified in Table C-4. Should a particular value or values fall outside of the specified tolerance limits, this shall be considered a load discrepancy and shall require further investigation and/or analyses to resolve the discrepancy. One or more of the following actions may occur to resolve the discrepancy:
  1. The sampling and analytical data are reviewed to verify that they are indeed correct.
  2. Additional analyses can be conducted in order to resolve discrepancies or to re-profile the waste.
  3. The generator or authorized representative is contacted. In cases where the waste is amenable to storage or treatment, the waste may be stored at the facility while the discrepancy is resolved with the generator or authorized representative. This may involve creating a new profile for the waste or updating the existing profile.
- For lab packs, a discrepancy is when there is a piece count issue as noted above or when the contents of lab packs don't match the contents of the load inventory sheet. At least ten percent of the lab packs for each manifest line item shall be verified with a minimum of one lab pack per manifest. Discrepancies shall be reconciled with the waste generator. If a discrepancy in contents is documented, 100% of the lab packs from the load shall be verified. Lab packs generated on site are not required to follow the verification procedure.

The waste can be accepted if the discrepancy is resolved. The resolution of the discrepancy shall be clearly indicated in the operating record. If the discrepancy is not resolved within 15 days, the Facility will notify, in writing, the Director and the ARA for TSCA regulated wastes.

Waste that cannot be accepted shall either be rejected and returned to the generator or

shipped to another facility that can appropriately store, treat, or dispose of the waste. The generator shall be notified if the waste is unacceptable and upon approval the waste shall be manifested off-site to an approved transfer, treatment or disposal facility.

## **2.9. Transfer Operations**

Wastes that are manifested to another facility may be held temporarily (ten days or less, where day one is the first calendar day after arrival and day 10 ends on midnight of the 10th day) at the facility during transit. The waste can be part of a load for which some of the material is destined for GMF. When this material is shipped off-site, the original manifest shall accompany the waste. The 10-day transfer loads shall be documented as part of the operating record.

This differs from wastes that are accepted for storage only and then subsequently shipped to another facility. A new manifest shall be generated by the facility as the generator in this situation.

For waste streams that are at the facility for a maximum of ten days and then shipped to another TSDF there are no requirements for sampling or profile verification. The facility shall comply with the transporter requirements in R315-6 of Utah Admin. Code (Subpart C of 40 CFR § 263) for these wastes. The containers shall be inspected to ensure they are in good condition. The containers shall be segregated from other profiled wastes, clearly identified as 10-day wastes along with the date of arrival. Issues of compatibility shall be handled in the same manner as if on a transport vehicle using shipping paper information.

## **2.10. Non-Hazardous Waste / Non-RCRA Waste / Non-TSCA Regulated Waste**

Non-hazardous waste, non-RCRA waste, non-TSCA regulated waste, household hazardous wastes, and other wastes excluded from regulation or not regulated under RCRA, TSCA, or as defined under R315 of Utah Admin. Code is referred to hereafter as “NH” wastes. Generators of NH wastes shall submit a profile for their waste as described in 2.1. When a shipment of NH waste arrives at the Facility, the Facility shall follow the applicable waste verification procedures specified in Section 2.5. If there is a variation in the weight, count, or type, the Facility shall follow the discrepancy procedures specified in Section 2.8.

## **2.11. Storage Only Wastes**

The Facility may store RCRA and non-hazardous waste for up to one year. PCB waste streams shall be disposed of within one year of the date of removal from service. Wastes intended for storage shall be profiled as described in Section 2.1. Upon arrival, the Facility

shall follow the visual inspection portion of the waste verification procedures specified in Section 2.5. If there is a variation in the weight, count or type, the Facility will follow the discrepancy procedures specified in Section 2.8.

### **3.0 TEST METHODS:**

The test methods to measure the parameters discussed throughout this Attachment are currently identified in those listed in Table C-5. Whenever possible these are established methods or modified methods from Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition, US EPA, 1986 and its updates. However, SW-846 does not have methods for all the parameters specified; nor are those methods necessarily the most accurate or sensitive. In these particular cases, other established methods are used, including American Society for Testing and Materials (ASTM); and EPA 600/4-79-020, Methods for Chemical Analysis of Water and Wastes; Standard Methods for Examination of Water and Wastewater, Latest Edition; EPA 40 CFR, 136, App. A Methods; EPA Contract Laboratory Program, Inorganic SOW and Organic SOW Methods. Where other practical methods are not available, methods have been developed. These methods are described in Sections 3.1 through 3.7 of this Attachment or are described in manufacturer literature. GMF and the suitable laboratories GMF uses are authorized to use the methods and method updates / improvements that the State of Utah Bureau of Laboratory Improvement (BLI) and/or NELAP certify as soon as the request is made to the BLI and/or NELAP for the lab to be certified for that method.

#### **3.1. Ignitability Screen for Sludges (GMF-8b)**

The ignitability screen for sludges is determined using a modified version of EPA SW-846 Method 1010. Instead of an actual flash point determination as outlined in the 1010, the sludge is heated in the test cup to 140°F. When the temperature in the cup reaches 140°F, the flame is applied to the sample. A flash/no-flash measurement shall be determined and recorded as positive or negative.

#### **3.2. Ignitability Screen for Liquids, Solids and Sludges (GMF-9401)**

The setaflash method is based upon ASTM D3828. This is a flash/no flash screening test suitable for liquids, solids, highly viscous liquids, and sludges. The sample is introduced into the cup of the apparatus by opening the cover and adding the sample. The tester is set and maintained at fixed threshold temperatures. After one (1) minute, a test flame of a specific size is applied and an observation made as to whether or not a flash occurs. A flash/no-flash measurement shall be determined and recorded as positive or negative.

### **3.3. Waste Compatibility Qualitative Assessment (GMF-12)**

As part of the pre-approval procedures, the chemical characteristics (pH, reactivity, flammability, etc.) of waste streams shall be assessed by waste acceptance personnel from the profile, to compare compatibility of the waste with shipping and storage containers. This assessment shall be based on information about the waste, but does not require analytical analyses.

### **3.4. VOLATILE ORGANIC VAPOR TEST (LEL) (GMF-14)**

This is one method that may be used to determine the presence of combustible vapors / volatile organic compounds dissipating from a waste. A positive result (failure) is indicated by a reading of greater than 10% LEL on the instrument. A failure requires that a flash point analysis be performed to test for ignitability if the material is destined for direct land disposal at GMF. If destined for storage or treatment in tanks, the TLV Sniff test (GMF-5) shall also be performed.

To perform the test containers of waste shall be opened enough to insert the probe. The instrument pulls any vapors above the waste into the detectors. The LEL instrument shall be purged so that the gauge on the instrument reads zero prior to testing the subsequent sample.. The container is sampled immediately after opening. The probe inlet shall be placed close to, but not touching, the waste in the container. The result (POS/NEG) shall be documented in the logbook. Care shall be exercised to ensure that drafts are avoided in the area that is being sampled as this can cause a false negative result. The instrument shall be calibrated according to the procedures and at the frequency specified by the manufacturer. It shall be operated according to the instructions provided by the manufacturer. Daily sensitivity checks and continuing sensitivity checks every twentieth sample shall be conducted. The test shall not be run with an instrument that is not functioning correctly.

### **3.5. Combustible Vapor Test (TLV SNIFF) (GMF-5)**

This is another method that may be used to determine the presence of volatile organic compounds dissipating from a waste. A reading of greater than 200 ppm on the instrument (FID, PID and or Catalytic Combustible gas and vapor sensing instrument or equivalent) requires that a flash point analysis be performed to test for ignitability if the material is destined for direct land disposal. A reading of < 500 ppm on the instrument (FID, PID and or Catalytic Combustible gas and vapor sensing instrument or equivalent) is required if the material is destined for storage or treatment in tanks.



To perform the test, the sample container is opened enough to insert the probe and the probe is inserted immediately over the sample. The probe inlet shall be placed within 0.5 cm, but not touching, the waste. Sufficient time shall be allowed to clear the air from the sample line prior to sampling. The result (POS/NEG) shall be documented in the lab record. Care shall be exercised to ensure that drafts are avoided in the area that is being sampled as this can cause a false negative result.

The instrument shall be calibrated according to the procedures and at the frequency specified by the manufacturer. It shall be operated according to the instructions provided by the manufacturer. Daily sensitivity checks and continuing sensitivity checks every twentieth sample shall be conducted.. The test shall not be run with an instrument that is not functioning correctly.

### **3.6. TLV Sniff / Field (GMF-5-MOD)**

This is another method that may be used to determine the presence of volatile organic compounds dissipating from a waste. A reading of greater than 200 ppm on the instrument (FID, PID and or Catalytic Combustible gas and vapor sensing instrument or equivalent) requires that a flash point analysis be performed to test for ignitability if the material is destined for direct land disposal. A reading of < 500 ppm on the instrument (FID, PID and or Catalytic Combustible gas and vapor sensing instrument or equivalent) is required if the material is destined for storage or treatment in tanks.

To perform the test, containers of waste are opened enough to insert the probe. The instrument pulls any vapors above the waste into the detectors. Sufficient time shall be allowed to clear the air from the sample line prior to sampling. The container is sampled immediately after opening. The probe inlet shall be placed close to, but not touching, the waste in the container. The result (POS/NEG) is documented in the logbook. Care shall be exercised to ensure that drafts are avoided in the area that is being sampled as this can cause a false negative result.

The instrument shall be calibrated according to the procedures and at the frequency specified by the manufacturer. It shall be operated according to the instructions provided by the manufacturer. Daily sensitivity checks and continuing sensitivity checks every twentieth sample shall be conducted. The test shall not be run with an instrument that is not functioning correctly.

### **3.7. Radioactivity Screen (GMF-6 / 9916-mod)**

All incoming waste shipments shall be monitored for radioactivity using a count rate meter with a Geiger-Mueller detector or equivalent. The detector shall be operated in accordance with the manufacturer's recommended procedures. Detectors shall be calibrated by the manufacturer at least annually and after repair.

After a container of waste is opened, the detector window shall be placed within one (1) inch (but not in contact with) of the sample surface until a steady, time weighted count rate is obtained.

Results of surveys are to be recorded in terms of microR/hr. Any waste found to have a reading of three times over background shall not be accepted without receiving authorization from the Division of Radiation Control. A background reading shall be taken for each sampling day and the measurement recorded.

## **4.0 WASTE SAMPLING METHODOLOGY**

This section presents methods to be used to obtain samples of wastes as required by this Attachment and the applicable regulations. These methods shall apply to waste generated off-site as well as facility-generated waste. The specific sampling methods selected are dependent on both the nature of the waste and its location, and shall be decided upon before sampling. In some instances, company personnel may perform sampling at off-site locations (e.g., clean-up projects, off-site generators location, etc.).

### **4.1. Sampling Locations:**

Samples of hazardous and TSCA-regulated waste from incoming waste loads may be collected from a variety of locations throughout the facility or at an off-site location. Waste may be sampled from storage vessels, such as a tank, drum, roll-off box, rail gondola car, rail tank car, pin box, tanker or dump-type truck, etc. or from other locations including containment areas, process equipment, pipes and pumps. Sampling may also occur at the Clive and Aragonite Facilities.

### **4.2. Sampling Methods**

Representative samples shall be taken using methods outlined in "Test Methods for the Evaluation of Solid Waste, Physical/Chemical Methods," SW 846, EPA; "Handbook for Sampling and Sample Preservation of Water and Wastewater," (EPA-600/4-82-029); or

"Samplers and Sampling Procedures for Hazardous Waste Streams," (EPA-600/2-80-018); or R315-50-6 of the Utah Admin. Code (40 CFR § 261, Appendix I).

The methods and equipment used for sampling vary with the form and consistency of the waste to be sampled. They also vary depending upon the regulatory requirements for which the testing is done. Where samples are used to identify or confirm the identity of a waste, the appropriate representative sampling techniques, devices, and containers shall be selected from the options presented in R315-50-6 of Utah Admin. Code (40 CFR § 261 Appendix I) or equivalent. Where samples are used to determine compliance with treatment standards expressed in R315-13-1 of Utah Admin. Code which incorporates 40 CFR § 268.40 by reference, after treatment, sampling techniques appropriate to the waste type shall be used.

Sampling accuracy (the closeness of a sample's analytical results compared to the results associated with the waste profile) and sampling precision (the closeness of repeated sample values) are important in determining the quality of the data. From both regulatory and scientific perspectives, the primary objectives of a sampling plan are to collect samples that allow accurate and precise measurements of the chemical properties of the waste. If the chemical measurements are sufficiently accurate and precise, they are considered reliable estimates of the chemical properties of the waste. Statistical techniques for obtaining accurate and precise samples are relatively simple and easy to implement. Sampling accuracy is usually achieved by some form of random sampling. In random sampling, every unit in the population has a theoretically equal chance of being sampled and measured. Consequently, statistics generated by the sample are unbiased (accurate) estimators of true population parameters. In other words, the sample is representative of the population. Where particular types of sampling are indicated by the treatment standards, these shall be used.

### **4.3. Traceability**

Sample traceability for all internal sampling and analysis and shipment of samples to suitable laboratories shall be followed. This involves the documentation of procedures so that a set of data can be traced back through the analyst, to the person performing the sampling, and then to the waste itself. All samples shall receive a unique sample identification number to facilitate this process. See the Quality Assurance Plan (Attachment II-WAP, Appendix 1) sections 5.2 & 5.4 for the requirements for seals and/or chain-of-custody.

#### **4.4. Sampling Personnel**

Sampling shall be performed by trained personnel. The Facility Manager or designee shall train sampling personnel and periodically observe their sampling technique to ensure a thorough understanding of sample collection, storage, and transportation practices. The training provided to the sampling personnel shall be incorporated into the operating record.

#### **4.5. Sample Labels**

Sample labels shall be used to provide identification of samples. The labels shall be affixed to the containers prior to or at the time of sampling. The labels shall be filled out with the following information:

- sample identification;
- place of collection;
- date of collection;
- person sampling; and
- manifest number & generator name or load number, etc., if applicable.

#### **4.6. Record (Log Book, Unload Work Order, or Equivalent)**

All information pertinent to field surveys or sampling shall be recorded and incorporated into the operating record. Sufficient information shall be recorded to allow someone to reconstruct the sampling without reliance on the collector's memory. This record shall include, at a minimum, the following information:

- location of sampling point;
- volume of samples taken;
- date of collection;
- sample identification number;
- person sampling;
- comments or observations;
- sampling methodology
- copy of sampling results

#### **4.7. Sample Preservation:**

All samples shall be preserved in accordance with the parameter to be measured, as specified by the analytical method for that parameter. For sample preservation, specific procedures are found in the Quality Assurance Plan. Hazardous waste samples do not require preservation but are subject to holding times.

#### **4.8. Sampling Small Containers:**

The term "small container" refers to receptacles designed for transporting materials (e.g., drums and other small receptacles) typically transported on flat beds or vans as opposed to bulk transport containers or stationary tanks. This section addresses sampling of small containers that are of a size that could be stored in the container storage building. COLIWASAs, tubes, shovels, drum thieves, and triers shall be the devices used to sample containers.

The following sampling criteria shall apply to shipments of a single waste stream from the same generator. Ten percent (10%) of the containers, rounding to the next whole number, shall be sampled. Samples of containers with like physical appearance can be composited. Samples of unlike physical appearance can not. All containers in a waste stream, prior to being treated and/or disposed at GMF, shall be opened to verify conformance to the physical appearance of those sampled. Additional samples shall be taken from containers with non-conforming appearance.

Samples shall be taken from locations displaced both vertically and horizontally throughout the waste. For liquids (or liquids with precipitated solids), the sampling person shall use a COLIWASA or equivalent. The sampling device shall be inserted into the container from the top and pushed down slowly until the bottom of the container is reached. The device is sealed to retain the contents. The contents of the sampling device are then transferred to an appropriate sample container, which is labeled with waste identification information. The sampling device may also be stoppered at both ends, wiped dry with a disposable cloth, and then transferred to the lab for analysis.

A trier, thief, shovel, or scoop shall be used to sample containers that are solid in nature. The sampling person shall remove a sample that uniformly represents the waste composition of the container (i.e., all layers and phases shall be represented in the sample). If the contents are solidified, such as concrete, clay, polymerized material, glue, a sample from the top of the container shall be collected.

#### **4.9. Sampling Liquid Tanks:**

Typically liquid tanks are sampled from the outlet valve or piping. The valve shall be flushed prior to the sample actually being drawn. The liquid accumulated from the flushing process shall be placed in a bucket and returned to the tank. In addition, other methods for sampling tanks may be used such as a weighted bottle or bomb sampler in order to allow for sampling at various depths.

#### **4.10. Sampling Bulk Containers:**

Bulk containers are typically rolloff boxes, dump trucks, tank trucks, rail tank cars, rail gondola cars. Where sampling of bulk loads is required, each container of each load shall be sampled as described below.

Bulk solids in rolloff boxes or dump trucks (or truck and pup) shall be sampled at two locations in the waste container(s). A trier, thief, auger or shovel shall be used in order to draw a sample from at least one foot in depth or the full depth of the waste which ever is less at each location. The samples shall be composited together so that there is one sample which represents that particular bulk solids shipment.

Bulk solids in rail gondola cars shall be sampled at four distinct locations in the waste container. A trier, thief, auger or shovel shall be used in order to draw a sample from at least one foot in depth or the full depth of the waste which ever is less at each location. The samples shall be composited together so that there is one sample which represents that particular bulk solids shipment. This sample shall be used for all rolloff boxes or dump trucks filled from that particular gondola car. Each incoming load from that car will be visually inspected to ensure visual conformance with the incoming load sample. A visual non-conformance will initiate actions to resolve the discrepancy.

Bulk liquids are sampled by using a COLIWASA or similar device which can sample vertical anomalies. Bulk sludges shall be sampled with a device appropriate for the consistency of the material. That may be a COLIWASA, trier, dip tube, or thief, etc. Each compartment of a tanker truck is sampled. Compartment samples from the same generator and waste stream may be composited prior to analysis only if there is no difference in physical appearance.

Tank trucks without man-ways shall be sampled through the valve. The valve shall be flushed prior to the sample actually being drawn. The flushed material shall be managed with the waste.

An exception to the requirement for sampling each load of bulk load shipments will be where multiple bulk loads of a single waste stream are received from a single source (e.g., a major site clean-up of contaminated material or a large volume generator shipping over a short time period). In such cases, all loads shall be inspected for physical appearance. A visual non-conformance will initiate actions to resolve the discrepancy. The Facility shall sample the first load of the day (and then the 11<sup>th</sup>, 21<sup>st</sup>, etc.) and analyze for the incoming load parameters.

#### **4.11. Frozen Waste:**

Loads may arrive at temperatures which prevent a representative sample from being obtained. Under such circumstances, the wastes will be allowed to warm until such time as sampling can be performed. Sampling can occur at any temperature provided a representative sample can be obtained. A sample shall then be taken and analyzed. Alternatively, and if conditions warrant (e.g., freezing conditions) a sample of PCB waste being delivered to the Facility may be obtained at the point of generation for the purpose of satisfying the requirements of this Attachment. Upon arrival, the load shall be visually inspected for free liquids.

#### **4.12. Other Samples (i.e., Process Equipment, Containment, Sumps, etc.)**

The sampling method for waste in and from process equipment (i.e., stabilization tanks), containment and containment sumps, put-piles, etc., will vary with the nature of the waste material but will normally be grab samples as these are typically homogeneous wastes. For grab samples the sampling device of choice shall be a scoop, shovel, bottle, cup or similar device with a container in which to deposit and transport the sample. A dip tube or COLIWASA may also be used to sample sumps.

#### **4.13. Post Treatment Sampling of Waste Treated in Stabilization Tanks**

When waste is treated in the stabilization tanks it is mixed with reagents. A sample is then obtained for LDR conformation analysis. Because of the mixing it is reasonable to approach the pile as a mass with no vertical or horizontal stratification. GMF shall follow the sampling methodology stated in R315-13-1 of Utah Admin. Code, which incorporates 40 CFR § 268.40 (b) by reference, for waste treated at GMF. Any grab sample shall pass the treatment standards before the waste is disposed. When there is any uncertainty in achievement of treatment standards, the Facility shall follow the procedures for re-sampling in Section 4.13.2 of this Attachment.

#### 4.13.1. Initial Sampling

One grab sample from each batch of treated waste shall be taken. It shall be collected from either the tank after treatment is completed, or during removal from the tank, or from the transport vehicle used to move the waste to the staged “put-pile” location, or immediately after the “put-pile” is placed.

##### 4.13.1.1. Re-Sampling

Wastes treated in the stabilization tanks and staged as “put-piles” to await analytical results, may need resampling for confirmatory (verification) analyses. Resamples shall consist of two grab samples per batch of material placed in the put-pile. If results from the initial sample indicate a failure to meet LDR treatment standards, two resamples shall either be taken to verify the results of the initial sample or the waste shall be retreated. If one or both resamples fail, the waste shall be retreated. If both pass, the Facility will determine that the waste meets treatment standards and may be released for disposal.

#### **4.14. Surface Impoundment**

The following describes the collection of liquid and sludge samples from surface impoundments.

##### 4.14.1. Liquid Phase

The representativeness of the samples of the waste in a surface impoundment is dependent on the number of samples collected over the volume of the waste in the impoundment. If the waste stored in the impoundment is a homogeneous mixture (e.g. non-hazardous and/or F039 liquids), the sampling approach will be that of a non-stratified, free-flowing liquid. At a minimum, at least three samples shall be collected, one from near the bottom and one from at least two sides of the impoundment. These samples shall be composited unless stratification is observed and, if present, discrete aliquots shall be taken as grab samples.

##### 4.14.2. Sludge Phase (on the Bottom)

The representativeness of the samples of the sludge at the bottom of the surface impoundment is dependent on the number of samples collected over the volume of the waste in the impoundment.

If there is less than three inches of sludge buildup on the bottom of the impoundment, it may be difficult to get a sample. Under such circumstances,



four grab samples taken from the bottom and on each side of the impoundment shall be taken and composited together.

If the buildup is three inches or more, at least four samples shall be taken from the thickest layers of sludge at random locations.

#### **4.15. Leachate from RCRA Leachate Collection Systems:**

GMF has determined that it meets the exemption to the air emission standards under R315-8-22 of Utah Admin. Code (Subpart CC in accordance with 40 CFR § 264.1082). The following procedure shall be used to verify the applicability of the exemption.

##### 4.15.1. Frequency

The leachate from each cell shall be analyzed during the 4<sup>th</sup> quarter to confirm that the Volatile Organics (VO) concentration in the leachate is < 500 ppmw.

##### 4.15.2. Collection and Sampling of Leachate Storage Tanks from Each Individual RCRA Cell

An equal amount of leachate shall be pumped from each leachate sump (all risers) in a given RCRA cell into the portable leachate collection tank. A sample from the portable leachate collection tank shall be collected using a collowasa. The leachate collection tank shall be emptied prior to sampling the following cell. Chain-of-custody procedures shall be used to send the sample to a laboratory for analysis.

##### 4.15.3. Analysis

The waste shall be analyzed in accordance with R315-7-30 of Utah Admin. Code, which incorporates 40 CFR § 265.1084 (a)(3)(iii) by reference. The concentration of VO in the leachate will need to be < 500 ppmw for the Facility to maintain the exemption.

#### **4.16. Water from Wheel Wash Collection Tanks**

GMF has determined that it meets the exemption to the air emission standards under R315-8-22 of Utah Admin. Code which incorporates 40 CFR § 264.1082 (Subpart CC). The following procedure is used to verify the applicability of the exemption.

##### 4.16.1. Frequency

Water from the wheel wash tank(s) shall be analyzed annually to confirm that the

VO concentration in the water is < 500 ppm.

#### 4.16.2. Collection and Sampling of Wheel Wash Water

Prior to emptying the Wheel Wash Tank(s), a sample shall be collected and chain-of-custody procedures shall be used to, send the sample to a laboratory for analysis.

#### 4.16.3. Analysis

The waste shall be analyzed in accordance with R315-7-30 of Utah Admin. Code (40 CFR § 265.1084 (a)(3)(iii)). The concentration of VO in the leachate will need to be < 500 ppmw for the Facility to maintain the exemption.

### **4.17. Sample Disposal**

Samples of waste streams shall be disposed in the same fashion as the waste stream itself. Samples received which are unacceptable for management on-site may be returned to the generator (or representative) or sent to an approved facility for disposal. To facilitate this process (sample disposal), samples approved for the same management processes may be consolidated in containers.

### **4.18. Sampling Apparatus Cleaning**

Sampling tools shall be kept clean of materials that will interfere with future analyses. Those analyses being conducted for gross qualification shall be kept free of loose material which would enter the sample, whereas visually clean or new sampling equipment shall be required where the sampling is being performed to determine constituents in the parts per million range.

## 5.0 PCB WASTE MANAGEMENT PROCEDURES

The following are examples of the types of PCB wastes that can be disposed of in a landfill at the Facility after the receiving process has been finished and a determination has been made to accept the waste:

- a. Contaminated debris and/or rags;
- b. PCB-contaminated or small PCB capacitors;
- c. Drained or drained and flushed PCB hydraulic machines per 40 CFR § 761.60(b)(3);
- d. Drained PCB articles per 40 CFR § 761.60(b)(5)(I)(B) and (ii) or containers per 40 CFR § 761.60(c)(1)(ii) and (2); and
- e. Flushed PCB transformers per 40 CFR § 761.60(b)(1)(I).
- f. Asbestos or asbestos-containing materials contaminated with PCB's.

The following PCB waste types shall be sampled and analyzed as per this Attachment prior to ultimate disposal in the authorized cell:

- a. Contaminated soils;
- b. All free liquids and sludges contaminated with <500 ppm PCB provided, that those wastes do not contain more than 10% Total Organic Carbon (TOC) prior to solidification. (e.g. Dredged materials, industrial sludges, municipal sewage, and treatment sludges).

The following special PCB wastes include materials from on-site and off-site activities that are not required to be sampled and analyzed but shall be physically inspected prior to disposal, to verify the contents:

- a. Contaminated Trash and Debris - Consisting of rags, clothing, sampling/analysis apparatus, contaminated lab debris, glassware, pallets, etc.
- b. "Empty" containers contaminated with PCB's - This applies to a portable container which has been emptied, but which may hold residuals of PCB's. Examples of containers are: portable tanks, drums, barrels, cans, bags, liners, etc. A container shall be determined "empty" according to the criteria specified in R315-2-7 of Utah Admin. Code (40 CFR § 261.7);
- c. PCB equipment removed from service provided that adequate information is available from the generator to determine regulatory status (e.g., PCB origin and concentration; manufacturer's status; etc.). Examples: fluorescent light tubes, microwave ovens and

fixtures, electronic equipment, etc.

- d. PCB waste produced from the demolition or dismantling of industrial process equipment of facilities contaminated with PCB's. For these exceptions, the generator shall supply the Facility with sufficient chemical and physical characteristics information for proper management of the waste.

Containers requiring storage prior to landfill disposal shall be stored in the container storage area of the drain and flush building at the PCB treatment facility or in an area in compliance with 40 CFR § 761.65. (Wastes which are to be handled at the PCB treatment facility are discussed in Appendix 1 "Other Facilities".) "Staging" of PCB waste is only authorized for a period of 30 calendar days or less in an area permanently designated outside of the TSCA disposal cell. Any waste being staged longer than 30 days shall be moved to the TSCA-approved storage area.

PCB wastes shall be managed in one of the 15 procedures in the following list:

- |   |  |
|---|--|
| 1. Mineral oil dielectric fluid containing PCBs.  | May go to the PCB storage facility on-site for eventual shipment off-site to a suitable facility under 40 CFR § 761. |
| 2. Kerosene flushing fluid contaminated with PCBs.  | May go to the PCB storage facility on-site for eventual shipment off-site to a suitable facility under 40 CFR § 761. |
| 3. Commercially graded oil contaminated with PCBs.  | May go to the PCB storage facility on-site for eventual shipment off-site to a suitable facility under 40 CFR § 761. |
| 4. Other oils with <500 ppm PCB.  | May go to the PCB storage facility on-site for eventual shipment off-site to a suitable facility under 40 CFR § 761. |
| 5. Flushed PCB transformers, and transformers flushed at the Facility, with original PCB concentration >500 ppm per 40 CFR § 761.60(b)(1)(i). | May go directly to a landfill for disposal after physical appearance is examined and required inspections occur.     |
| 6. Asbestos/PCB-Contaminated Waste.   | May go directly to a landfill for disposal after physical appearance is examined and required inspections occur.     |

- |  |   |
|--|---|
| 7. Contaminated soil, debris and/or rags.  | May go directly to a landfill for disposal after physical appearance is examined and required inspections occur.  |
| 8. Non-PCB (<50 ppm), PCB-contaminated, or small PCB capacitors.   | May go directly to a landfill for disposal after physical appearance is examined and required inspections occur.  |
| 9. Drained or drained and flushed PCB hydraulic machines.  | May go directly to a landfill for disposal after physical appearance is examined and required inspections occur.  |
| 10. Drained PCB articles or containers.  | May go directly to a landfill for disposal after physical appearance is examined and required inspections occur. Note, that this does not include transformers, which are addressed Item 5 above.   |
| 11. Incidental Liquids <500 ppm PCB concentration (including solidified liquids) (40 CFR § 761.60(a)(3)) | Shall be sampled as part of fingerprint analyses prior to acceptance for final disposal at the Facility. Fingerprint analyses (including any confirming additional analyses (i.e., PCB, TOC) shall be performed either in the Grassy Mountain laboratory or in a suitable laboratory. This type of waste shall be evaluated as described in Section 2.0. Aqueous-based liquids having a Specific Gravity of $1.0 \pm 0.1$ , have a less than 10% separable oil phase, and demonstrates a TOC value of less than 10% may be solidified and landfilled. Liquids or sludges containing > 10% TOC, shall be handled as PCB-contaminated oil and and shipped offsite to a facility properly approved to manage PCBs of these types. In addition, if there is evidence to believe that the oil phase was diluted from > 500 ppm PCBs, the waste shall be managed under Item 3, above. |
| 12. Dredged materials, industrial sludges, and municipal sewage treatment sludges.                       | Shall be sampled as part of fingerprint analyses prior to acceptance for final disposal at the Facility. Fingerprint analyses (including any confirming additional analyses (i.e. PCB, TOC) are performed either in the Grassy Mountain   |

laboratory or another suitable laboratory defined in this Attachment.

13. Drained PCB-contaminated electrical equipment.

May go directly to a landfill for disposal after physical appearance is examined and required inspections occur.

14. Sludge-like chemical materials.

Shall be sampled as part of fingerprint analyses prior to acceptance for final disposal at the Facility. Fingerprint analyses (including any confirming additional analyses (i.e. PCB, TOC) will be performed either in the Grassy Mountain laboratory or in another suitable laboratory. This waste shall be evaluated as described in Section 2.0. Aqueous-based liquids having a Specific Gravity of  $1.0 \pm 0.1$ , have a less than 10% separable oil phase, and demonstrates a TOC value of less than 10% may be solidified and landfilled. Liquids or sludges containing > 10% TOC, shall be handled as PCB-contaminated oil and and shipped offsite to a facility properly approved to handle PCBs of these types. In addition, if there is evidence to believe that the oil phase was diluted from > 500 ppm PCBs, the waste shall be managed under Item 3, above.

15. Other PCB materials accepted for storage and transferred to off-site facilities.

May go to the PCB Storage Facility or Drum Dock, which are both on-site for eventual shipment off-site to a suitable facility under 40 CFR § 761.

## **6.0 PRE-TREATMENT PROCEDURES**

The following describes the steps that shall be taken before a waste is treated.

### **6.1. Waste Characterization**

The waste shall be profiled and characterized as described in Section 2. To determine the constituents in the waste prior to treatment, the profile and laboratory analytical information shall be used. If the profile analysis and/or annual verification sample analysis, or for debris, or other waste that is not amenable to sampling, generator / GMF knowledge, may be used in lieu of sampling to determine the constituents in the waste prior to treatment. This information shall be used to develop the appropriate treatment recipe. The analyses shall be performed on homogeneous blends of wastes, representative composite samples, or on individual batches.

### **6.2. Visual Inspection**

All containers at the Container Management Building shall be inspected for the presence of free liquids prior to being sent for landfill with the exception of:

- Lab packs; and
- items that are excluded by the Permit or Director authorization.

A waste stream is considered without free liquids if the pre-acceptance description was non-liquid and if the incoming load inspection confirmed this description.

Waste streams that are exempt from visual inspections shall be certified by the generator to not contain free liquids and that the container holding the waste is at least 90% full. In addition, photo documentation of such containers is required.

All storage containers (e.g., shipping containers, overpack containers, etc.) that do not meet one of the conditions above and which contain free liquids shall be either solidified or decanted to remove the free liquids.

### **6.3. Wastes that do not Require Samples**

Section 2.5 contains a list of waste types that are not required to be sampled. The chemical characteristics (those specified on Table C-2) of these waste types shall be determined from the description of the material, container inventory sheets, generating process, generator knowledge, literature searches, and/or good judgement rather than from analysis of a sample.

The method for determining these parameters shall be clearly documented in the operating record.

## **7.0 TREATMENT PROCESSES**

The Facility's treatment processes include solidification, stabilization, oxidation/reduction, debris treatment (microencapsulation and macroencapsulation). The Facility will treat RCRA hazardous waste that contains multiple treatment standards for constituents of concern to the most stringent regulatory or statutory treatment standard. The following describes the treatment processes.

### **7.1. Solidification**

The solidification process shall consist of treating waste containing free liquids with pozzolanic and other appropriate material to assure all free liquids are chemically fixed. This process could also be used to neutralize a waste stream and meet the LDR Technology Standard of "NEUTR and/or DEACT."

Pre-treatment analyses of the wastes is required to determine compatible with the pozzolanic reactant. The analyses shall include the initial analysis, fingerprint analysis and the compatibility testing done prior to treatment. In-process analyses are not required for this treatment. Post-treatment analyses is required to assure that all free liquids have been chemically reacted and the mixture is suitable for final handling or processing. The Paint Filter Test shall be performed in order to verify that the process was effective.

### **7.2. Stabilization / Oxidation / Reduction, Etc.**

The following provides information on the stabilization, oxidation, reduction treatment processes.

#### **7.2.1. Process Descriptions**

A variety of techniques are used by GMF to treat waste to meet LDR numeric and/or technology standards prior to land disposal. These include pH adjustment and buffering, oxidation, reduction, conversion to insoluble salts, and chemically bonding elements to an insoluble matrix. Technology standards that GMF achieves through this process are:



- Chemically "fixing" (i.e. reducing the leachability) inorganic metal component(s) in a given waste (LDR Technology Standard of STABL). This is done by converting the more soluble metal compounds to less soluble compounds and/or combining the metal compounds with reagents which physically bind them. Depending upon the waste stream and its constituents oxidation and/or reduction reactions shall be required to achieve the desired results.
- Oxidizing and/or reducing a waste stream shall be required to reduce total and/or amenable cyanides or sulfides in a waste to below LDR concentration standards.
- Oxidizing a waste stream to achieve the LDR treatment technology standard of "CHOXD" and/or "DEACT"
- Reducing a waste stream to achieve the LDR treatment technology standard of "CHRED".
- Neutralization: This process could also be used to neutralize a waste stream and meet the LDR Technology Standard of "NEUTR"
- One of the immobilization technologies listed in R315-13-1 of Utah Admin. Code which incorporates, 40 CFR § 268.45 by reference, shall be used to treat hazardous debris.
- Physical sizing of waste, as necessary, is allowed to facilitate stabilization treatment.

The following text outlines the approach that GMF shall adhere to when treating wastes to meet LDR standards:

#### 7.2.2. Frequency and Scope of Testing

The Facility shall use either Option A, Option B or Option C when treating LDR wastes with numeric LDR standards that are destined for Land Disposal:

#### 7.2.2.1 Option A

A suitable laboratory shall analytically test each treated waste batch, selected for this option. The resulting analytical data shall demonstrate that the treated wastes meet all applicable treatment standards specified in R315-13-1 of Utah Admin. Code which, incorporates 40 CFR §§ 268.41, 268.43, 268.48 and/or 268.49 by reference, prior to land disposal of such wastes.

#### 7.2.2.2 Option B

Treatment "recipes" shall be used to establish a ratio between the waste and the material or reagent that is to be used to treat the waste so that the LDR numerical treatment standard is met. These "recipes" shall be recorded in the operating record of the Facility. All wastes treated on-site utilizing Option B shall be treated using the appropriate "recipe". Tier testing shall be used as an expression of the statistical confidence of the application of a particular treatment recipe to a particular waste stream. The waste stream shall be consistent in its chemical and physical properties, and the treatment recipe shall be uniformly effective for Option B to be used.

Minor changes to the established recipe include allowances for moisture/liquid content of the waste or quantities of the treatment reagents used. These shall be within a 25% quantity variance. The exception to this is Cement Kiln Dust, which varies significantly in regards to its effectiveness. All other reagents shall be within 25 percent of the established recipe.

If there is a failure in meeting the treatment standards at any time, the Facility shall return to Tier 1, if on Tier 2 Treatment Verification, or Tier 3a Treatment Verification if on Tier 3 Treatment Verification, on the next load of the same waste stream that arrives at the facility, following documenting the failure to meet the standards. Waste that has been land disposed is not affected by returning to Tier 1 or Tier 3a.

The following procedure and testing frequency shall be followed:

- Tier 1 Treatment Verification

Each batch of a treatment waste stream treated with the same recipe shall be analytically tested using applicable test method(s). The resulting analytical

data must demonstrate that the treated wastes meet all applicable treatment standards specified in R315-13-1 of Utah Admin. Code, which incorporates 40 CFR §§ 268.41, 268.43, 268.48 and/or 268.49 by reference, prior to land disposal of such waste. If the test results from the treatment of nine successive same waste treatment stream batches demonstrates that all nine batches of treated waste meets treatment standards, the Permittee shall be allowed to advance to Tier 2 and test one of every five batches of the same waste treatment stream . The Permittee shall not proceed to Tier 2 until the analytical results of all nine batches are verified and determined to have met the LDR standards. Loads of the same waste stream that arrive at the facility, while waiting for the analytical results from the ninth load to be verified, shall be subject to Tier 1 treatment verification.

If the Permittee has verified 20 consecutive batches of the same waste stream that has been treated with the same recipe, Tier 2 can be omitted, allowing the Permittee to go directly to Tier 3.

- Tier 2 Treatment Verification

Tier 2 shall begin with the 10<sup>th</sup> load, which is sampled. If the next four batches of the same waste treatment stream are treated with the same recipe, they can be land disposed without testing. The 15th batch shall be sampled and analytically tested using applicable test method(s). The resulting analytical data from this batch shall be required to demonstrate that the treated wastes meet all applicable treatment standards of R315-13-1 of Utah Admin. Code, which incorporates 40 CFR § 268 by reference, prior to land disposal. The next four batches of the same waste treatment stream that are treated with the same recipe, can be land disposed without further testing. The Facility then has the option to proceed to Tier 3. The Facility cannot proceed to Tier 3 until the analytical results of the 15th batch are verified and determined to have met the LDR standards. Loads of the same waste stream that arrive at the Facility, while waiting for the analytical results from the 15th load to be verified, shall be subject to Tier 2 treatment verification.

If the analytical results indicate that any load tested during Tier 2 Treatment Verification failed to meet the standards, the Permittee shall resume Tier 1 Testing, starting at sample one as indicated on Table C-6.

- Tier 3 Treatment Verification

Tier 3 shall begin with the 20th batch being sampled and analytically tested. If the next nine batches of the same waste treatment stream are treated with the same recipe, they can be land disposed without testing. The 30th batch shall be analytically tested using applicable test method(s). The resulting analytical data from this batch shall be required to demonstrate that the treated wastes meet all applicable treatment standards of R315-13-1 of Utah Admin. Code, which incorporates 40 CFR § 268 by reference, prior to land disposal. The next nine batches of the same waste treatment stream that are treated with the same recipe, can be land disposed without further testing.

If the analytical results indicate that any load tested during Tier 3 testing failed to meet the standards, the Facility shall, at a minimum proceed to Tier 3a Treatment Verification on the next load of the same waste stream that arrives at the Facility. The Facility has the option to return to Tier 1 Treatment Verification procedures in the event of a failure during Tier 3 Treatment Verification.

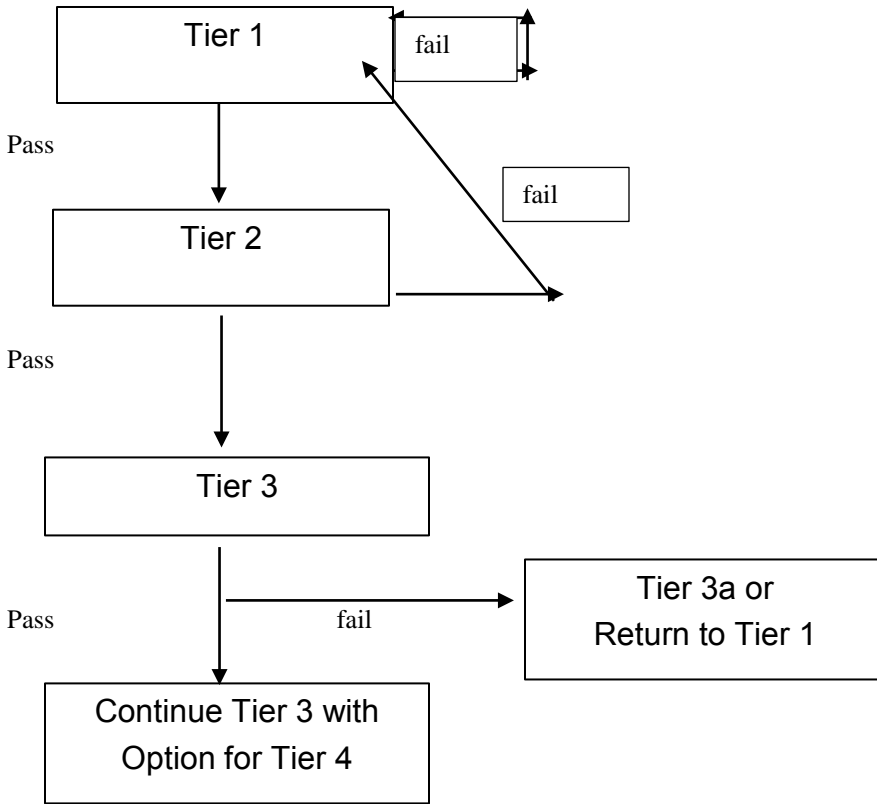
- Tier 3a Treatment Verification

Tier 3a Treatment Verification is an option if a sample tested and analyzed during Tier 3 Treatment Verification fails to meet the standards. Tier 3a shall require that five consecutive samples be obtained and analyzed. If all five samples consecutive samples meet the treatment standards identified in R315-13-1 of Utah Admin. Code, which incorporates 40 CFR § 268 by reference, the Facility may return to Tier 3 treatment Verification.

- Tier 4 Treatment Verification

If a uniform and homogeneous waste treatment stream can be demonstrated as receiving adequate treatment from an established recipe on a consistent basis, a Class 1 permit modification, requiring prior approval may be requested of the Director to further reduce the post treatment verification analysis beyond that of Tier 3. A combination of suitable laboratory post treatment analysis and batch testing can be utilized to demonstrate consistency and uniformity to satisfy this request. Typically, a Tier 4 request will allow a reduction to one batch in every 20, although further reductions may be considered and approved by the Director.

Tier Testing Block Flow Diagram



7.2.2.3 Option C

If a total analysis of the waste demonstrates that individual analytes are not present in the waste, or that they are present but at such low concentrations that the appropriate regulatory levels could not possibly be exceeded, the TCLP test is not required. However, the Facility shall provide the total waste analysis and justification of its decision not to run the TCLP test in the operating record.

When a liquid or solid waste stream at the point of generation is above the applicable TCLP treatment standards specified in R315-13-1 of Utah Admin. Code, which incorporates 40 CFR §§ 268.41, 268.43, 268.48 and/or 268.49 by reference, prior to treatment at GMF, but would meet these TCLP treatment

standards following the 20:1 dilution that is specified in TCLP Method 1311 , Option C may be used.

Pprior to solidification and land disposal a raw waste sample of the waste stream shall be analyzed for total concentration of each applicable parameter. The maximum leaching potential (MLP) will be calculated from the analytical result, as if the material were 100% solid. If the MLP of the applicable parameters meet the associated treatment standards, then that load and all subsequent loads for that waste stream can be directly land disposed following solidification and passing a Paint Filter Test.

Waste streams that meet applicable treatment standards by calculation of the MLP, shall subsequently be re-verified annually and/or whenever there is reason to believe the waste stream has changed, such as the addition of one or more applicable elements, or a process change at the point of generation, which might cause the concentration of target parameters to become elevated.

If an element's MLP exceeds applicable treatment standards, GMF shall revert to Option A or Option B.

### **7.3. Treatment of Hazardous Debris**

GMF may utilize the following Alternative Treatment Standards for Hazardous Debris contained in R315-13-1 of Utah Admin. Code, which incorporates 40 CFR § 268.45, by reference:

- Any of the “Physical Extraction Technologies” listed in R315-13-1 of Utah Admin. Code which incorporates Table I, A.1.a., b., c., d., and/or 3 of 40 CFR § 268.45, by reference. The procedure for documenting the results of utilizing these standards shall be available upon request;
- Any of the “Immobilization Technologies” listed in R315-13-1 of Utah Admin. Code which, incorporates Table I, C.1., 2., and/or 3 of 40 CFR § 268.45 by reference; or
- Any self-implementing treatment authorized in 40 CFR § 761.79, Decontamination Standards and Procedures, may be used to decontaminate, for PCBs, RCRA wastes containing PCB,sor materials containing PCBs.

## 7.4. Macroencapsulation

Macroencapsulation (macro), as an alternative treatment standard for hazardous debris, is defined as “the application of surface coating materials such as polymeric organics (e.g., resins and plastics) or use of jacket of inert inorganic materials to substantially reduce surface exposure to potential leaching media” (R315-13-1 of Utah Admin. Code which incorporates, 40 CFR § 268.45 Table I, C.1 by reference). The performance standard for macroencapsulation of debris requires that “encapsulating material shall completely encapsulate debris and be resistant to degradation by the debris and its contaminants and materials into which it may come into contact after placement (leachate, other waste, microbes).

This is a technology-based standard, and not a numeric-based standard, so no sampling and analysis are required on waste that meet the definition of hazardous debris.

The GMF is permitted to use two types of macro methods. One involves entombing the waste in a macro vault. The second involves the covering of the waste with a high density polyethylene (HDPE).

### 7.4.1. Macroencapsulation in a Vault

A macro vault, consisting of a container (e.g. drums and metal boxes, gondola, rolloff box, or intermodal container) or a pit in the cell, is prepared in the landfill cell. As an alternative, concrete forms may be assembled and used as a macro vault. Wood blocks or other material are placed in the macro vault to keep the debris from having contact with the bottom of the vault. As an alternative, a layer of concrete can be placed in the vault and allowed to begin to cure. The hazardous debris waste stream is then loaded into the macroencapsulation vault. Concrete, or other pozzolanic material, is poured into the vault, assuring that void space is minimized. Void space in the waste stream is filled with inert material to help address structural integrity issues. This is accomplished with the use of flowable pozzolanic material. The macro vault shall be created to minimize interior voids or air pockets. The encapsulating material shall have long-term integrity such that potential leaching media within a hazardous waste cell would not cause the encapsulating material to deteriorate. Waste shall not protrude through the surface of the macro vault. A macroencapsulated waste shall have the macro material (concrete/pozzolanic material) present and apparent upon surficial visual inspection at the point of disposal. A minimum exterior coating thickness of one inch is required. Corrective action is required for any macro

vault that is found to lack structural integrity prior to disposal in a lift.

#### 7.4.2. Macroencapsulation with Inert Jacket

The method utilized by the GMF shall require that a geomembrane liner be welded around the debris waste. This will typically be employed with pipe and large manufactured items around which a jacket can be custom fitted. A minimum of 40 mil high density polyethylene geomembrane shall be used.

In order to assure that the waste is consistent with the Clean Harbors profile, waste streams macroencapsulated utilizing this method shall be previously inspected by a Clean Harbors representative. The encapsulation can occur off-site or at the GMF, as long as the waste has been inspected for:

1. Verification with consistency with the waste profile description
2. That there are no free liquids in the waste
3. And that void space shall be minimized within the inert jacket.

As an alternative, the generator of the waste shall certify that the above criteria have been met. This data shall be incorporated into the operating record.



## **8.0 RECORD KEEPING FOR WASTE CODES**

When waste is profiled to be stored and/or treated at GMF, the waste codes shall be reviewed to determine the applicability of storing, treating and/or disposing of that waste at GMF. When waste arrives at GMF waste codes assigned to the waste via manifest and LDR forms shall be compared with those on the profile to ensure that the codes and LDR standards that have not been met and are associated with the shipment continue to be those that the facility can manage.

Most waste at GMF is contained and managed in discrete containers prior to disposal and much of it meets treatment standards prior to being received. Beyond profiling and receiving procedures, tracking codes of waste already meeting treatment standards is not required. If, however, the waste needs to be treated prior to disposal, GMF shall track codes in the treatment vessels to ensure that all standards are being met.

### **8.1 Waste Code Record Keeping for Storage and/or Treatment Vessels**

There are two cumulative storage and/or treatment units that shall require tracking of waste codes. These are:

- Leachate Tanks; and
- Stabilization Tanks.

#### **8.1.1. Wheel Wash Collection Tank**

The wheel wash collection tank contains the rinse water from washing trucks after they have exited the landfill. This water shall either be solidified and landfilled or sent to Aragonite for incineration.

#### **8.1.2. Leachate Storage Tanks**

These tanks routinely store leachate from the RCRA landfills. Other site water from sumps and containment and groundwater monitoring activities shall be collected solidified and placed into a RCRA landfills or sent to Aragonite for incineration. Other < 500 ppmw VOC water may be stored in these tanks with waste codes other than that for leachate. If that occurred, section 8.1 of this Attachment shall be used for waste code tracking for those tanks.

### 8.1.3. Stabilization Tanks

These tanks shall be used only for treating wastes. Each waste may carry different waste codes. Each time the tank is emptied (all material is removed that can be removed with the trackhoe or equivalent) all RCRA or State waste codes shall be considered to be removed.

No waste code tracking shall be required unless more than one waste, with different waste codes, is being treated at the same time.

If the facility accepts and treats TSCA/RCRA waste, the tanks in which treatment occurred shall be emptied and determined to meet the definition of empty for RCRA purposes and by triple-rinsing with a suitable solvent for TSCA purposes. The third and final rinseate shall be tested and confirmed to be < 2 ppm to be considered clean for TSCA purposes. Alternatively, the surfaces shall be wipe sampled and confirmed to be < 10 ug/100 cm<sup>2</sup> to be considered clean.

### 8.1.4. Storage/Treatment Vessel Waste Code Tracking Procedure

Specific record keeping requirements shall be necessary for cumulative vessels to account for the wastes remaining when the vessel is refilled with wastes carrying additional waste codes. Waste codes shall be tracked in cumulative vessels by the following procedure.

### 8.1.5. Waste Code Tracking / Removal Procedure for Cumulative Tanks

When a new batch of compatible waste is added to the tank, the waste codes associated with this new waste shall be added to those waste codes already associated with tank. The tank shall accumulate waste codes until the codes are removed (the vessel is emptied) or all waste codes that the facility can accept for disposal are associated with that vessel. For RCRA only waste streams the Stabilization Tanks will be considered empty when all the waste has been removed by normal means (e.g. the trackhoe). When the vessel is emptied, as described in this section, no waste codes remain in that vessel.

If batches with different waste codes are mixed, the LDR standards for all the waste codes in the batch shall be met prior to disposal.

If the vessel is used for TSCA/RCRA waste, the vessels shall accumulate the TSCA /RCRA codes by contact until either emptied by the RCRA definition by

triple-rinsing or with a suitable solvent for TSCA purposes. The third and final rinse shall be tested and confirmed to be < 2 ppm to be considered clean for TSCA purposes. Alternatively, the surfaces shall be wipe sampled and confirmed to be < 10 ug/100 cm<sup>2</sup> to be considered clean.

#### **9.0 ANALYSIS OF TREATED WASTE:**

A suitable laboratory shall perform the analysis of the treated wastes. The treated wastes shall be tested for all LDR constituents with numeric standards and UHCs as appropriate for the waste codes in the waste that did not meet treatment standards prior to treatment.

#### **10.0 FATE OF TREATED WASTES:**

Treated wastes can be temporarily (six months or less) "put" onto a liner (put-pile) within a hazardous waste landfill cell or in a container while awaiting laboratory (verification) analyses. The liner shall be visible on all sides of the waste so as to prevent commingling with the waste in the landfill and other put-piles. Such wastes shall be labeled with a tracking number and located in such a manner that allows complete retrieval of the waste should the waste analyses subsequently determine that the waste does not meet the treatment standards of R315-13-1 of Utah Admin. Code, which incorporates 40 CFR § 268 by reference. Wastes making up a put-pile shall be disposed within one year of receipt at GMF and no more than 250 put-piles can be in existence at one time.

#### **11.0 WASTE CODE RECORD KEEPING OF DISPOSED WASTE**

The GMF shall comply with R315-8-14.4 (40 CFR § 264.309) by maintaining records that contains the following information. The information shall be presented with the use of a diagram or map of each cell, and contain on the diagram (or map) the following: The information shall be maintained in the operating record may include tabulated supporting data. The following is the minimum information required:

A description and the quantity of each hazardous waste received (including manifest number) and the methods and dates of treatment and disposal.

The location of each hazardous waste disposed of at the facility.



## TABLES

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**Table C-1  
Pre-acceptance, Storage and Verification (Fingerprint) Analyses  
When Sampling is Required**

<b>Parameter</b>	<b>Rationale for Selection</b>
Physical Description	Shall be used to determine the general characteristics of the waste stream. This facilitates subjective comparison of the load sample with the approved profile.
pH Screen	Shall be required of all aqueous waste streams, it is used to indicate the corrosivity of the waste to ensure proper storage of the waste. It is also used as a parameter to compare the load sample to the approved profile.
Water Reactivity Screen	Shall be used to determine whether the waste has a potential to react with water to generate heat, flammable gases, or other products. Ensures prohibited waste is not accepted for storage or treatment unless approved by the Director. It is also used as a parameter to compare the load sample to the approved profile.
Reactive Sulfides Screen	Shall be used to indicate whether the waste produces hydrogen sulfide upon acidification below pH 2. It is also used as a parameter to compare the load sample to the approved profile. Only run on wastes that have a pH > 2.0. Waste containing total releasable sulfide with concentrations less than 500 ppm are considered non-reactive. Not applicable to azide waste streams, or others as approved by the Director.
*Ignitability / VOC Screen (TLV Sniff or equivalent)	Shall be used to indicate the fire-producing potential of the waste, and to indicate whether the waste might be a RCRA ignitable waste or regulated as flammable or combustible by the US DOT. This test can be applied to all waste liquids, semi-solids or solids. The screen shall be supplemented with the flash point test for those materials exceeding 200 ppm if they are destined for land disposal. Shall not be required if ignitability test is performed. If < 500 ppm, the waste may be processed. If not, the reading shall be resolved with the generator or rejected. Shall not be required for wastes destined for incineration if the waste is treated as ignitable waste.
*LEL / VOC Screen	Shall be used in lieu of the TLV Sniff. VOC Screen or the TLV sniff or equivalent, shall be used for all wastes which are not required to be sampled but that will be treated in the stabilization system or stored in a tank. GMF generated waste is excluded from this requirement. VOC Screen shall be used to detect volatile organics in the waste. A reading of > 10% LEL shall require the TLV Sniff test be performed on the waste. If < 500 ppm, the waste may be processed. If not, the reading shall be resolved with the

**Table C-1**  
**Pre-acceptance, Storage and Verification (Fingerprint) Analyses**  
**When Sampling is Required**

	generator or rejected.
Reactive Cyanides Screen	Shall indicate whether the waste produces hydrogen cyanide upon acidification below a pH of 2. It shall also be used as a parameter to compare the load sample to the approved profile. Shall be run on wastes that have a pH > 2.0. Wastes containing total releasable cyanide with concentrations less than 250 ppm are considered non-reactive. Not applicable to azide waste streams, or others as approved by the Director.
Oxidizer Screen	Is a general qualitative test that shall be used to determine whether a waste is an oxidizer. Oxidizers have the potential to react with a wide range of waste streams and therefore often need to be segregated. It shall also be used as a parameter to compare the load sample to the approved profile. Shall only be performed on wastes that have a pH > 2.0.
Radioactivity Screen	Shall be used to help identify prohibited wastes. It shall also used as a parameter to compare the load sample to the approved profile.
Specific Gravity	Shall be used for liquids to compare the load sample to the approved profile.
Waste Compatibility Qualitative Assessment	Shall be part of the profile approval procedures, the chemical characteristics (pH, corrosivity of non-aqueous wastes, reactivity, flammability, etc.) of waste streams shall be assessed by waste acceptance personnel. This assessment shall be based on information about the waste, not necessarily on any analyses.
Supplemental Discretionary Analyses (SDAs)	Shall be used when GMF determines that additional analysis is required to properly manage waste. Table C-2



**Table C-2  
Treatment & Supplemental Analysis**

<b>Parameter</b>	<b>Rationale for Selection</b>
RCRA Metals (As, Ba, Be, Cd, Cr, Pb, Hg, Ni, Ag, Sb, Se, Tl, Va, Zn)	Analysis of one or more of these metals maybe required in order to demonstrate compliance with LDR standards.
Ignitability	Indicates the fire-producing potential of the waste and determines whether the waste is RCRA ignitable. It is also used as a parameter to compare the load sample to the approved profile.
Reactive Cyanide (Releasable)	Ensures waste is handled safely and determines if treatment may be required
Reactive Sulfide (Releasable)	Ensures waste is handled safely and determines if treatment may be required
Total Cyanide	May be required to demonstrate compliance with LDR standards.
Amenable Cyanide	May be required to demonstrate compliance with LDR standards.
No Free Liquids by Paint Filter	Analysis is necessary to ensure free liquids are not placed into the landfill
Specific Organic Analysis	Gas chromatography and gas chromatography/mass spectrometry may be used to identify and quantify specific regulated organic compounds, i.e. listed waste constituents of concern, characteristic wastes, etc.) when the generator is unaware of waste stream's composition.
HOC Screen	Used to detect the presence of Halogenated Organic Compounds or leachable Halogenated Organic Compounds (HOC) that might adversely affect the cell liner. Any one of the three SK methods found in Appendix 4 shall be used.
PCB Analysis	May be used to determine if PCBs are present in liquids, except leachate or water, (visible sheen or oil layer fractions) at less than 500 ppm and therefore,

**Table C-2**  
**Treatment & Supplemental Analysis**

	amenable to solidification and ultimate landfill. It is one of the two “Organic Analyses” required for determining the acceptability of these PCB wastes.
Total Organic Carbon (TOC) Analysis (for PCB liquids < 500 ppm)	May be used to determine if a liquid, except for leachate and water, contains organic compounds in concentrations which would allow solidification of waste prior to landfilling. Liquids or sludges containing <10% TOC must be solidified prior to landfilling or may be shipped off-site for disposal. Liquid or sludges containing ≥10% TOC cannot be managed at the Facility.

<b>Table C-3</b>	
<b>Specific PCB Waste Type of Analyses</b>	
<b>PCB Waste Type</b>	<b>Analyses Run</b>
1. Contaminated debris/trash, etc. (including demolition materials)	Physical Appearance
2. Empty containers, tanks, drums, barrels, liners, etc.	Physical Appearance
3. PCB Contaminated or small capacitors*	Physical Appearance
4. Drained or drained and flushed PCB hydraulic machines.	Physical Appearance
5. Drained PCB Articles or containers and article containers/electrical equipment.	Physical Appearance
6. Flushed PCB transformers.	Physical Appearance
7. Contaminated soil or sludges (e.g., dredged materials, industrial sludges, municipal sewage, treatment sludges) which DO NOT require organic analyses per this WAP.	Physical Appearance pH TLV SNIFF Specific Gravity Reactive Cyanides <sup>(1)</sup> Reactive Sulfides <sup>(1)</sup> PCB Concentration <sup>(2)</sup> Leachable TOC (Total Organic Carbon) <sup>(2)</sup> Paint Filter Liquids Test (PLFT) <sup>(3)</sup>
8. Liquids (leachate, tire wash water, ground water, etc.) from onsite TSCA operations and liquids for which organic analyses (other than	Physical Appearance pH TLV SNIFF Specific Gravity Reactive Cyanides <sup>(1)</sup> Reactive Sulfides <sup>(1)</sup>

<b>Table C-3</b> <b>Specific PCB Waste Type of Analyses</b>	
	PCB Concentration <sup>(2)</sup> Leachable TOC (Total Organic Carbon) <sup>(2)</sup> Paint Filter Liquids Test (PLFT) <sup>(4)</sup>

**NOTES:**

- (1) Reactive Cyanides Screen shall be run to indicate whether the PCB waste produces hydrogen cyanide upon acidification below pH 2. It is not required if the pH of the waste is less than 6, or if the waste is not water-soluble, or if the waste is not aqueous. Reactive Sulfides Screen shall be run to indicate whether the PCB waste produces hydrogen sulfide upon acidification below pH 2. It is not required if the pH of the waste is less than 6, or if the waste is not water-soluble, or if the waste is not aqueous.
- (2) If the liquid is water with no visual indication of oil being present, the PCB concentration need not be determined. If a phase separation is indicated, the oil shall be analyzed for PCB concentration however the water is not required to be analyzed; any free oil phase shall be removed and handled separately as aPCB-contaminated oil. If there is doubt as to whether the liquid is water, a specific gravity test shall be conducted on the liquid. If the specific gravity is not 1.0 within +/- 0.10 accuracy, the waste profile sheet shall be reviewed and a determination as to the type of liquid shall be made.
- (3) If there is doubt as to the presence or absence of free liquids via the physical appearance determination, then the PFLT shall be run.
- (4) PFLT Test is run to determine if solidified materials are suitable for TSCA landfill management (disposal).
- (5) If the liquids appear to be an oil/water emulsion, water/soil slurry or suspension, or a similar aqueous-based liquid, both the specific gravity test and a TOC or PCB test shall be conducted. Liquids which have a specific Gravity of  $1.0 \pm 0.1$ ; which also contain less than 10% TOC or < 50 ppm PCB; may be approved for solidification and landfill. Any liquids outside of these parameters shall be handled separately as PCB contaminated oil.

\*Defined as < 100 inches<sup>3</sup> in size, or between 100 inches<sup>3</sup> and 200 inches<sup>3</sup> in size and weighing less than 9 lbs.

**Table C-4  
Methods and Tolerance Limits**

<b>Parameter Limits</b>	<b>Tolerance</b>
Physical Description	Shall be consistent with profile.
Specific Gravity	± 20%
pH Screen	± 3 pH units, as long the profile pH is >2 and < 12.5. If the profile pH is < 2 or > 12.5, the incoming load sample must be the same.
TLV-Sniff	If > 200 ppm, and destined for landfill, flash point shall be conducted. If TLV-Sniff is <200, the flashpoint is considered > 140°F and it may be disposed in landfill. Shall be < 500 ppm if destined for storage or treatment in tanks.
Water Reactivity Screen	No tolerance; load samples must agree with profile
Reactive Sulfides Screen	Shall be consistent with profile <sup>1,2</sup>
Reactive Cyanides Screen	Shall be consistent with profile <sup>1,3</sup>
Ignitability	Shall be consistent with profile, i.e. if profile is reported as being >140°F it must test >140°F.
Radioactivity Screen	No tolerance; load samples shall be less than 40 microR/hr over background unless authorization is obtained as described in the Prohibited Materials section of this Attachment. No explanation is required for wastes profiled with a positive radioactive screen and arriving with a negative screen.
Oxidizer Screen	Shall be consistent with profile. <sup>1</sup>
HOC Screen or Specific Analysis of those chemicals in Appendix 3 of this WAP	The limit shall be 1000 ppm HOCs or equivalent leachable HOCs by either method. If the screen shows > 1000 ppm or equivalent leachable HOC, the specific Appendix 3 analysis shall be used to determine if the waste contains > 1000 ppm of those compounds or the equivalent that are leachable. If it does, the

**Table C-4**  
**Methods and Tolerance Limits**

	waste shall either be retreated until it no longer contains >1000 ppm of these compounds or the equivalent leachable HOCs or it will not be land disposed at GMF.
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Notes:

1. For negative to positive results, the generator shall be contacted for a qualitative explanation of the difference. The answer shall be documented in the facility operating record.
2. If this material is to be disposed of directly into the landfill, an increase above 500 ppm for Sulfide shall require explanation, further analysis or, potentially, different handling.
3. If this material is to be disposed of directly into the landfill, an increase above 250 ppm for CN shall require explanation, further analysis or, potentially, different handling.

<b>Table C-5</b>		
<b>Analytical Parameters and Associated Methods</b>		
<b>PARAMETER</b>	<b>METHOD NUMBER</b>	<b>REFERENCE</b>
*Acid-Base Partition Cleanup	3650	(1)
*Acid Digestion of Sediments, Sludges, and Soils	3050	(1)
*Acid Digestion of Aqueous Samples and Extracts for Total Metals for Analysis by Flame Atomic Absorption Spectroscopy or Inductively Coupled Plasma Spectroscopy	3010 3010-MOD	(1)
*Acid Digestion of Aqueous Samples and Extracts for Total Metals for Analysis by Furnace Atomic Absorption Spectroscopy	3020	(1)
*Alumina Column Cleanup	3610	(1)
*Aluminum (AA)	7020	(1)
*Aluminum (ICP)	6010	(1)
*Antimony (ICP)	6010	(1)
*Antimony (AA)	7040	(1)
	7041	(1)
*Aromatic and Halogenated Volatile Organics	8021	(1)
*Arsenic (ICP)	6010	(1)
*Arsenic (AA)	7060	(1)
	7061	(1)

**Table C-5  
Analytical Parameters and Associated Methods**

PARAMETER	METHOD NUMBER	REFERENCE
*Ash	D482	(2)
*Atomic Absorption Spectroscopy	7000	(1)
*Barium (ICP)	6010	(1)
*Barium (AA)	7080 7081	(1) (1)
*Beryllium (ICP)	6010	(1)
*Beryllium (AA)	7090 7091	(1) (1)
*Bromide	9056	(1)
Bulk Density, Solids	D5057	(2)
*Cadmium (ICP)	6010	(1)
*Cadmium (AA)	7130 7131	(1) (1)
*Calcium (ICP)	6010	(1)
*Calcium (AA)	7140	(1)
*Carbamate pesticides (LCMS)	8321	(1)
*Chloride	9253	(1)
*Chloride (Ion Chromatography)	9056	(1)



<b>Table C-5</b>		
<b>Analytical Parameters and Associated Methods</b>		
<b>PARAMETER</b>	<b>METHOD NUMBER</b>	<b>REFERENCE</b>
*Chlorinated Herbicides	8151 8151-MOD	(1) (1)
*Chromium (ICP)	6010	(1)
*Chromium (AA)	7190 7191	(1) (1)
*Cobalt (ICP)	6010	(1)
*Cobalt (AA)	7201	(1)
*Copper (ICP)	6010	(1)
*Copper (AA)	7210 7211	(1) (1)
*Continuous Liquid-Liquid Extraction	3520	(1)
* Dithiocarbamates as Ziram, total	630 and 630-MOD / Modified CDFA Procedure	(3) and (12)
*Fluoride (Ion Chromatography)	9056	(1)
*Fluoride	340.2 5050 D3987	(3) (1) (2)
*Florasil Column Cleanup	3620	(1)
*Gas Chromatography	8000	(1)

<b>Table C-5</b>		
<b>Analytical Parameters and Associated Methods</b>		
<b>PARAMETER</b>	<b>METHOD NUMBER</b>	<b>REFERENCE</b>
*Gas Chromatography/Mass Spectrometry for Volatile Organics	8260	(1)
*Gas Chromatography/Mass Spectrometry for Semi-volatile Organics	8270	(1)
*Gel-Permeation Cleanup (GPC)	3640	(1)
*Halogenated Volatile Organics	8010 8021	(1) (1)
*Headspace	3810	(1)
*Heat of Combustion (BTU)	D240 D240-MOD 5050	(2) (2) (1)
HOC Screen (Oil, Soil, Water)	9078	(1)
HOC Screen (Oil)	D-5384, 9077	(2), (1)
*HOC Screen	22 a*/b 9022 9023	(4) (1) (1)
*Ion Chromatography	9056	(1)
Ignitability , Setaflash	D3828	(2)
Ignitability , Penske Martin, actual flashpoint	1010	(1)
Ignitability Liquid, actual flashpoint, no	1020	(1)

**Table C-5  
Analytical Parameters and Associated Methods**

PARAMETER	METHOD NUMBER	REFERENCE
suspended solids		
Ignitability Liquid, at 140°F, no suspended solids	8b	(4)
Ignitability Liquid or Solids, room temperature	D4982	(2)
Ignitability Sludge, at 140°F	8b	(4)
*Iron (AA)	7380 7381	(1) (1)
*Iron (ICP)	6010	(1)
*Lead (ICP)	6010	(1)
*Lead (AA)	7420 7421	(1) (1)
LEL	14	(4)
Liquids, Sludge Compatibility (see note 3)	D5058	(2)
*Magnesium (ICP)	6010	(1)
*Magnesium (AA)	7450	(1)
*Manganese (ICP)	6010	(1)
*Manganese (AA)	7460 7461	(1) (1)
*Mercury Cold Vapor (AA)	7470	(1)

**Table C-5  
Analytical Parameters and Associated Methods**

PARAMETER	METHOD NUMBER	REFERENCE
	7471	(1)
*Microwave Assisted Acid Digestion of Aqueous Samples and Extracts	3015	(1)
*Microwave Assisted Acid Digestion of Sediments, Sludges, Soils and Oils	3051	(1)
*Moisture (organic liquids)	D1533	(2)
*Moisture (Inorganics)	2540	(5)
*Molybdenum (ICP)	6010	(1)
*Molybdenum (AA)	7480 7481	(1) (1)
*Nickel (ICP)	6010	(1)
*Nickel (AA)	7520	(1)
*Total Kjeldahl Nitrogen	D3590	(2)
*Nitrate/Nitrite Ion Chromatography	9056	(1)
*Nitrogen, Total	7.025-7.031	(7)
*Nonhalogenated Volatile Organics	8015	(1)
*Organic Extraction and Sample Preparation	3500	(1)
*Organochlorine Pesticides	8081	(1)

**Table C-5  
Analytical Parameters and Associated Methods**

PARAMETER	METHOD NUMBER	REFERENCE
*Organophosphorus Compounds by Capillary Column GC	8141	(1)
Oxidizer Screen	D4981	(2)
Paint Filter	9095	(1)
*PCDD	8280 8290	(1) (1)
*PCDF	8280 8290	(1) (1)
*PCBs	8081 8082	(1) (1)
*PCB and Pesticides (GC/MS)	680	(6)
*PCB Wipes	5503	(8)
pH Screen	D4980	(2)
pH Electrometric	9040	(1)
pH Paper	9041	(1)
pH Waste	9045	(1)
pH Solids	9045	(1)
Physical Description	D4979	(2)

**Table C-5**  
**Analytical Parameters and Associated Methods**

PARAMETER	METHOD NUMBER	REFERENCE
*Potassium (ICP)	6010	(1)
*Potassium (AA)	7610	(1)
*Purge-and-Trap	5030	(1)
Radioactivity Screen	6 / 9916 MOD	(4)
Reactive Cyanide Screen (see note 2)	D5049	(2)
Reactive Sulfide Screen Confirmation (see note 2)	D4978	(2)
*Cyanide (Releasable)	Chapter 7, Sec. 7.3.3.2	(1)
*Sulfide (Releasable)	Chapter 7 Sec. 7.3.4.2	(1)
*Selenium (ICP)	6010	(1)
*Selenium (AA)	7740 7741	(1) (1)
*Separatory Funnel Liq-Liq Extraction	3510	(1)
*Silica Gel Cleanup	3630	(1)
*Silver (ICP)	6010	(1)
*Silver (AA)	7760 7761	(1) (1)

**Table C-5**  
**Analytical Parameters and Associated Methods**

PARAMETER	METHOD NUMBER	REFERENCE
*Sodium (ICP)	6010	(1)
*Sodium (AA)	7770	(1)
Solids Compatibility (see note 3)	N/A	(9)
	D5058	(2)
*Sonication Extraction	3550	(1)
*Soxhlet Extraction	3540	(1)
Specific Conductance	120.1	(3)
Specific Gravity	D1429	(2)
Specific Gravity/ Bulk Density	D5057	(2)
*Sulfides	9030	(1)
	9031	(1)
	9034*	(1)
	376.1	(3)
*Sulfate Ion Chromatography	9056	(1)
*Sulfur	D2784	(2)
	D1266	(2)
*Sulfur Cleanup	3660	(1)
*Sulfuric Acid Cleanup	3665	(1)
*Thallium (ICP)	6010	(1)
*Thallium (AA)	7841	(1)

**Table C-5**  
**Analytical Parameters and Associated Methods**

PARAMETER	METHOD NUMBER	REFERENCE
	7840	(1)
*Tin (ICP)	6010	(1)
*TCLP	1311	(1)
TLV Sniff	5 5-MOD	(4)
*Total and Amenable Cyanide (Distillation)	9010	(1)
*Total and Amenable Cyanide (Colorimetric, Automated UV)	9012	(1)
*Titrimetric and Manual Spectrophotometric Determinative Methods for Cyanide	9014	(1)
*Total Organic Carbon	9060	(1)
*Total Halogen	5050 9253 9056 9212	(1) (1)
*Vanadium (ICP)	6010	(1)
*Vanadium (AA)	7910 7911	(1) (1)
*Viscosity	D2983	(2)
*Volatile Organic Compounds	21 25	(10) (10)



<b>Table C-5</b>		
<b>Analytical Parameters and Associated Methods</b>		
<b>PARAMETER</b>	<b>METHOD NUMBER</b>	<b>REFERENCE</b>
	All Listed	(11)
Waste Compatibility Qualitative Assessment	12	(4)
*Waste Dilution	3580	(1)
Water Reactivity Screen (see note 1)	D5058	(2)
*Zinc (ICP)	6010	(1)
*Zinc (AA)	7950 7951	(1) (1)
* typically conducted at an off-site laboratory		

**TABLE C-5**

**ANALYTICAL PARAMETERS AND ASSOCIATED METHODS**

- (1) Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, EPA Publication SW-846 [3rd Edition (November, 1986), with current updates
- (2) American Society for Testing and Materials
- (3) Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020
- (4) Facility Methods, not based on any standard method.
- (5) Standard Methods for the Examination of Water and Wastewater, Latest Edition, APHA, WEF
- (6) Alford-Steven, A.; Eichelberger, J.W. and Budde W.L. Method 680. Determination of Pesticides and PCBs in Water and Soil/Sediment by Gas Chromatography/Mass Spectrometry. Physical and Chemical Methods Branch. Environmental Monitoring and Support Laboratory Office of Research and Development. U.S. EPA, Cincinnati, Ohio 45268. November 1985.
- (7) Association of Official Analytical Chemists, 14th Edition
- (8) National Institute for Occupational Safety and Health
- (9) A Method for Determining the Compatibility of Hazardous Wastes, EPA-600/2-80-076, April, 1980
- (10) 40 CFR § 60 Appendix A

- (11) 40 CFR § 265.1085 (c)
- (12) Method 630 is for liquids. Method 630-MOD / Modified CDFA (California Department of Food and Agriculture) Procedure was developed for solids. Both rely on the fact that when dithiocarbamates are acidified, carbon disulfide is released. Method 630 is a colorimetric method while 630-MOD / Modified CDFA Procedure analyzes the headspace by gas chromatography using a FPD detector. Currently GMF could only find one commercial lab in the USA that analyzes for total dithiocarbamates in solids. That lab is E.M.A. Inc. (Environmental Micro Analysis) located in Woodland, CA. The modified method is theirs.

NOTES:

- 1. A significant temperature change as stated in paragraph 24.8 of ASTM method D5058-90 is defined as  $\geq 15^{\circ}\text{C}$ . The test does not apply to wastes already in contact with excess water, nor is a waste water reactive if the heat generation is due solely to a strong acid/base reaction as verified by pH analysis or heat of solution, i.e. lime is not water reactive. Occurrence of the reactions listed in paragraph 24.4 of ASTM method D5058-90 result in failure of the water reactivity test, except that formations of precipitates or emulsions are considered failures only if the ability to mix and pump the resulting liquids is impaired.
- 2. The test is not required for wastes with  $\text{pH} < 2$ .
- 3. A temperature rise as stated in paragraph 11.8 of ASTM method D5058-90 is defined as  $\geq 15^{\circ}\text{C}$ . Occurrence of the reactions listed in paragraph 11.7 of ASTM method D5058-90 result in failure of the compatibility test, except that formations of layers, precipitation, emulsification, or increases in viscosity are considered failures only if the ability to manage the resulting liquids is impaired.

**TABLE C-6  
Tier Testing Sampling Frequency**

Tier No.	Batch No.	Testing? Y/N	
1	1	Y	
	2	Y	
	3	Y	
	4	Y	
	5	Y	
	6	Y	
	7	Y	
	8	Y	
	9	Y	
2	10	Y	
	11	N	
	12	N	
	13	N	
	14	N	
	15	Y	
	16	N	
	17	N	
	18	N	
	19	N	
3	20	Y	
	21	N	
	22	N	

Tier No.	Batch No.	Testing? Y/N	
	23	N	
	24	N	
	25	N	
	26	N	
	27	N	
	28	N	
	29	N	
	30	Y	
	31-39	N	
	40	Y	
	41-49	N	

## **EXHIBITS**

Example Waste Material Profile  
(this form is subject to change)



# WASTE MATERIAL PROFILE SHEET

Clean Harbors Profile No. CH639323

**A. GENERAL INFORMATION**  
 GENERATOR EPA ID #/REGISTRATION # **UTD991301748** GENERATOR NAME: **Clean Harbors Grassy Mountain LLC**  
 GENERATOR CODE (Assigned by Clean Harbors) **GM** CITY **Grantsville** STATE/PROVINCE **UT** ZIP/POSTAL CODE **84029**  
 ADDRESS **3 Miles East 7 Miles North of Knolls Exit 41 off I-80** PHONE:  
 CUSTOMER CODE (Assigned by Clean Harbors) **GM** CUSTOMER NAME: **Clean Harbors Grassy Mountain LLC**  
 ADDRESS **3 Miles East 7 Miles North of Knolls Exit 41 off I-80** CITY **Grantsville** STATE/PROVINCE **UT** ZIP/POSTAL CODE **84029**

**B. WASTE DESCRIPTION**  
 WASTE DESCRIPTION:  
 PROCESS GENERATING WASTE:  
 IS THIS WASTE CONTAINED IN SMALL PACKAGING CONTAINED WITHIN A LARGER SHIPPING CONTAINER ?

**C. PHYSICAL PROPERTIES (at 26C or 77F)**

<b>PHYSICAL STATE</b> SOLID WITHOUT FREE LIQUID POWDER MONOLITHIC SOLID LIQUID WITH NO SOLIDS LIQUID/SOLID MIXTURE % FREE LIQUID % SETTLED SOLID % TOTAL SUSPENDED SOLID SLUDGE GAS/AEROSOL	<b>NUMBER OF PHASES/LAYERS</b> 1 2 3 TOP <b>0.00</b> % BY VOLUME (Approx.) MIDDLE <b>0.00</b> BOTTOM <b>0.00</b>			<b>VISCOSITY (if liquid present)</b> 1 - 100 (e.g. Water) 101 - 500 (e.g. Motor Oil) 501 - 10,000 (e.g. Molasses) > 10,000		<b>COLOR</b>
	<b>ODOR</b> NONE MILD STRONG Describe:		<b>BOILING POINT °F (°C)</b> <= 95 (<=35) 95 - 100 (35-38) 101 - 129 (38-54) >= 130 (>54)		<b>MELTING POINT °F (°C)</b> < 140 (<60) 140-200 (60-93) > 200 (>93)	
<b>FLASH POINT °F (°C)</b> < 73 (<23) 73 - 100 (23-38) 101 - 140 (38-60) 141 - 200 (60-93) > 200 (>93)	<b>pH</b> <= 2 2.1 - 6.9 7 (Neutral) 7.1 - 12.4 >= 12.5	<b>SPECIFIC GRAVITY</b> < 0.8 (e.g. Gasoline) 0.8-1.0 (e.g. Ethanol) 1.0 (e.g. Water) 1.0-1.2 (e.g. Antifreeze) > 1.2 (e.g. Methylene Chloride)	<b>A&amp;H</b> < 0.1 0.1 - 1.0 1.1 - 5.0 5.1 - 20.0		<b>BTU/LB (MJ/kg)</b> < 2,000 (<4.6) 2,000-5,000 (4.6-11.6) 5,000-10,000 (11.6-23.2) > 10,000 (>23.2) Actual:	

**D. COMPOSITION** (List the complete composition of the waste, include any inert components and/or debris. Ranges for individual components are acceptable. If a trade name is used, please supply an MSDS. Please do not use abbreviations.)

CHEMICAL	MIN	MAX	UOM
DOES THIS WASTE CONTAIN ANY HEAVY GAUGE METAL DEBRIS OR OTHER LARGE OBJECTS (EX. METAL PLATE OR PIPING >1/4" THICK OR >12" LONG, METAL REINFORCED HOSE >12" LONG, METAL WIRE >12" LONG, METAL VALVES, PIPE FITTINGS, CONCRETE REINFORCING BAR OR PIECES OF CONCRETE >3")? If yes, describe, including dimensions:		YES	NO
DOES THIS WASTE CONTAIN ANY METALS IN POWDERED OR OTHER FINELY DIVIDED FORM?		YES	NO
DOES THIS WASTE CONTAIN OR HAS IT CONTACTED ANY OF THE FOLLOWING; ANIMAL WASTES, HUMAN BLOOD, BLOOD PRODUCTS, BODY FLUIDS, MICROBIOLOGICAL WASTE, PATHOLOGICAL WASTE, HUMAN OR ANIMAL DERIVED SERUMS OR PROTEINS OR ANY OTHER POTENTIALLY INFECTIOUS MATERIAL? I acknowledge that this waste material is neither infectious nor does it contain any organism known to be a threat to human health. This certification is based on my knowledge of the material. Select the answer below that applies: The waste was never exposed to potentially infectious material. Chemical disinfection or some other form of sterilization has been applied to the waste.		YES	NO
I ACKNOWLEDGE THAT THIS PROFILE MEETS THE CLEAN HARBORS BATTERY PACKAGING REQUIREMENTS.		YES	NO
I ACKNOWLEDGE THAT MY FRIABLE ASBESTOS WASTE IS DOUBLE BAGGED AND WETTED.		YES	NO
SPECIFY THE SOURCE CODE ASSOCIATED WITH THE WASTE.	SPECIFY THE FORM CODE ASSOCIATED WITH THE WASTE.		



F. REGULATORY STATUS

YES NO USEPA HAZARDOUS WASTE? \_\_\_\_\_

YES NO DO ANY STATE WASTE CODES APPLY? \_\_\_\_\_  
Texas Waste Code \_\_\_\_\_

YES NO DO ANY CANADIAN PROVINCIAL WASTE CODES APPLY? \_\_\_\_\_

YES NO IS THIS WASTE PROHIBITED FROM LAND DISPOSAL WITHOUT FURTHER TREATMENT PER 40 CFR PART 268?  
LDR CATEGORY: \_\_\_\_\_  
VARIANCE INFO: \_\_\_\_\_

YES NO IS THIS A UNIVERSAL WASTE?

YES NO IS THE GENERATOR OF THE WASTE CLASSIFIED AS CONDITIONALLY EXEMPT SMALL QUANTITY GENERATOR (CESQG)?

YES NO IS THIS MATERIAL GOING TO BE MANAGED AS A RCRA EXEMPT COMMERCIAL PRODUCT, WHICH IS FUEL (40 CFR 261.2 (C)(2)(III))?

YES NO DOES TREATMENT OF THIS WASTE GENERATE A F006 OR F019 SLUDGE?

YES NO IS THIS WASTE STREAM SUBJECT TO THE INORGANIC METAL BEARING WASTE PROHIBITION FOUND AT 40 CFR 268.3(C)?

YES NO DOES THIS WASTE CONTAIN VOC'S IN CONCENTRATIONS >=500 PPM?

YES NO DOES THE WASTE CONTAIN GREATER THAN 20% OF ORGANIC CONSTITUENTS WITH A VAPOR PRESSURE >= .3KPA (.044 PSIA)?

YES NO DOES THIS WASTE CONTAIN AN ORGANIC CONSTITUENT WHICH IN ITS PURE FORM HAS A VAPOR PRESSURE > 77 KPA (11.2 PSIA)?

YES NO IS THIS CERCLA REGULATED (SUPERFUND ) WASTE ?

YES NO IS THE WASTE SUBJECT TO ONE OF THE FOLLOWING NESHAP RULES?  
Hazardous Organic NESHAP (HON) rule (subpart G) Pharmaceuticals production (subpart GGG)

YES NO IF THIS IS A US EPA HAZARDOUS WASTE, DOES THIS WASTE STREAM CONTAIN BENZENE?  
YES NO Does the waste stream come from a facility with one of the SIC codes listed under benzene NESHAP or is this waste regulated under the benzene NESHAP rules because the original source of the waste is from a chemical manufacturing, coke by-product recovery, or petroleum refinery process?  
YES NO Is the generating source of this waste stream a facility with Total Annual Benzene (TAB) >10 Mg/year?  
What is the TAB quantity for your facility? \_\_\_\_\_ Megagram/year (1 Mg = 2,200 lbs)  
The basis for this determination is: Knowledge of the Waste Or Test Data Knowledge Testing  
Describe the knowledge : \_\_\_\_\_

G. DOT/TDG INFORMATION

DOT/TDG PROPER SHIPPING NAME: \_\_\_\_\_

H. TRANSPORTATION REQUIREMENTS

ESTIMATED SHIPMENT FREQUENCY	ONE TIME	WEEKLY	MONTHLY	QUARTERLY	YEARLY	OTHER
	CONTAINERIZED		BULK LIQUID		BULK SOLID	
0-0	CONTAINERS/SHIPMENT	GALLONS/SHIPMENT: 0 Min - 0 Max		GAL.	SHIPMENT UOM:	TON YARD
STORAGE CAPACITY:					TONS/YARD/SHIPMENT: 0 Min - 0 Max	
CONTAINER TYPE:	CUBIC YARD BOX PALLET					
	TOTE TANK DRUM					
OTHER:	DRUM SIZE:					

I. SPECIAL REQUEST

COMMENTS OR REQUESTS: \_\_\_\_\_

GENERATOR'S CERTIFICATION

I certify that I am authorized to execute this document as an authorized agent. I hereby certify that all information submitted in this and attached documents is correct to the best of my knowledge. I also certify that any samples submitted are representative of the actual waste. If Clean Harbors discovers a discrepancy during the approval process, Generator grants Clean Harbors the authority to amend the profile, as Clean Harbors deems necessary, to reflect the discrepancy.

AUTHORIZED SIGNATURE	NAME (PRINT)	TITLE	DATE
_____	_____	_____	_____



## **APPENDICES**



## Appendix 1

### Quality Assurance Plan FOR Clean Harbors Grassy Mountain, LLC.

#### **INDUSTRIAL AND HAZARDOUS WASTE FACILITY**

(Modifications to this QAP are considered to be a class 1 modification to the permit and may be made without prior approval of the Director if the changes are necessary to stay current with the most recent SW-846 methods or comply with Utah BLI requirements. A copy of the modified QAP will be provided to the Director within seven days of making the changes.)

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LABORATORY / TECHNICAL MANAGER

-----  
DATE

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## Quality Assurance Plan

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## 1.0 QAP DESCRIPTION

This manual is the written document that identifies the policies, organizational objectives, functional objectives, and specific quality activities designed to achieve the quality goals desired for operation of the laboratory. This manual describes, in a reasonably systematic way, the measures the laboratory employs to implement the quality assurance program. It is intended to be flexible and adaptable to changes in the methods, techniques, and personnel.

Data of unknown quality is useless. It is this premise which management bases its stance on quality control.

Data of good quality does not just happen. Quality control must be an integral part of day to day operations. It relies on each individual within the program to make data quality his/her primary objective.

The goal is to produce high quality data so that good decision making can occur. This Quality Assurance Plan is designed to ensure that all data generated are complete, precise, and accurate. Data quality will be documented.

There are three (3) primary areas where data quality is of concern. These are as follows:

- Waste Approval
- Waste Acceptance
- Treatment Residue Monitoring

The objective of the first area is to examine the chemical and physical properties of a particular waste stream and determine if the facility is capable of accepting the material under its permit conditions.

The second area is a quality control check to determine that the waste being accepted at the facility is indeed the same waste, which was previously approved. A waste's compatibility with other wastes already being stored at the facility is also assessed.

The last area concerns demonstrating that wastes treated at the facility meet the requirements of the Land Disposal Restrictions prior to land disposal.

This plan does not affect analyses that may be performed to assist in determining treatment recipes.

### 1.1 PURPOSE

The purposes of this Quality Assurance Plan is to ensure that all information, data, and resulting decisions compiled under a specific task are technically sound, statistically valid, properly documented and are adequate to meet the requirements for which they are performed. Quality Assurance is the program or structure within an organization that plans, designs, and monitors the QA procedures and affirms the data quality in reports.

Quality Control is the mechanism or activities through which Quality Assurance achieves its goals. This is accomplished through a program, which defines the frequency and methods of checks, audits, and reviews necessary to identify problems and dictate corrective action.

### 1.2 SCOPE

The Quality Assurance Plan encompasses the entire measurement system from initial sampling to the final reporting and interpretation of results. This QAP is for the GMF laboratory. Data generated by Suitable Laboratories for GMF must meet the requirements of this QAP.

### 1.3 OBJECTIVE

This Quality Assurance Plan is designed to produce accurate and reliable data. In order to accomplish this objective, the following criteria must be achieved:

- All procedures and practices shall be accepted by the client and/or regulatory agency.
- A continuing program shall be developed to monitor the performance of the program.
- A mechanism shall be developed for correcting problems, which are determined by the monitoring assessment.

### 2.0 LABORATORY ORGANIZATION AND RESPONSIBILITY

The organizational structure of the laboratory is shown in Figure 2.1.

The initial step in any Quality Assurance Plan begins with the people involved. In addition to the organizational chart, descriptions of those individuals involved in Quality Assurance and their responsibilities are included.

#### 2.1 QUALITY CONTROL MANAGER

The Quality Control Manager is responsible for identifying quality problems, to recommend and provide solutions, and to verify the implementation of the solutions. The duties include:

- developing mechanisms to carry out QA/QC objectives;
- administration of quality control procedures;
- implementation of corrective action(s); and
- maintenance of QA/QC records.

#### 2.2 LABORATORY MANAGER

The Laboratory Manager is responsible for the daily operation and management of the laboratory. The manager's duties include:

- management of laboratory personnel;
- oversee and coordinate instrument and equipment maintenance;
- review of work procedures and daily laboratory practices;
- work scheduling;
- record keeping;
- training of laboratory personnel; and
- responsible for the administration of Quality Control at his/her respective laboratory.

#### 2.3 LABORATORY SUPERVISOR

The Laboratory Supervisor supervises the daily operation and management of the laboratory. The supervisor's duties include:

- management of chemists and technicians;
- oversee and coordinate instrument and equipment maintenance;



- review of work procedures and daily laboratory practices;
- work scheduling;
- record keeping;
- training of laboratory personnel; and
- responsible for the administration of quality control at his/her respective laboratory.

## 2.4 CHEMIST

The Chemist's duties as they relate to QA/QC are as follows:

- recommendations for technical decisions;
- evaluating and reviewing test procedures;
- reviewing and signing laboratory reports;
- ensuring that results are accurate and reproducible;
- calculations and interpretations of test results;
- equipment and instrument calibration and operation; and
- sample preparation and analysis.

## 2.5 LABORATORY TECHNICIANS

The laboratory technicians duties as they relate to QA/QC are as follows:

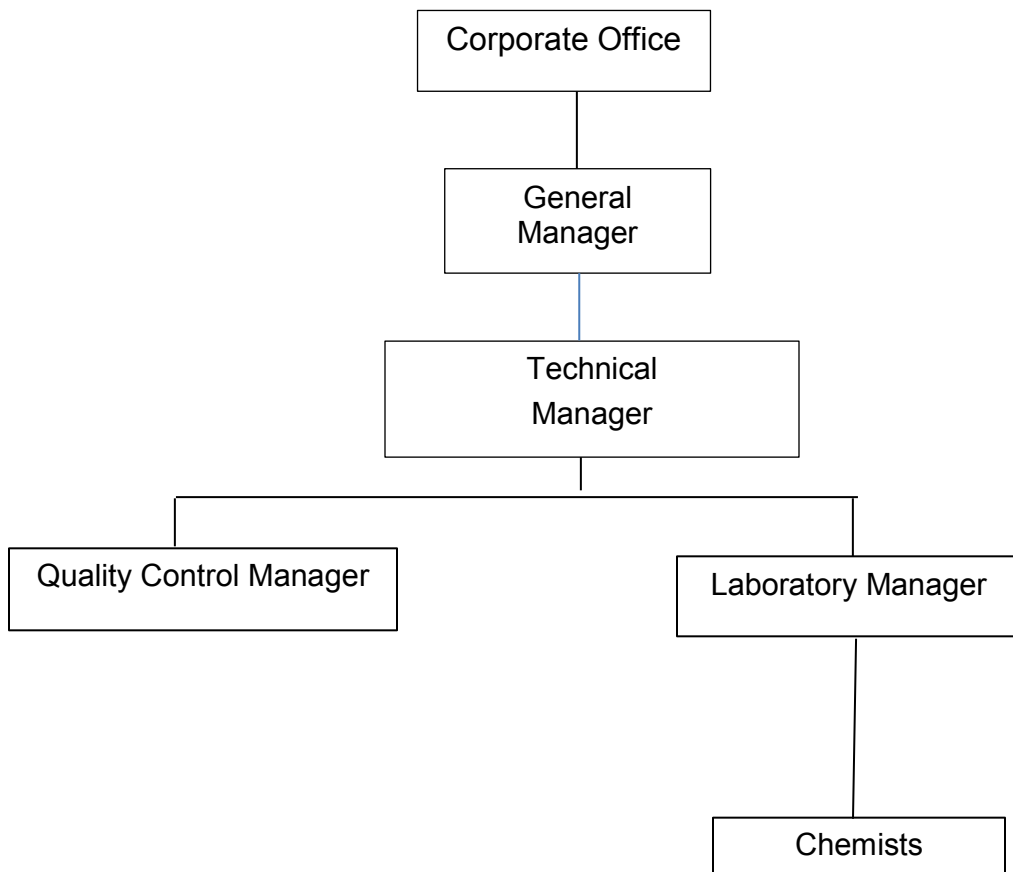
- performing sample preparations and analysis;
- maintaining a clean and safe working environment;
- making recommendations to supervisors regarding analysis or QA/QC performances;
- performing QA/QC analysis; and
- reviewing and signing laboratory reports.

## 2.6 SAMPLING TECHNICIANS

Sampling technicians are specially trained personnel responsible for sampling containers, vessels, tanks, and process streams. These people may be chemists, engineers, laboratory technicians, or operations personnel. They all have specialized training in sampling QA/QC techniques including the use of various sampling apparatus, sample site selection, sampling methodologies, and chain of custody procedures.

The Facility Manager or designee interacts with the sampling technicians to assure understanding of selection, collection, storage, transportation, and documentation practices.

Figure 2.1



Note: The facility may use personnel from another facility to fulfill any of the positions listed above. For example, the Technical Manager, Lab Manager and Quality Control Manager may be Clean Harbors from other location employees while functioning in these same capacities for Grassy Mountain. Depending upon the operations being performed at the facility, only the General Manager, Lab Manager and QC positions must be filled to maintain an operating laboratory. For a functioning laboratory, the person performing the Laboratory Supervisor function, must be stationed at the facility.

### 3.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT IN TERMS OF PRECISION, ACCURACY, COMPLETENESS, AND COMPARABILITY.

Data Quality objectives are defined as follows:

- Precision - is the measure of agreement of a set of replicate results among themselves. Precision is assessed by means of duplicate/replicate sample analysis.
- Accuracy - is the nearness of a result or the mean (X) of a set of results to the true value or an established laboratory mean. Accuracy is assessed by means of reference samples and percent recoveries.
- Completeness - is the measure of the amount of valid data derived from a system of measurement as compared to the amount of data which was expected to be obtained.

#### 3.1 ACCURACY

Using one or more of the following techniques generates accuracy information for quantitative measurements:

##### Calibration Checks

Calibration checks determine the acceptability of a calibration. The limits are method specified.

*Calibration Check Standards* are used as continuing checks for organic analysis. The equation for the Calibration Check Standard is:

$$\% \text{ Recovery} = 100(\text{result}/\text{true value})$$

*Calibration Verification Standards (CVS)* are second-source standards (a different lot from those used for generating a calibration curve) to check the accuracy of the calibration curve. The equation for the CVS is:

$$\% \text{ Recovery} = 100(\text{result}/\text{true value})$$

##### Method Accuracy Checks

Method Accuracy checks determine the acceptability of a batch of samples that have been subjected to a preparation step (i.e., digestion, extraction, combustion, etc.). The limits are method specified or statistically generated. The means and limits are tracked by generating statistical data. Statistically generated data must also meet the method-specified range, if there is one, to be used to demonstrate method accuracy. If the Method Accuracy check does not fall within the control limit, the batch is rejected and rerun for the failed constituent(s).

$$\text{Control Limit} = \begin{array}{l} \text{method / QAP specified} \\ \text{or} \\ \text{mean} \pm 3\text{sd} \end{array}$$

*Laboratory Control Sample (LCS)* consists of an aliquot of clean (control) matrix and is the same weight or volume as the sample matrix. The LCS is spiked with the same analytes at the same concentrations as the matrix spike. When the results of the matrix spike analysis indicate a potential problem due to the sample matrix itself, the LCS results are used to verify that the laboratory can perform the analysis in a clean matrix, thus validating the laboratory's analytical process.

*Control Blank Spikes* (CBS) are blanks that are spiked with the constituents being analyzed.

#### Matrix Accuracy Checks

*Matrix Spikes* (MS) are samples that are spiked with the constituents being analyzed. They are only used as method accuracy checks when the matrix has demonstrated a lack of interference in the analysis.

$$\% \text{ Matrix Spike Recovery} = 100(\text{Sample Spike Result}-\text{Sample Amount})/\text{Spike Amount}$$

### 3.2 PRECISION

Performing a Matrix Duplicate (MD) or a Matrix Spike Duplicate (MSD), as specified by methodology generates precision information for quantitative measurements. The results of the duplication are compared to the initial accuracy check. The limits are method specified or statistically generated. As appropriate, the means and limits are tracked by generating statistical data. Statistically generated data must also meet the method specified control limit, if there is one, to be used to demonstrate precision. All precision outliers must be explained in the permanent laboratory record.

$$\text{Control Limit} = \begin{array}{l} \text{Method / QAP specified} \\ \text{or} \\ \text{Upper Control Limit} \end{array}$$

*Laboratory Control Sample Duplicate* (LCS), or *Control Blank Spike Duplicates* (CBS) are analyzed by the same procedure as the initial method accuracy check.

*Matrix Spike Duplicates* (MSD) are samples that are spiked with the constituents being analyzed. They are only used as precision checks when the matrix has demonstrated a lack of interference in the analysis.

Method Specified Limits for precision are compared to results generated by either:  
Relative Percent Difference (RPD) =  $100(\text{Range of Results}/\text{Average of Results})$

$$\text{or} \\ \text{Coefficient of Variation (CV)} = 100(\text{standard deviation}/\text{mean})$$

Upper Control Range Limits are generated by historical statistical techniques.  
Upper Control Range Limit = Mean of Ranges x  $(D_2/d_2)$

where: Range = absolute difference between replicates

$D_2$  = 99% confidence upper limit (equivalent to  $\pm 3sd$ ) on a population mean of replicate averages (when  $n=2$ ,  $D_2=3.686$ ).

$d_2$  = factor that converts a range into a standard deviation between replicates (when  $n=2$ ,  $d_2=1.128$ ).

Source of  $D_2$  and  $d_2$ : ASTM Manual, *Quality Control of Materials*.

### 3.3 METHOD PREPARATION CHECKS

When a method preparation check is outside the prescribed limits, a notation, or *flag*, is documented in the final report. The limits are listed in Table 3.1.

*Matrix Spikes* (MS) are samples that are spiked with the constituents being analyzed. The results are compared to method specified limits or statistically generated limits for a determination of preparation efficiency.

*Matrix Spike Duplicates* (MSD) are the same as *Matrix Spikes*. The results are compared to the initial *Matrix Spike* result for a determination of the precision of preparation efficiency.

*Surrogates* are constituents that are not commonly found in the natural environment or in commercial waste products. They are added to the sample at the beginning of the preparation step. In organic chromatographic analysis, they are clearly distinguishable from target compounds. They are somewhat less susceptible to inferences and are used as an additional determination of preparation efficiency. The strategy used for evaluating surrogate recovery is as follows:

A. If the surrogate recovery falls outside the  $\pm 3sd$  limits, and review of the chromatography does not indicate matrix interference, the analyst must:

(1) Rerun the extract.

If the result is within the limits, the analysis is finished.

If the result is still outside the limits, the sample must be re-extracted once and rerun on the instrument. If the result is within the limits, the analysis is finished. If it continues to fall outside the limits, the analysis is finished and the final report must be flagged (matrix interference can be assumed).

OR

(2) Re-extract the sample and rerun on the instrument.

If the result is within the limits, the analysis is finished. If it continues to fall outside the limits, the analysis is finished and the final report must be flagged (matrix interference can be assumed).

### 3.4 COMPLETENESS

A data package is considered complete when the following applicable items are finished:

- All appropriate logbooks contain all essential information;
- Data validation has been performed;
- Data files contain raw data, completed data validation forms, and all worksheets that document acceptable accuracy, and precision; and,
- Final results are placed into the laboratory record, LIMS or paper copies.

**TABLE 3.1**  
**ACCURACY, PRECISION, METHOD PREPARATION: OBJECTIVES AND LIMITS**  
**\*ICP Metals, AA Metals, Hg (CVAA), Cyanide, Reactive Sulfide**

Analysis	Calibration Checks	Limits	Method Accuracy Checks	Limits	Method Precision Checks	Limits	Method Preparation Check (Efficiency)	Limits	Method Preparation Check (Precision)	Limits
ICP Metals (Totals and TCLP)	Calibration Verification Standard	90-110%	Control Blank Spike	75-125%	NA	NA	Matrix Spike	75-125%	Matrix Spike Duplicates	RPD<20
	Continuing Calibration Blanks	<3 IDL or Ave of 2 or more repeated results <3 sd of background mean					Post-Digestion Spike	75-125%		
	Interelement Interference	As specified by method					TCLP Matrix Spike	>50% <sup>1</sup>		
AA Metals	Calibration Verification Standard	90-110%	Control Blank Spike (after initial)	80-120%	NA	NA	Matrix Spike	80-120%	Matrix Spike Duplicates	RPD<20
Hg	Calibration Verification Standard	90-110%	Control Blank Spike (after initial)	80-120%	NA	NA	Matrix Spike TCLP Matrix Spike	80-120% >50% <sup>1</sup>	Matrix Spike Duplicates	RPD<20
Reactiv	NA	NA	Control	75-125%	NA	NA	NA	NA	Sample	<20%

Analysis	Calibration Checks	Limits	Method Accuracy Checks	Limits	Method Precision Checks	Limits	Method Preparation Check (Efficiency)	Limits	Method Preparation Check (Precision)	Limits	
e Sulfide			standard						Duplicate	RPD	
Cyanide	High and Low Calibration Verification Standards		Titrametric-N/A Colorometric - 85-115%	Control Blank Spike	85-115%	NA	NA	Matrix Spike	85-115%	Sample Duplicate	<20% RPD

<sup>1</sup> Perform Method of Standard Additions when (1) the recovery of the spike TCLP extract is <50% and the unspiked extract does not exceed the regulatory level,  
or (2) the concentration of the metal in the extract is within 20% of the appropriate regulatory level.

**ACCURACY, PRECISION, METHOD PREPARATION: OBJECTIVES AND LIMITS  
GCMS VOLATILES**

**TABLE 3.1 (Cont.)**

Analysis	Calibration Checks	Limits	Method Accuracy Checks	Limits	Method Precision Checks	Limits	Method Preparation Check (Efficiency)	Limits	Method Preparation Check (Precision)	Limits
<b>GCMS Volatiles</b>	<u>Initial</u> BFB Tuning	As per Table 4, (8260)	Control Blank Spike (5 MS Compounds)	±3sd	Control Blank Spike Duplicate	<Upper Range Limit	Matrix Spike (5 MS Compounds)	±3sd	Matrix Spike Duplicates	<Upper Range Limit
	Continuing Calibration Compounds	RF RSD <30	OR		OR		Surrogates (3)	±3sd	N/A	N/A
	System Performance Check Compounds	Min RRF 0.10 (0.30 for CBZ, TetCE)	Matrix Spike (5 MS Compounds)	±3sd	Matrix Spike Duplicate	<Upper Range Limit				
	<u>Daily</u> SPCC	0.10 (0.30 for CBZ, TetCE)								
	CCC	<25% difference from initial								
Internal Standard EICP	As required by 8260									



**ACCURACY, PRECISION, METHOD PREPARATION: OBJECTIVES AND LIMITS  
GCMS SEMIVOLATILES**

**TABLE 3.1 (Cont.)**

<b>Analyses</b>	<b>Calibration Checks</b>	<b>Limits</b>	<b>Method Accuracy Checks</b>	<b>Limits</b>	<b>Method Precision Checks</b>	<b>Limits</b>	<b>Method Preparation Check (Efficiency)</b>	<b>Limits</b>	<b>Method Preparation Check (Precision)</b>	<b>Limits</b>
<b>GCMS Semi-volatiles</b>	<u>Initial</u> DFTPP Tuning	As per Table 3, (8270A)	Control Blank Spike (11 MS Compounds)	$\pm 3sd$	Control Blank Spike Duplicate	<Upper Range Limit	Matrix Spike (11 MS Compounds)	$\pm 3sd$	Matrix Spike Duplicates	<Upper Range Limit
	Continuing Calibration Compounds	RF RSD <30	OR		OR		Surrogates (6)	$\pm 3sd$	N/A	N/A
	System Performance Check Compounds	Min RRF 0.050	Matrix Spike (11 MS Compounds)	$\pm 3sd$	Matrix Spike Duplicate	<Upper Range Limit				
	<u>Daily</u> SPCC	Min RRF 0.050								
	CCC	<30% difference from initial								
Internal Standard EICP	As required by 8270									

**ACCURACY, PRECISION, METHOD PREPARATION: OBJECTIVES AND LIMITS  
PESTICIDES, PCBs, HOMOLOGS**

**TABLE 3.1 (Cont.)**

Analysis	Calibration Checks	Limits	Method Accuracy Checks	Limits	Method Precision Checks	Limits	Method Preparation Check (Efficiency)	Limits	Method Preparation Check (Precision)	Limits
<i>Pesticides</i>	<u>Initial</u> Calibration Factor (External Std Method)	RSD<20	Control Blank Spike (6MS Compounds)	±3sd	Control Blank Spike Duplicate	<Upper Range Limit	Matrix Spike (6 MS Compounds)	±3sd	Matrix Spike Duplicates	<Upper Range Limit
			OR		OR			±3sd	N/A	N/A
	Response Factor (Internal Std Method)	RSD<20	Matrix Spike (6 MS Compounds)	±3sd	Matrix Spike Duplicate	<Upper Range Limit	Surrogates			
	4,4'-DDT and Endrin Breakdown	<15%								
	<u>Daily</u> Continuing Calibration Compounds	85-115% (or ave of all 85- 115%)								
PCBs	<u>Initial</u> Calibration Factor (External Std Method)	RSD<20	Laboratory Control Sample	±3sd	Laboratory Control Sample Duplicate	<Upper Range Limit	Matrix Spike	±3sd	Matrix Spike Duplicates	<Upper Range Limit
			OR		OR			±3sd	N/A	N/A
	<u>Daily</u> Continuing Calibration Compounds	85-115%	Matrix Spike	±3sd	Matrix Spike Duplicate	<Upper Range Limit	Surrogates			

**ACCURACY, PRECISION, METHOD PREPARATION: OBJECTIVES AND LIMITS  
HERBICIDES, METHANOL**

**TABLE 3.1 (Cont.)**

Analysis	Calibration Checks	Limits	Method Accuracy Checks	Limits	Method Precision Checks	Limits	Method Preparation Check (Efficiency)	Limits	Method Preparation Check (Precision)	Limits
<i>Herbicides</i>	<u>Initial</u> Calibration Factor (External Std Method)	RSD<20	Control Blank Spike (3 MS Compounds)	±3sd	Control Blank Spike Duplicate	<Upper Range Limit	Matrix Spike (3 MS Compounds)	±3sd	Matrix Spike Duplicates	<Upper Range Limit
	<u>Daily</u> Continuing Calibration Compounds	85-115%	OR Matrix Spike (3 MS Compounds)	±3sd	OR Matrix Spike Duplicate	<Upper Range Limit	Surrogates	±3sd	N/A	N/A
<i>Methanol &amp; Other Volatiles GC</i>	<u>Initial</u> Calibration Factor (External Std Method)	RSD<20	Control Blank Spike	±3sd	Control Blank Spike Duplicate	<Upper Range Limit	Matrix Spike	±3sd	Matrix Spike Duplicates	<Upper Range Limit
	<u>Daily</u> Continuing Calibration Compounds	85-115%	OR Matrix Spike	±3sd	OR Matrix Spike Duplicate	<Upper Range Limit	Surrogates	±3sd	N/A	N/A

**ACCURACY, PRECISION, METHOD PREPARATION: OBJECTIVES AND LIMITS  
DIOXINS/FURANS (LOW RESOLUTION)**

**TABLE 3.1 (Cont.)**

Analysis	Calibration Checks	Limits	Method Accuracy Checks	Limits	Method Precision Checks	Limits	Method Preparation Check (Efficiency)	Limits	Method Preparation Check (Precision)	Limits
<b>Dioxins/Furans (Low Resolution)</b>	<u>Initial</u> Relative Response Factor	RSD<15 TriPLICATE injections of each level.	N/A	N/A	N/A	N/A	Internal to Recovery Standard	40-120%	N/A	N/A
	<u>Initial Tuning</u> Isotopic Ratio Measurements w/ Column Performance Check Mixture	As per 8280 Table 3								
	Valley Percent Resolution for 2,3,7,8-TCDD and 1,2,3,4-TCDD	<25								
	<u>Daily/Continuing</u> Mid-level Check Standard	±30% of the Initial Calibration RRFs								
<u>Daily Tuning</u> Same as Initial Tuning	Same as Initial Tuning									

**ACCURACY, PRECISION, METHOD PREPARATION: OBJECTIVES AND LIMITS  
DIOXINS/FURANS (HIGH RESOLUTION)**

**TABLE 3.1 (Cont.)**

Analysis	Calibration Checks	Limits	Method Accuracy Checks	Limits	Method Precision Checks	Limits	Method Preparation Check (Efficiency)	Limits	Method Preparation Check (Precision)	Limits
<b>Dioxins/ Furans (High Resolution)</b>	<u>Initial</u> Relative Response Factor 17 unlabeled 9 labeled  <u>Initial Tuning</u> Isotopic Ratio Measurements for 17 unlabeled 11 labeled  Valley Percent Resolution for Column Performance Check Standard  Valley Percent PFK m/z 304.09824 & TCDF m/z 303.9016  <u>Daily/Continuing</u>	RSD<20 RSD<30  As per 8290 Table 8  <25  <10  ±20% ±30% of the Initial Calibration RRFs  Same as	N/A	N/A	N/A	N/A	Internal to Recovery Standard	40-135%	Matrix Spikes and Matrix Spike Duplicates  Unspiked Duplicates	RPD<20  RPD<25

Analysis	Calibration Checks	Limits	Method Accuracy Checks	Limits	Method Precision Checks	Limits	Method Preparation Check (Efficiency)	Limits	Method Preparation Check (Precision)	Limits
	High Resolution Calibration Compound-3 17 unlabeled 9 labeled  <u>Daily Tuning</u> Same as Initial Tuning  <u>End Cal Check</u> HRCC-3 17 unlabeled 9 labeled	Initial Tuning  RPD<25 RPD<35 of the previous 12hr HRCC-3 Check								

**ACCURACY, PRECISION, METHOD PREPARATION: OBJECTIVES AND LIMITS  
WET CHEMISTRY**

**TABLE 3.1 (Cont.)**

Analysis	Calibration Checks	Limits	Method Accuracy Checks	Limits	Method Precision Checks	Limits	Method Preparation Check (Efficiency)	Limits	Method Preparation Check (Precision)	Limits
<i>Heat of Combustion (BTU)</i>	<u>Initial</u> Generate an EE value with 6 runs of	Results must be within 56 BTU/lb of	Laboratory Control Sample	$\pm 200$ BTU/lb or $\pm 3sd$ of	Laboratory Control Sample Duplicate	Within 56 BTU/lb	N/A	N/A	N/A	N/A

Analysis	Calibration Checks	Limits	Method Accuracy Checks	Limits	Method Precision Checks	Limits	Method Preparation on Check (Efficiency)	Limits	Method Preparation on Check (Precision)	Limits
	benzoic acid on two non-consecutive days  Daily Benzoic Acid	each other  11373 BTU/lb $\pm$ 56		historical mean (use the more stringent)		of initial LCS run or <upper Range Limit (use the more stringent)				
<b>Chloride (for Total Halogens)</b>	Calibration Verification Standard	90-110%	Laboratory Control Sample	$\pm$ 3 sd of historical mean	Laboratory Control Sample Duplicate	<Upper Range Limit	Matrix Spike	$\pm$ 3sd	Matrix Spike Duplicates	<Upper Range Limit
<b>Setaflash Ignitability</b>	n-Butanol OR p-Xylene	98°F $\pm$ 2  81°F $\pm$ 2	Select a compound with a flashpoint near 140°F	Pass/Fail	N/A	N/A	N/A	N/A	N/A	N/A
<b>Pensky-Marten Ignitability</b>	p-Xylene OR per method D93	81°F $\pm$ 2  per method D93	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
<b>Percent Moisture: Evaporation</b>	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Duplicate	RPD<10

Analysis	Calibration Checks	Limits	Method Accuracy Checks	Limits	Method Precision Checks	Limits	Method Preparation on Check (Efficiency)	Limits	Method Preparation on Check (Precision)	Limits
<i>Karl Fischer</i>	Hydranal	90-110%	N/A	N/A	N/A	N/A	N/A	N/A	Duplicate	RPD<10

**ACCURACY, PRECISION, METHOD PREPARATION: OBJECTIVES AND LIMITS**  
Wet Chemistry

TABLE 3.1 (Cont.)

Analysis	Calibration Checks	Limits	Method Accuracy Checks	Limits	Method Precision Checks	Limits	Method Preparation Check (Efficiency)	Limits	Method Preparation Check (Precision)	Limits
<i>Percent Ash</i>	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Duplicate	RPD<10
<i>Fluoride (from Combustate)</i>	Calibration Verification Standard	90-110%	Laboratory Control Sample	±3sd of historical mean	Laboratory Control Sample Duplicate	<Upper Range Limit	Matrix Spike	±3sd	Matrix Spike Duplicates	<Upper Range Limit
<i>Viscosity</i>	Calibration Verification Standard	90-110%	N/A	N/A	N/A	N/A	N/A	N/A	Duplicate	RPD<10
<i>Specific Gravity / Bulk Density</i>	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Duplicate	RPD<10
<i>pH:</i>										



Analysis	Calibration Checks	Limits	Method Accuracy Checks	Limits	Method Precision Checks	Limits	Method Preparation Check (Efficiency)	Limits	Method Preparation Check (Precision)	Limits
<b>Water</b>	pH Buffers appropriate for waste being tested	N/A	Calibration Verification Standard	±0.05 pH Units	N/A	N/A	N/A	N/A	Duplicates on all water samples	±0.1 pH Units
<b>pH Paper Screen</b>	Check each lot against NIST traceable buffer	± 1 color increment	N/A	N/A	N/A	N/A	N/A	N/A	Duplicate per batch	±1 color increment
<b>pH Paper</b>	Check each lot against NIST traceable buffer	± 1 color increment	N/A	N/A	N/A	N/A	N/A	N/A	Duplicate on all samples	±1 color increment
<b>Waste</b>		N/A	Calibration Verification Standard	±0.05 pH Units	N/A	N/A	N/A	N/A	Duplicate per batch	±1 color increment on narrow range paper
<b>Solids</b>	pH Buffers appropriate for waste being tested	N/A	Calibration Verification Standard	±0.05 pH Units	N/A	N/A	N/A	N/A	Duplicate per batch	±0.1 pH Units
	pH Buffers appropriate for waste being tested									±0.1 pH Units

#### 4.0 SAMPLING PROCEDURES

A comprehensive program is essential in order to ensure that all samples taken are appropriate for the analysis being performed, that the analysis is complete and accurate, and that the final reports contain sufficient information to achieve their intended purpose. That purpose is primarily the safe and efficient treatment and disposal of hazardous waste.

Waste samples do not require preservation but are subject to holding times. The analytical methods included in this Quality Assurance Plan refer to the optimum means of preservation. Since the chemical make-up of certain samples can alter the effectiveness of the sample preservation measures, all samples are analyzed as soon as possible after sampling and before the maximum recommended holding time has expired.

Table 4-1 indicates the parameter of interest, appropriate container, preservation, and maximum holding times for samples of various matrix types. A copy of this table may be sent to generators to assist them in properly preserving the integrity of samples sent to laboratories for analysis.

#### 4.1 SAMPLE COLLECTION

The first step in any analysis is the collection of the sample. A wide range of techniques and sampling devices are utilized to sample waste materials in containers, tanks, and process streams.

The sampling methodology is determined by the sampling strategy employed. Sampling may be representative, composite, grab or surface area depending on sample strategy. The methods and equipment used for sampling waste material vary with the form and consistency of the waste materials, and by the type and purpose of the testing.. The following sampling procedures may be utilized for the following types of materials:

- Extremely viscous liquids. . . . . ASTM D140;SW846
- Crushed or powdered material . . . . ASTM D346;SW846
- Soil or rock-like material . . . . . ASTM D420;SW846
- Soil-like material . . . . . ASTM 1452;SW846
- Fly-ash-like material. . . . . ASTM D2234;SW846
- Stratified liquids . . . . . EPA-600/2-80-018;SW846

**Table 4.1  
SAMPLING CONTAINERS, PRESERVATION, AND HOLDING TIMES**

MATRIX	ANALYSIS	CONTAINER	PRESERVATION *	MAXIMUM HOLDING TIME
<i>Solids, Organic Liquids, Sludges</i>	Semi-Volatile Organics	Glass	4°C	Extraction: 14 Days Extract: 40 Days
	Volatile Organics	VOA Vial / (Glass) **	4°C	14 Days
	ICP Metals	Glass, Plastic	4°C	6 Months
	Mercury	Glass, Plastic	4°C	Extraction: 28 Days Extract: 28 Days
	Cyanide	Glass, Plastic	4°C	14 Days
	Wet Chemistry and Fingerprint	Glass, Plastic	4°C	6 months
<i>Aqueous Liquids</i>	Semi-Volatile Organics	Glass	4°C	Extraction: 7 Days Extract: 40 Days
	Volatile Organics	VOA Vial / (Glass) **	4°C	14 Days
	ICP Metals	Glass, Plastic	4°C, HNO <sub>3</sub> to pH<2	6 Months
	Mercury	Glass, Plastic	4°C, HNO <sub>3</sub> to pH<2	38 Days w/Glass 13 Days w/Plastic
	Cyanide	Glass, Plastic	4°C, NaOH to pH>12	14 Days
	Wet Chemistry and Fingerprint	Glass, Plastic	4°C	6 months

\* Hazardous Waste Samples Require No Preservation (Sources: SW-846 Volume II, Chapter 9, Page NINE-71, Paragraph 5., and Paul White, USEPA Method and Information Exchange (703) 676-4690.)

\*\* Glass for Hazardous Waste samples only.

#### 4.2 SAMPLING SMALL CONTAINERS

See Section 4.8 of the main body of the Waste Analysis Plan

#### 4.3 SAMPLING LIQUID TANKS

See Section 4.9 of the main body of the Waste Analysis Plan

#### 4.4 SAMPLING BULK WASTE

See Section 4.10 of the main body of the Waste Analysis Plan

#### 4.5 SAMPLING SURFACES

The 40 CFR § 761.123 contains standardized EPA procedures for taking PCB surface wipe samples. The definition constitutes the minimum requirements for an appropriate wipe testing protocol. A standard size template (10 cm X 10 cm) is used to identify the sampling area; the wiping media is an all collection gauze pad which has been saturated with hexane. The wipe is performed quickly once the gauze is exposed to air.

#### 4.6 FROZEN WASTE:

See Section 4.11 of the main body of the Waste Analysis Plan

#### 4.7 OTHER SAMPLES, i.e., PROCESS EQUIPMENT, CONTAINMENT, SUMPS, ETC.:

See Section 4.12 of the main body of the Waste Analysis Plan

## 5.0 TRACEABILITY

The facility routinely follows sample traceability for all internal sampling and analysis. This involves the documentation of procedures so that a set of data can be traced back through the analyst, to the person performing the sampling, and then to the waste itself. All samples receive a unique sample identification number to facilitate this process.

Should Chain-of-Custody be warranted, i.e., shipping samples off-site, then procedures in Section 5.4, Chain-of-Custody are followed:

In order to trace sample possession from the time of collection, a traceability record is filled out and accompanies the sample. The record contains the following information:

- sample ID;
- signature of the collector;
- date collected;
- waste type;
- signature of persons involved;
- inclusive date of possession; and
- cross reference to manifest (if applicable).

## 5.1 SAMPLE LABELS

Sample labels are necessary to prevent misidentification of samples. The labels are gummed and affixed to the containers prior to or at the time of sampling. The labels are filled out at the time of collection.

## 5.2 SAMPLE SEALS

Sample seals are used to detect any tampering during shipment for samples sent off site. The seals are initialed, dated, and then affixed to the sample containers or shipping containers before the samples leave the custody of the lab. Sample seals are not necessary for samples taken onsite at the facility and sent to the onsite laboratory or if being transported by GMF personnel or the personnel from the laboratory that is going to perform the analysis. They are required for Chain-of-Custody events where Clean Harbors personnel are not transporting the samples.

## 5.3 SAMPLING RECORD

All information pertinent to field surveys or sampling is recorded in a record. Since sampling situations vary widely, no set of rules can be given as to the extent of information that must be entered in the record. However, sufficient information is recorded to allow someone to reconstruct the sampling without reliance on the collector's memory. This record includes at a minimum the following information:

- location of sampling point;
- volume of samples taken;
- date of collection;
- sample identification number;
- person sampling;
- comments or observations;
- sampling methodology

#### 5.4 CHAIN-OF-CUSTODY

Sample chain-of-custody is maintained as required by the client or regulatory agency. A chain-of-custody is used to ensure the data from sample collection to data reporting is legally defensible. This includes the ability to trace the possession and handling of samples from the time of collection through analysis and final disposition.

The components of the chain-of-custody include the following: sample seals, a log, and chain-of-custody record. The procedures for their use are described in further detail.

A sample is considered to be under a person's custody if:

- it is in a person's physical possession;
- in view of the person after possession has taken place;
- secured by that person so that undetected tampering with the sample cannot occur; or
- secured by that person in an area which is restricted to authorized personnel.

Upon receipt of the sample(s) in the laboratory they are entered into the sample receipt log. All chain-of-custody samples are directed to the sample custodian. The shipping containers and sample bottles are inspected for proper seals and labels. The contents of the containers are then checked against the chain-of-custody record. The chain-of-custody record may include but is not limited to the following:

- Sampler Signature
- Date Sampled
- Sample ID
- Type of sample, i.e. composite or grab
- Number of Containers
- A place for comments
- Blocks for the person relinquishing the sample to sign, print his/her name, and put the date and time the sample was relinquished.
- Blocks for the person receiving the sample to sign, print his/her name, and put the date and time the sample was received.

If the chain-of-custody information is complete and the integrity of the samples has not been broken, each sample is assigned a unique identification number. If the information on the chain-of-custody record is not complete, the sample custodian shall contact the appropriate facility personnel to obtain the missing information, and a unique identification number is assigned. All problem resolutions will be documented in the sample receipt log.

The samples are then put into storage to await analysis. Maximum holding times for the samples are described in Section 6 of this Quality Assurance Plan.

## 6.0 CALIBRATION PROCEDURES AND FREQUENCIES

All instruments are calibrated in accordance with the appropriate analytical method. The methods commonly utilized are referenced in Section 9.1. These methods cite the appropriate calibration procedures and frequencies. In addition, all instruments are calibrated in accordance with the manufacturer's procedures.

Prior to the analysis of samples, instruments are either calibrated or their calibrations verified. Calibration curves of signal response versus concentration are generated on each applicable analytical instrument.

Calibrations are evaluated using calibration check standards. Should this sample fall outside of acceptable limits as specified by the method, the instrument is recalibrated. Table 8.1 summaries instrument calibration procedures and frequencies.

Sources of reference materials include the National Bureau of Standards, and reputable commercial vendors. PCB reference materials will be obtained from EPA's reference laboratory or from a suitable chemical supply firm such as Supelco, Foxboro, Radian, or ULTRA Scientific.

**TABLE 6.1  
SUMMARY OF  
CALIBRATION PROCEDURES AND FREQUENCIES**

<u>Instrument</u>	<u>Standards</u>	<u>Frequency</u>
GC	Mid-level Standard	Daily and every 10th sample.
	5-7 Standards	Recalibration if CVS is greater than 15% of expected value.
GC/MS	Mid-level Standard	Daily
	5-7 Standards	Recalibration if CCC* is greater than 30% for semi-volatiles and 25% for volatiles.
	Mass Calibration (GC/MS tuning)	Every 12 hours.
ICP	Calibration Verification Standard (CVS)	Beginning and end of analytical run and every 10th sample.
	3-5 Standards	Recalibration if CVS not within $\pm 10\%$ of expected value.
AAS	3-5 Standards	Analysis of standards at the beginning of an analytical run.

\* CCC = Continuing Calibration Check



## 7.0 ANALYTICAL METHODS

The analytical methods used are listed in Section 3 of the Waste Analysis Plan.

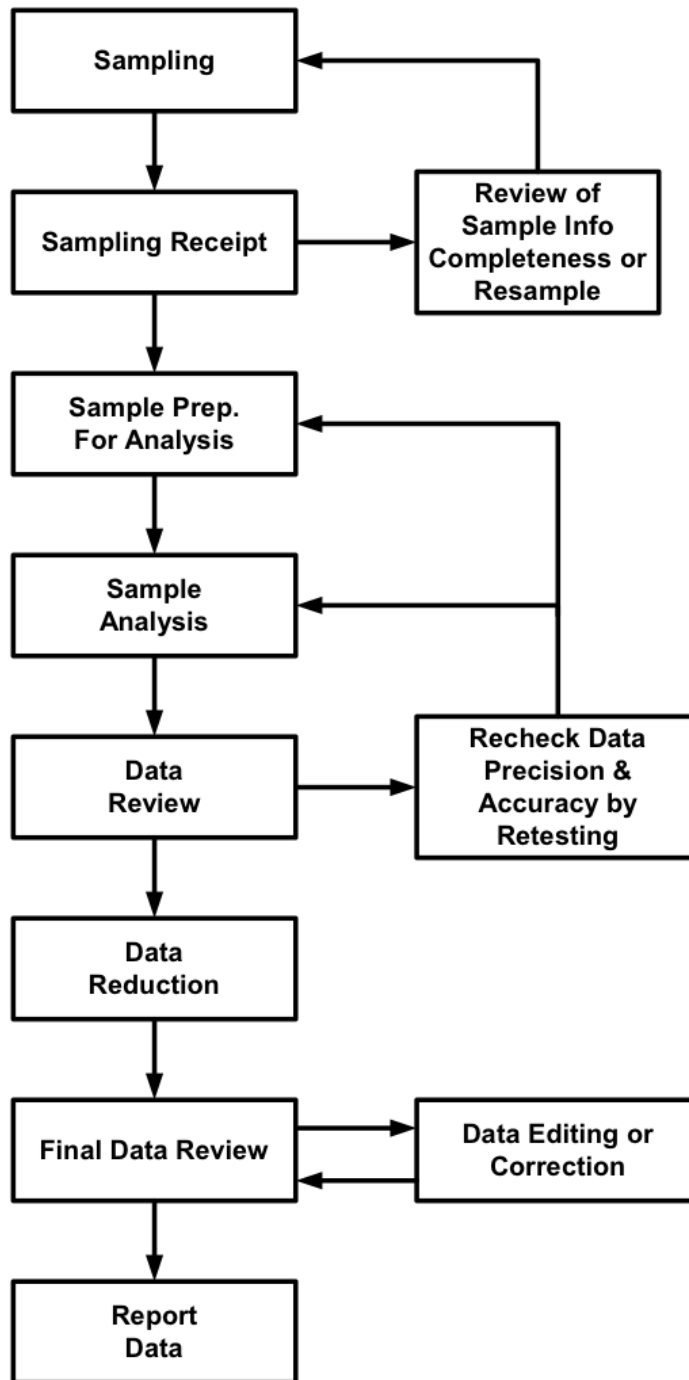
## 8.0 DATA REDUCTION, VALIDATION, AND REPORTING

Data reduction procedures are designed to include several levels of data review. Data validation begins with the person generating data. The chemist or analyst makes the initial calculations and records the results. Each section supervisor or designee is then responsible for reviewing data and as well as 10% of hand calculations generated by their respective group.

Discrepancies and/or errors are corrected or referred back to the chemist or analyst performing the analysis. If necessary, the samples are reprepared and reanalyzed.

Figure 8.1 depicts the data reporting scheme.

**FIGURE 8.1 DATA REPORTING**



## 8.1 DATA REDUCTION

Raw data from chromatographs, spectrometers, recorders, and physical measurements are reduced to yield concentrations of the analytes of interest. All data reduction is performed in accordance with the applicable method as referenced in section 9.0.

Data reduction, which is not computerized, is recorded in ink on worksheets or in lab notebooks.

## 8.2 DATA VALIDATION

All data are validated prior to being disseminated from the laboratory. The data are reviewed for both editorial and technical validity.

The editorial review consists of a check for typographical, transpositional, and omissions errors. This review also includes a review of any text which may accompany the data.

The technical review consists of a check to see that all precision, accuracy, and detection limit requirements have been met. In addition, the data are also reviewed for completeness and representativeness.

## 8.3 DATA REPORTING

Once data have been reviewed and all requirements for completeness, representativeness, precision, accuracy, and limits of detection have been met, results are reported to the client.

Typically, only the final reduced data is reported. All QC data, calculations, chromatograms, etc., which support the reported data are retained in the laboratory records.

## 9.0 INTERNAL QUALITY CONTROL CHECKS

A minimum level of quality control is maintained as described in Chapter 1 "Quality Control," SW-846.

Table 3.1 describes the quality control strategies for each analysis. A glossary of terms is listed in Section 11.2.

## 9.1 FIELD QUALITY CONTROL

The procedures that are used in the field to ensure data quality include:

- The use of accepted sampling techniques.
- The justification and documentation of any field action contrary to accepted or specified techniques.
- The documentation of activities, such as container preparation, instrument calibration, etc.
- The documentation of field measurement Quality Control Data.
- The documentation of field activities.
- The documentation of post-field activities including sample shipment and receipt,

- equipment check in, and de-briefing.
- The generation of Quality Control Samples, including duplicates.

## 9.2 ANALYTICAL QUALITY CONTROL

The procedures used in the laboratory to ensure analytical data quality include:

Duplicate Spike - is analyzed (when applicable) with every analytical batch or once in ten samples, whichever is more frequent. Analytes stipulated by the method applicable regulations, or agreement with the client, are spiked into the sample. Selection of the sample to be spiked and/or split depends on the information required and the variety of conditions within a typical matrix. In some situations, requirements of the site being sampled may dictate that the person sampling select a sample to be spiked and split based on a pre-visit evaluation or on-site inspection. This does not preclude the laboratory's spiking a sample of its own selection. In most cases, the laboratory will select the sample to be spiked. The laboratory's selection is based on the attempt to determine the extent of matrix bias or interference on the analyte recovery and sample to sample precision.

Blanks - accompany each batch of samples and are carried through the entire analytical procedure.

Surrogate Standards - are spiked into samples according to the appropriate analytical methods. Surrogate spike recoveries will fall within the control limits set to be in accordance with the procedures specified in the method.

Check Samples - containing a representative subset of the analytes of interest are used to evaluate equipment performance.

Clean-Ups - are used to eliminate interferences in organic extracts. All associated QC samples must undergo the same procedures as field samples.

Column-Check Sample - is used to verify column performance. The elution pattern is reconfirmed after activating or de-activating a batch of absorbent.

Instrument Adjustment - requirements and procedures are instrument and method specific. Analytical instrumentation is tuned and aligned in accordance with requirements which are specific to the instrumentation procedures employed.

Calibration - is performed in accordance with the manufactures' requirements and the procedures specified in the applicable method.

## 9.3 SPECIFIC REQUIREMENTS FOR INORGANIC ANALYSIS

Standard curves used in the determination of inorganic analytes are prepared as follows.

Standard curves derived from data consisting of one reagent blank and at least one additional concentration are prepared for each analyte. The response for each prepared standard is based upon the average of three replicate readings of each standard. Sample results must fall within the concentration range of the standard curve. If the results of the verification are not within  $\pm 10\%$  for ICP and 10% for Atomic Absorption of the original standard curve, a reference standard is employed to determine if the discrepancy is with the standard or with the instrument.

New standards are prepared on a quarterly basis. All data used in drawing or describing the curve are

indicated on the curve or its description and a record is made of this verification.

Standard deviations and relative standard deviations are calculated from the absolute recovery of analytes from the spike sample duplicates.

#### 9.4 SPECIFIC REQUIREMENTS FOR ORGANIC ANALYSIS

The following requirements are applied to the analysis of samples by gas chromatography, liquid chromatography and gas chromatography/mass spectrometry.

The calibration of each instrument is verified at frequencies specified in the methods. Standard curves are prepared as specified in the methods.

The tune of each GC/MS system used for the determination of organic analytes is checked with 4-bromofluorobenzene (BFB) for determinations of volatiles and with decafluorotriphenylphosphine (DFTPP) for determination of semi-volatiles. The required ion abundance criteria are met before determination of any analytes.

If the system does not meet the required specification for one or more of the required ions, the instrument is retuned and rechecked before proceeding with sample analysis. The tune performance check criteria are achieved daily or for each 12 hour operation period, whichever is more frequent.

The background subtraction is straightforward and designed only to eliminate column bleed or instrument background. Background subtraction actions resulting in spectral distortions for the sole purpose of meeting special requirements are contrary to the objectives of Quality Assurance and are unacceptable.

For determinations by HPLC or GC, the instrument calibration is verified as specified in the methods.

#### 10.0 PROFICIENCY TESTING AND SYSTEM AUDITS

The laboratory is subject to both internal and external audits, in order to monitor the capability and performance of the total measurement systems.

The systems audit consists of evaluation of all components of the measurement system to determine their proper selection and use. This audit includes a careful evaluation of both field and laboratory quality control procedures. System audits are normally performed prior to or shortly after a new system has been implemented. Performance audits are then performed on a routine basis, at least semi-annually, during the lifetime or continuing operation of the system.

#### 10.1 INTERNAL AND EXTERNAL PROFICIENCY TESTING

The laboratories participate in blind round robin tests with other laboratories who perform environmental analysis when available. If round robins are available more frequently than semi-annually, participation is only required semi-annually.

A set of blind samples are split among the laboratories. This helps management evaluate the precision and accuracy of its own laboratories, as well as provide information about the amount of inter-laboratory deviation which can be associated with a particular method. If the laboratory fails a

proficiency testing audit, a corrective action plan will be generated and corrective action taken as described in Section 14 of this QAP.

For samples that are reported for certification purposes, the following rules apply:

The laboratory shall follow the proficiency testing provider's instructions for preparing the proficiency testing sample and shall analyze the proficiency testing sample as if it were a client sample.

The following are strictly prohibited:

- performing multiple analyses (replicates, duplicates) which are not normally performed in the course of analysis of routine samples;
- averaging the results of multiple analyses for reporting when not specifically required by the method;

The laboratory shall not:

- discuss the results of a proficiency testing audit with any other laboratory until after the deadline for receipt of results by the proficiency testing provider;

The laboratory shall maintain a copy of all proficiency testing records, including analytical worksheets.

The Technical Manager of the laboratory shall sign and retain an attestation statement stating that the certified laboratory followed the proficiency testing provider's instructions for preparing the proficiency testing sample and analyzed the proficiency testing sample as if it were a client sample.

The laboratory staff shall be trained on the proper handling of proficiency testing sample.

## 10.2 INTERNAL SYSTEM AUDITS

Internal audits are performed on a semi-annual basis. The audit is conducted by the Quality Control Manager under the direction of the Facility Manager or designee. The audit report is due 30 days following the conclusion of the audit.

The audit evaluates the system from the receipt of samples to the reporting of results. Specific areas which are addressed include: sample flow through the lab, sample storage, sample preparation, analysis, data reduction, data reporting, QC samples, logbooks, and raw data storage.

## 11.0 PREVENTATIVE MAINTENANCE

The laboratories are equipped and maintained to provide the best conditions possible for performing laboratory analysis. Equipment which has become obsolete by the advancement of technology is replaced or upgraded. All equipment is inspected regularly to ensure that it is in proper working order.

Equipment is maintained in accordance with the manufacturer's recommendations. All major pieces of equipment are covered by service contracts from the manufacturer. Whenever possible, an inventory of spare parts which typically need replacement is maintained, this includes such compounds as septa, GC columns, ion volumes, torches, regulators, and so forth.

Table 13.1 lists pieces of equipment or components which are routinely maintained, the frequency at

which they are serviced and the type of maintenance performed.

**TABLE 11.1  
MAINTENANCE SCHEDULE**

<b>EQUIPMENT COMPONENT</b>	<b>MAINTENANCE PERFORMED</b>	<b>FREQUENCY</b>
<u>Gas Chromatographs</u> septa column syringes inlet liner (tube)	replace replace/condition replace clean/replace	as required as required as required as required
ELCD (HALL) Ni catalyst solvent resin	leak check replace/condition replace	as required as required as required
ECD	wipe test leak check factory clean/recondition	semi-annually as required as required
PID lamp	leak check replace	as required as required
FID jets	leak check clean	as required as required
<u>ICP</u> nebulizer pump tubing air filters torch	clean/replace replace clean clean/replace	as required as required as required as required
<u>MERCURY ANALYZER</u> drying tube desiccant sample tubing stannous chloride tubing drain tubing lamp optics	replace replace replace replace replace clean	daily twice/week as required as required as required as required
<u>CALORIMETER</u> bombs tubing	calibration/certification check/replace	after 500 firings daily
<u>COMPRESSED GASES</u> fittings traps	leak checks replace	as required as required



## 12.0 CORRECTIVE ACTION

Quality Control procedures are designed to identify the need for corrective action. Most corrective actions are performed by the chemists doing the analysis, and are usually as simple as recalibrating an instrument should the instrument check sample be out of its acceptable range. Most corrective actions are found in methods, standard operating manuals, and instrument manuals.

Corrective actions may also be initiated as a result of various Quality Assurance activities, including:

- 1) performance audits,
- 2) system audits,
- 3) laboratory or interfield comparison studies,
- 4) program audits, and
- 5) final review of data reports

Corrective action reports shall be sent to the Laboratory Manager for review and implementation.

The standard approach for corrective action consists of the following:

- 1) define the problem,
- 2) determine the cause(s) of the problem,
- 3) determine possible solutions to the problem,
- 4) implement the corrective action, and
- 5) verify that the corrective action is effective.

All employees are encouraged to bring to their supervisor's attention any problem or practice which they feel may effect data quality.

## 13.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

The Quality Control Manager is responsible for reporting to the laboratory manager on the performance of measurement systems and data quality. The Laboratory and Facility Manager reviews and returns the report. These reports include:

- 1) Assessment of measurement data accuracy, precision, and completeness.
- 2) Results of performance audits.
- 3) Results of system audits.
- 4) Significant Quality Assurance problems and recommended solutions.

## **Appendix 2**

### **Approved Waste Code List**



Appendix 2 - Approved Waste Code List

EPA Waste Code List  (See Note 1)	Module III (Containers)  May store these wastes  CONTAINERS  (See Notes 2, 5)	Module IV (Tanks)  May store these wastes  STORAGE TANKS  (See Notes 2, 4, 5)	Module IV (Tanks)  May treat these wastes  STABILIZATION TANKS  (See Notes 2, 4, 5)	Module VI (Landfills)  May dispose these wastes  LANDFILLS  (See Notes 3, 5)
D001	D001	D001	D001	D001
D002	D002	D002	D002	D002
D003	D003	D003	D003	D003
D004	D004	D004	D004	D004
D005	D005	D005	D005	D005
D006	D006	D006	D006	D006
D007	D007	D007	D007	D007
D008	D008	D008	D008	D008
D009	D009	D009	D009	D009
D010	D010	D010	D010	D010
D011	D011	D011	D011	D011
D012	D012	D012	D012	D012
D013	D013	D013	D013	D013
D014	D014	D014	D014	D014
D015	D015	D015	D015	D015
D016	D016	D016	D016	D016
D017	D017	D017	D017	D017
D018	D018	D018	D018	D018

EPA Waste Code List	Module III (Containers) May store these wastes	Module IV (Tanks) May store these wastes	Module IV (Tanks) May treat these wastes	Module VI (Landfills) May dispose these wastes
D019	D019	D019	D019	D019
D020	D020	D020	D020	D020
D021	D021	D021	D021	D021
D022	D022	D022	D022	D022
D023	D023	D023	D023	D023
D024	D024	D024	D024	D024
D025	D025	D025	D025	D025
D026	D026	D026	D026	D026
D027	D027	D027	D027	D027
D028	D028	D028	D028	D028
D029	D029	D029	D029	D029
D030	D030	D030	D030	D030
D031	D031	D031	D031	D031
D032	D032	D032	D032	D032
D033	D033	D033	D033	D033
D034	D034	D034	D034	D034
D035	D035	D035	D035	D035
D036	D036	D036	D036	D036
D037	D037	D037	D037	D037
D038	D038	D038	D038	D038
D039	D039	D039	D039	D039
D040	D040	D040	D040	D040
D041	D041	D041	D041	D041
D042	D042	D042	D042	D042
D043	D043	D043	D043	D043

EPA Waste Code List	Module III (Containers) May store these wastes	Module IV (Tanks) May store these wastes	Module IV (Tanks) May treat these wastes	Module VI (Landfills) May dispose these wastes
F001	F001	F001	F001	F001
F002	F002	F002	F002	F002
F003	F003	F003	F003	F003
F004	F004	F004	F004	F004
F005	F005	F005	F005	F005
F006	F006	F006	F006	F006
F007	F007	F007	F007	F007
F008	F008	F008	F008	F008
F009	F009	F009	F009	F009
F010	F010	F010	F010	F010
F011	F011	F011	F011	F011
F012	F012	F012	F012	F012
F019	F019	F019	F019	F019
F020	F020	F020*	F020*	F020*
F021	F021	F021*	F021*	F021*
F022	F022	F022*	F022*	F022*
F023	F023	F023*	F023*	F023*
F024	F024	F024	F024	F024
F025	F025	F025	F025	F025*
F026	F026	F026*	F026*	F026*
F027	F027	F027*	F027*	F027*
F028	F028	F028*	F028*	F028*
F032	F032	F032	F032	F032
F034	F034	F034	F034	F034

EPA Waste Code List	Module III (Containers) May store these wastes	Module IV (Tanks) May store these wastes	Module IV (Tanks) May treat these wastes	Module VI (Landfills) May dispose these wastes
F035	F035	F035	F035	F035
F037	F037	F037	F037	F037
F038	F038	F038	F038	F038
F039	F039	F039	F039	F039
	F999	F999	F999	F999
K001	K001	K001	K001	K001
K002	K002	K002	K002	K002
K003	K003	K003	K003	K003
K004	K004	K004	K004	K004
K005	K005	K005	K005	K005
K006	K006	K006	K006	K006
K007	K007	K007	K007	K007
K008	K008	K008	K008	K008
K009	K009	K009	K009	K009
K010	K010	K010	K010	K010
K011	K011	K011	K011	K011
K013	K013	K013	K013	K013
K014	K014	K014	K014	K014
K015	K015	K015	K015	K015
K016	K016	K016	K016	K016
K017	K017	K017	K017	K017
K018	K018	K018	K018	K018
K019	K019	K019	K019	K019
K020	K020	K020	K020	K020

EPA Waste Code List	Module III (Containers) May store these wastes	Module IV (Tanks) May store these wastes	Module IV (Tanks) May treat these wastes	Module VI (Landfills) May dispose these wastes
K021	K021	K021	K021	K021
K022	K022	K022	K022	K022
K023	K023	K023	K023	K023
K024	K024	K024	K024	K024
K025	K025	K025	K025	K025
K026	K026	K026	K026	K026
K027	K027	K027	K027	K027
K028	K028	K028	K028	K028
K029	K029	K029	K029	K029
K030	K030	K030	K030	K030
K031	K031	K031	K031	K031
K032	K032	K032	K032	K032
K033	K033	K033	K033	K033
K034	K034	K034	K034	K034
K035	K035	K035	K035	K035
K036	K036	K036	K036	K036
K037	K037	K037	K037	K037
K038	K038	K038	K038	K038
K039	K039	K039	K039	K039
K040	K040	K040	K040	K040
K041	K041	K041	K041	K041
K042	K042	K042	K042	K042
K043	K043	K043	K043	K043
K044	K044	K044	K044	K044
K045	K045	K045	K045	K045



EPA Waste Code List	Module III (Containers) May store these wastes	Module IV (Tanks) May store these wastes	Module IV (Tanks) May treat these wastes	Module VI (Landfills) May dispose these wastes
K046	K046	K046	K046	K046
K047	K047	K047	K047	K047
K048	K048	K048	K048	K048
K049	K049	K049	K049	K049
K050	K050	K050	K050	K050
K051	K051	K051	K051	K051
K052	K052	K052	K052	K052
K060	K060	K060	K060	K060
K061	K061	K061	K061	K061
K062	K062	K062	K062	K062
K069	K069	K069	K069	K069
K071	K071	K071	K071	K071
K073	K073	K073	K073	K073
K083	K083	K083	K083	K083
K084	K084	K084	K084	K084
K085	K085	K085	K085	K085
K086	K086	K086	K086	K086
K087	K087	K087	K087	K087
K088	K088	K088	K088	K088
K093	K093	K093	K093	K093
K094	K094	K094	K094	K094
K095	K095	K095	K095	K095
K096	K096	K096	K096	K096
K097	K097	K097	K097	K097
K098	K098	K098	K098	K098

EPA Waste Code List	Module III (Containers) May store these wastes	Module IV (Tanks) May store these wastes	Module IV (Tanks) May treat these wastes	Module VI (Landfills) May dispose these wastes
K099	K099	K099	K099	K099
K100	K100	K100	K100	K100
K101	K101	K101	K101	K101
K102	K102	K102	K102	K102
K103	K103	K103	K103	K103
K104	K104	K104	K104	K104
K105	K105	K105	K105	K105
K106	K106	K106	K106	K106
K107	K107	K107	K107	K107
K108	K108	K108	K108	K108
K109	K109	K109	K109	K109
K110	K110	K110	K110	K110
K111	K111	K111	K111	K111
K112	K112	K112	K112	K112
K113	K113	K113	K113	K113
K114	K114	K114	K114	K114
K115	K115	K115	K115	K115
K116	K116	K116	K116	K116
K117	K117	K117	K117	K117
K118	K118	K118	K118	K118
K123	K123	K123	K123	K123
K124	K124	K124	K124	K124
K125	K125	K125	K125	K125
K126	K126	K126	K126	K126
K131	K131	K131	K131	K131

EPA Waste Code List	Module III (Containers) May store these wastes	Module IV (Tanks) May store these wastes	Module IV (Tanks) May treat these wastes	Module VI (Landfills) May dispose these wastes
K132	K132	K132	K132	K132
K136	K136	K136	K136	K136
K140	K140	K140	K140	K140
K141	K141	K141	K141	K141
K142	K142	K142	K142	K142
K143	K143	K143	K143	K143
K144	K144	K144	K144	K144
K145	K145	K145	K145	K145
K147	K147	K147	K147	K147
K148	K148	K148	K148	K148
K149	K149	K149	K149	K149
K150	K150	K150	K150	K150
K151	K151	K151	K151	K151
K156	K156	K156	K156	K156
K157	K157	K157	K157	K157
K158	K158	K158	K158	K158
K159	K159	K159	K159	K159
K161	K161	K161	K161	K161
K169	K169	K169	K169	K169
K170	K170	K170	K170	K170
K171	K171	K171	K171	K171
K172	K172	K172	K172	K172
P001	P001	P001	P001	P001
P002	P002	P002	P002	P002

EPA Waste Code List	Module III (Containers) May store these wastes	Module IV (Tanks) May store these wastes	Module IV (Tanks) May treat these wastes	Module VI (Landfills) May dispose these wastes
P003	P003	P003	P003	P003
P004	P004	P004	P004	P004
P005	P005	P005	P005	P005
P006	P006	P006	P006	P006
P007	P007	P007	P007	P007
P008	P008	P008	P008	P008
P009	P009	P009	P009	P009
P010	P010	P010	P010	P010
P011	P011	P011	P011	P011
P012	P012	P012	P012	P012
P013	P013	P013	P013	P013
P014	P014	P014	P014	P014
P015	P015	P015	P015	P015
P016	P016	P016	P016	P016
P017	P017	P017	P017	P017
P018	P018	P018	P018	P018
P020	P020	P020	P020	P020
P021	P021	P021	P021	P021
P022	P022	P022	P022	P022
P023	P023	P023	P023	P023
P024	P024	P024	P024	P024
P026	P026	P026	P026	P026
P027	P027	P027	P027	P027
P028	P028	P028	P028	P028
P029	P029	P029	P029	P029

EPA Waste Code List	Module III (Containers) May store these wastes	Module IV (Tanks) May store these wastes	Module IV (Tanks) May treat these wastes	Module VI (Landfills) May dispose these wastes
P030	P030	P030	P030	P030
P031	P031	P031	P031	P031
P033	P033	P033	P033	P033
P034	P034	P034	P034	P034
P036	P036	P036	P036	P036
P037	P037	P037	P037	P037
P038	P038	P038	P038	P038
P039	P039	P039	P039	P039
P040	P040	P040	P040	P040
P041	P041	P041	P041	P041
P042	P042	P042	P042	P042
P043	P043	P043	P043	P043
P044	P044	P044	P044	P044
P045	P045	P045	P045	P045
P046	P046	P046	P046	P046
P047	P047	P047	P047	P047
P048	P048	P048	P048	P048
P049	P049	P049	P049	P049
P050	P050	P050	P050	P050
P051	P051	P051	P051	P051
P054	P054	P054	P054	P054
P056	P056	P056	P056	P056
P057	P057	P057	P057	P057
P058	P058	P058	P058	P058
P059	P059	P059	P059	P059

EPA Waste Code List	Module III (Containers) May store these wastes	Module IV (Tanks) May store these wastes	Module IV (Tanks) May treat these wastes	Module VI (Landfills) May dispose these wastes
P060	P060	P060	P060	P060
P062	P062	P062	P062	P062
P063	P063	P063	P063	P063
P064	P064	P064	P064	P064
P065	P065	P065	P065	P065
P066	P066	P066	P066	P066
P067	P067	P067	P067	P067
P068	P068	P068	P068	P068
P069	P069	P069	P069	P069
P070	P070	P070	P070	P070
P071	P071	P071	P071	P071
P072	P072	P072	P072	P072
P073	P073	P073	P073	P073
P074	P074	P074	P074	P074
P075	P075	P075	P075	P075
P076	P076	P076	P076	P076
P077	P077	P077	P077	P077
P078	P078	P078	P078	P078
P081	P081	P081	P081	P081
P082	P082	P082	P082	P082
P084	P084	P084	P084	P084
P085	P085	P085	P085	P085
P087	P087	P087	P087	P087
P088	P088	P088	P088	P088
P089	P089	P089	P089	P089

EPA Waste Code List	Module III (Containers) May store these wastes	Module IV (Tanks) May store these wastes	Module IV (Tanks) May treat these wastes	Module VI (Landfills) May dispose these wastes
P092	P092	P092	P092	P092
P093	P093	P093	P093	P093
P094	P094	P094	P094	P094
P095	P095	P095	P095	P095
P096	P096	P096	P096	P096
P097	P097	P097	P097	P097
P098	P098	P098	P098	P098
P099	P099	P099	P099	P099
P101	P101	P101	P101	P101
P102	P102	P102	P102	P102
P103	P103	P103	P103	P103
P104	P104	P104	P104	P104
P105	P105	P105	P105	P105
P106	P106	P106	P106	P106
P108	P108	P108	P108	P108
P109	P109	P109	P109	P109
P110	P110	P110	P110	P110
P111	P111	P111	P111	P111
P112	P112	P112	P112	P112
P113	P113	P113	P113	P113
P114	P114	P114	P114	P114
P115	P115	P115	P115	P115
P116	P116	P116	P116	P116
P118	P118	P118	P118	P118
P119	P119	P119	P119	P119

EPA Waste Code List	Module III (Containers) May store these wastes	Module IV (Tanks) May store these wastes	Module IV (Tanks) May treat these wastes	Module VI (Landfills) May dispose these wastes
P120	P120	P120	P120	P120
P121	P121	P121	P121	P121
P122	P122	P122	P122	P122
P123	P123	P123	P123	P123
P127	P127	P127	P127	P127
P128	P128	P128	P128	P128
P185	P185	P185	P185	P185
P188	P188	P188	P188	P188
P189	P189	P189	P189	P189
P190	P190	P190	P190	P190
P191	P191	P191	P191	P191
P192	P192	P192	P192	P192
P194	P194	P194	P194	P194
P196	P196	P196	P196	P196
P197	P197	P197	P197	P197
P198	P198	P198	P198	P198
P199	P199	P199	P199	P199
P201	P201	P201	P201	P201
P202	P202	P202	P202	P202
P203	P203	P203	P203	P203
P204	P204	P204	P204	P204
P205	P205	P205	P205	P205
	P999 w/F999	P999 w/F999	P999 w/F999	P999 w/F999
PCBs	PCBs	PCBs <sup>1</sup>	PCBs <sup>1</sup>	PCBs <sup>1</sup>



EPA Waste Code List	Module III (Containers) May store these wastes	Module IV (Tanks) May store these wastes	Module IV (Tanks) May treat these wastes	Module VI (Landfills) May dispose these wastes
U001	U001	U001	U001	U001
U002	U002	U002	U002	U002
U003	U003	U003	U003	U003
U004	U004	U004	U004	U004
U005	U005	U005	U005	U005
U006	U006	U006	U006	U006
U007	U007	U007	U007	U007
U008	U008	U008	U008	U008
U009	U009	U009	U009	U009
U010	U010	U010	U010	U010
U011	U011	U011	U011	U011
U012	U012	U012	U012	U012
U014	U014	U014	U014	U014
U015	U015	U015	U015	U015
U016	U016	U016	U016	U016
U017	U017	U017	U017	U017
U018	U018	U018	U018	U018
U019	U019	U019	U019	U019
U020	U020	U020	U020	U020
U021	U021	U021	U021	U021
U022	U022	U022	U022	U022
U023	U023	U023	U023	U023
U024	U024	U024	U024	U024
U025	U025	U025	U025	U025
U026	U026	U026	U026	U026

EPA Waste Code List	Module III (Containers) May store these wastes	Module IV (Tanks) May store these wastes	Module IV (Tanks) May treat these wastes	Module VI (Landfills) May dispose these wastes
U027	U027	U027	U027	U027
U028	U028	U028	U028	U028
U029	U029	U029	U029	U029
U030	U030	U030	U030	U030
U031	U031	U031	U031	U031
U032	U032	U032	U032	U032
U033	U033	U033	U033	U033
U034	U034	U034	U034	U034
U035	U035	U035	U035	U035
U036	U036	U036	U036	U036
U037	U037	U037	U037	U037
U038	U038	U038	U038	U038
U039	U039	U039	U039	U039
U041	U041	U041	U041	U041
U042	U042	U042	U042	U042
U043	U043	U043	U043	U043
U044	U044	U044	U044	U044
U045	U045	U045	U045	U045
U046	U046	U046	U046	U046
U047	U047	U047	U047	U047
U048	U048	U048	U048	U048
U049	U049	U049	U049	U049
U050	U050	U050	U050	U050
U051	U051	U051	U051	U051
U052	U052	U052	U052	U052

EPA Waste Code List	Module III (Containers) May store these wastes	Module IV (Tanks) May store these wastes	Module IV (Tanks) May treat these wastes	Module VI (Landfills) May dispose these wastes
U053	U053	U053	U053	U053
U055	U055	U055	U055	U055
U056	U056	U056	U056	U056
U057	U057	U057	U057	U057
U058	U058	U058	U058	U058
U059	U059	U059	U059	U059
U060	U060	U060	U060	U060
U061	U061	U061	U061	U061
U062	U062	U062	U062	U062
U063	U063	U063	U063	U063
U064	U064	U064	U064	U064
U066	U066	U066	U066	U066
U067	U067	U067	U067	U067
U068	U068	U068	U068	U068
U069	U069	U069	U069	U069
U070	U070	U070	U070	U070
U071	U071	U071	U071	U071
U072	U072	U072	U072	U072
U073	U073	U073	U073	U073
U074	U074	U074	U074	U074
U075	U075	U075	U075	U075
U076	U076	U076	U076	U076
U077	U077	U077	U077	U077
U078	U078	U078	U078	U078
U079	U079	U079	U079	U079

EPA Waste Code List	Module III (Containers) May store these wastes	Module IV (Tanks) May store these wastes	Module IV (Tanks) May treat these wastes	Module VI (Landfills) May dispose these wastes
U080	U080	U080	U080	U080
U081	U081	U081	U081	U081
U082	U082	U082	U082	U082
U083	U083	U083	U083	U083
U084	U084	U084	U084	U084
U085	U085	U085	U085	U085
U086	U086	U086	U086	U086
U087	U087	U087	U087	U087
U088	U088	U088	U088	U088
U089	U089	U089	U089	U089
U090	U090	U090	U090	U090
U091	U091	U091	U091	U091
U092	U092	U092	U092	U092
U093	U093	U093	U093	U093
U094	U094	U094	U094	U094
U095	U095	U095	U095	U095
U096	U096	U096	U096	U096
U097	U097	U097	U097	U097
U098	U098	U098	U098	U098
U099	U099	U099	U099	U099
U101	U101	U101	U101	U101
U102	U102	U102	U102	U102
U103	U103	U103	U103	U103
U105	U105	U105	U105	U105
U106	U106	U106	U106	U106

EPA Waste Code List	Module III (Containers) May store these wastes	Module IV (Tanks) May store these wastes	Module IV (Tanks) May treat these wastes	Module VI (Landfills) May dispose these wastes
U107	U107	U107	U107	U107
U108	U108	U108	U108	U108
U109	U109	U109	U109	U109
U110	U110	U110	U110	U110
U111	U111	U111	U111	U111
U112	U112	U112	U112	U112
U113	U113	U113	U113	U113
U114	U114	U114	U114	U114
U115	U115	U115	U115	U115
U116	U116	U116	U116	U116
U117	U117	U117	U117	U117
U118	U118	U118	U118	U118
U119	U119	U119	U119	U119
U120	U120	U120	U120	U120
U121	U121	U121	U121	U121
U122	U122	U122	U122	U122
U123	U123	U123	U123	U123
U124	U124	U124	U124	U124
U125	U125	U125	U125	U125
U126	U126	U126	U126	U126
U127	U127	U127	U127	U127
U128	U128	U128	U128	U128
U129	U129	U129	U129	U129
U130	U130	U130	U130	U130
U131	U131	U131	U131	U131

EPA Waste Code List	Module III (Containers) May store these wastes	Module IV (Tanks) May store these wastes	Module IV (Tanks) May treat these wastes	Module VI (Landfills) May dispose these wastes
U132	U132	U132	U132	U132
U133	U133	U133	U133	U133
U134	U134	U134	U134	U134
U135	U135	U135	U135	U135
U136	U136	U136	U136	U136
U137	U137	U137	U137	U137
U138	U138	U138	U138	U138
U140	U140	U140	U140	U140
U141	U141	U141	U141	U141
U142	U142	U142	U142	U142
U143	U143	U143	U143	U143
U144	U144	U144	U144	U144
U145	U145	U145	U145	U145
U146	U146	U146	U146	U146
U147	U147	U147	U147	U147
U148	U148	U148	U148	U148
U149	U149	U149	U149	U149
U150	U150	U150	U150	U150
U151	U151	U151	U151	U151
U152	U152	U152	U152	U152
U153	U153	U153	U153	U153
U154	U154	U154	U154	U154
U155	U155	U155	U155	U155
U156	U156	U156	U156	U156
U157	U157	U157	U157	U157

EPA Waste Code List	Module III (Containers) May store these wastes	Module IV (Tanks) May store these wastes	Module IV (Tanks) May treat these wastes	Module VI (Landfills) May dispose these wastes
U158	U158	U158	U158	U158
U159	U159	U159	U159	U159
U160	U160	U160	U160	U160
U161	U161	U161	U161	U161
U162	U162	U162	U162	U162
U163	U163	U163	U163	U163
U164	U164	U164	U164	U164
U165	U165	U165	U165	U165
U166	U166	U166	U166	U166
U167	U167	U167	U167	U167
U168	U168	U168	U168	U168
U169	U169	U169	U169	U169
U170	U170	U170	U170	U170
U171	U171	U171	U171	U171
U172	U172	U172	U172	U172
U173	U173	U173	U173	U173
U174	U174	U174	U174	U174
U176	U176	U176	U176	U176
U177	U177	U177	U177	U177
U178	U178	U178	U178	U178
U179	U179	U179	U179	U179
U180	U180	U180	U180	U180
U181	U181	U181	U181	U181
U182	U182	U182	U182	U182
U183	U183	U183	U183	U183

EPA Waste Code List	Module III (Containers) May store these wastes	Module IV (Tanks) May store these wastes	Module IV (Tanks) May treat these wastes	Module VI (Landfills) May dispose these wastes
U184	U184	U184	U184	U184
U185	U185	U185	U185	U185
U186	U186	U186	U186	U186
U187	U187	U187	U187	U187
U188	U188	U188	U188	U188
U189	U189	U189	U189	U189
U190	U190	U190	U190	U190
U191	U191	U191	U191	U191
U192	U192	U192	U192	U192
U193	U193	U193	U193	U193
U194	U194	U194	U194	U194
U196	U196	U196	U196	U196
U197	U197	U197	U197	U197
U200	U200	U200	U200	U200
U201	U201	U201	U201	U201
U202	U202	U202	U202	U202
U203	U203	U203	U203	U203
U204	U204	U204	U204	U204
U205	U205	U205	U205	U205
U206	U206	U206	U206	U206
U207	U207	U207	U207	U207
U208	U208	U208	U208	U208
U209	U209	U209	U209	U209
U210	U210	U210	U210	U210
U211	U211	U211	U211	U211



EPA Waste Code List	Module III (Containers) May store these wastes	Module IV (Tanks) May store these wastes	Module IV (Tanks) May treat these wastes	Module VI (Landfills) May dispose these wastes
U213	U213	U213	U213	U213
U214	U214	U214	U214	U214
U215	U215	U215	U215	U215
U216	U216	U216	U216	U216
U217	U217	U217	U217	U217
U218	U218	U218	U218	U218
U219	U219	U219	U219	U219
U220	U220	U220	U220	U220
U221	U221	U221	U221	U221
U222	U222	U222	U222	U222
U223	U223	U223	U223	U223
U225	U225	U225	U225	U225
U226	U226	U226	U226	U226
U227	U227	U227	U227	U227
U228	U228	U228	U228	U228
U234	U234	U234	U234	U234
U235	U235	U235	U235	U235
U236	U236	U236	U236	U236
U237	U237	U237	U237	U237
U238	U238	U238	U238	U238
U239	U239	U239	U239	U239
U240	U240	U240	U240	U240
U243	U243	U243	U243	U243
U244	U244	U244	U244	U244
U246	U246	U246	U246	U246

EPA Waste Code List	Module III (Containers) May store these wastes	Module IV (Tanks) May store these wastes	Module IV (Tanks) May treat these wastes	Module VI (Landfills) May dispose these wastes
U247	U247	U247	U247	U247
U248	U248	U248	U248	U248
U249	U249	U249	U249	U249
U271	U271	U271	U271	U271
U278	U278	U278	U278	U278
U279	U279	U279	U279	U279
U280	U280	U280	U280	U280
U328	U328	U328	U328	U328
U353	U353	U353	U353	U353
U359	U359	U359	U359	U359
U364	U364	U364	U364	U364
U367	U367	U367	U367	U367
U372	U372	U372	U372	U372
U373	U373	U373	U373	U373
U387	U387	U387	U387	U387
U389	U389	U389	U389	U389
U394	U394	U394	U394	U394
U395	U395	U395	U395	U395
U404	U404	U404	U404	U404
U408	U408	U408	U408	U408
U409	U409	U409	U409	U409
U410	U410	U410	U410	U410
U411	U411	U411	U411	U411

## NOTES

1. "EPA LIST" (Column 1) are all EPA Waste Codes found in 40 CFR § 261.
2. Must meet Condition II.D.7. of this permit and other conditions of this WAP for storage of waste and the waste must be compatible with storage vessel materials of construction.
3. Must meet LDR Standards (40 CFR § 268) or Approved Variances.
4. The volatile organics in the waste must be < 500 ppm per subpart CC method or GMF/Generator knowledge.
5. For the dioxin wastes marked with an "\*", refer to the Supplemental Waste Management Plan, Attachment II-8, and Condition II.D.7.

## **Appendix 3**

### **Halogenated Organic Compounds of Concern**



ANALYTE	CAS Number	Analysis Method
<b>VOLATILE ORGANICS</b>		
Bromodichloromethane	75-27-4	SW-846 8260B
Bromoform (Tribromomethane)	75-25-2	SW-846 8260B
Bromomethane	74-83-9	SW-846 8260B
Carbon tetrachloride	56-23-5	SW-846 8260B
Chlorobenzene	108-90-7	SW-846 8260B
2-Chloro-1,3-butadiene (Chloroprene)	126-99-8	SW-846 8260B
Chloroethane	75-00-3	SW-846 8260B
2-chloroethyl vinyl ether	110-75-3	SW-846 8260B
Chloroform	67-66-3	SW-846 8260B
Chloromethane	74-87-3	SW-846 8260B
3-Chloropropene (Allyl Chloride)	107-05-1	SW-846 8260B
Dibromochloromethane	124-48-1	SW-846 8260B
1,2-Dibromo-3-chloropropane	96-12-8	SW-846 8260B or 8270C
1,2-Dibromoethane	106-93-4	SW-846 8260B
Dibromomethane (methylene bromide)	74-95-3	SW-846 8260B
trans-1,4-Dichloro-2-butene	110-57-6	SW-846 8260B
Dichlorodifluoromethane	75-71-8	SW-846 8260B
1,1-Dichloroethane	75-34-3	SW-846 8260B
1,2-Dichloroethane	107-06-2	SW-846 8260B
trans-1,2-Dichloroethene	156-60-5	SW-846 8260B
1,1-Dichloroethene	75-35-4	SW-846 8260B

<b>ANALYTE</b>	<b>CAS Number</b>	<b>Analysis Method</b>
1,2-Dichloropropane	78-87-5	SW-846 8260B
cis-1,3-Dichloropropene	10061-01-5	SW-846 8260B
trans-1,3-Dichloropropene	10061-02-6	SW-846 8260B
Methyl iodide (Iodomethane)	74-88-4	SW-846 8260B
Methylene chloride (Dichloromethane)	75-09-2	SW-846 8260B
Pentachloroethane	76-01-7	SW-846 8260B or 8270C
1,1,1,2-Tetrachloroethane	630-20-6	SW-846 8260B
1,1,2,2-Tetrachloroethane	79-34-5	SW-846 8260B
Tetrachloroethene	127-18-4	SW-846 8260B
1,1,1-Trichloroethane	71-55-6	SW-846 8260B
1,1,2-Trichloroethane	79-00-5	SW-846 8260B
Trichloroethene	79-01-6	SW-846 8260B
Trichlorofluoromethane	75-69-4	SW-846 8260B
1,2,3-Trichloropropane	96-18-4	SW-846 8260B
Vinyl chloride	75-01-4	SW-846 8260B
<b>SEMIVOLATILE COMPOUNDS (ACID/BASE/NEUTRAL EXTRACTABLES)</b>		
bis(2-Chloroethoxy)methane	111-91-1	SW-846 8270C
bis(2-Chloroethyl) ether	111-44-4	SW-846 8270C
bis(2-Chloroisopropyl) ether (2,2'-oxybis(1-Chloropropane))	108-60-1	SW-846 8270C
p-Chloroaniline	106-47-8	SW-846 8270C
Chlorobenzilate	510-15-6	SW-846 8270C
4-Chloro-3-methylphenol (p-Chloro-m-cresol)	59-50-7	SW-846 8270C

<b>ANALYTE</b>	<b>CAS Number</b>	<b>Analysis Method</b>
2-Chloronaphthalene	91-58-7	SW-846 8270C
2-Chlorophenol	95-57-8	SW-846 8270C
3-Chloropropionitrile		
1,2-Dichlorobenzene (o-Dichlorobenzene)	95-50-1	SW-846 8270C
1,3-Dichlorobenzene (m-Dichlorobenzene)	541-73-1	SW-846 8270C
1,4-Dichlorobenzene (p-Dichlorobenzene)	106-46-7	SW-846 8270C
3,3'-Dichlorobenzidine	91-94-1	SW-846 8270C
2,4-Dichlorophenol	120-83-2	SW-846 8270C
2,6-Dichlorophenol	87-65-0	SW-846 8270C
Hexachlorobenzene	118-74-1	SW-846 8270C
Hexachlorobutadiene	87-68-3	SW-846 8270C
Hexachlorocyclopentadiene	77-47-4	SW-846 8270C
Hexachloroethane	67-72-1	SW-846 8270C
Hexachlorophene	70-30-4	SW-846 8270C
Hexachloropropene	1888-71-7	SW-846 8270C
4,4-Methylinebis(2-chloroaniline)		
Isodrin	465-73-6	SW-846 8270C
Pentachlorobenzene	608-93-5	SW-846 8270C
Pentachloronitrobenzene	82-68-8	SW-846 8270C
Pentachlorophenol	87-86-5	SW-846 8270C
Pronamide	23950-58-5	SW-846 8270C
1,2,4,5-Tetrachlorobenzene	95-94-3	SW-846 8270C
2,3,4,6-Tetrachlorophenol	58-90-2	SW-846 8270C



<b>ANALYTE</b>	<b>CAS Number</b>	<b>Analysis Method</b>
1,2,4-Trichlorobenzene	120-82-1	SW-846 8270C
2,4,5-Trichlorophenol	95-95-4	SW-846 8270C
2,4,6-Trichlorophenol	88-06-2	SW-846 8270C

Tris(2,3-dibromopropyl)phosphate

<b>ORGANOCHLORINE PESTICIDES &amp; PCBs</b>		
Aldrin	309-00-2	SW-846 8081A or 8270
Hexachlorocyclohexane alpha-BHC	319-84-6	SW-846 8081A or 8250
Hexachlorocyclohexane beta-BHC	319-85-7	SW-846 8081A or 8250
Hexachlorocyclohexane delta-BHC	319-86-8	SW-846 8081A or 8250
Hexachlorocyclohexane gamma-BHC (Lindane)	58-89-9	SW-846 8081A or 8250
Chlordane	57-74-9	SW-846 8081A or 8250
4,4'-DDD	72-54-8	SW-846 8081A or 8270
4,4'-DDE	72-55-9	SW-846 8081A or 8270
4,4'-DDT	50-29-3	SW-846 8081A or 8270
Dieldrin	60-57-1	SW-846 8081A or 8270
alpha-Endosulfan (Endosulfan I)	959-98-8	SW-846 8081A or 8270
beta-Endosulfan (Endosulfan II)	33213-65-9	SW-846 8081A
Endrin	72-20-8	SW-846 8081A or 8270
Endrin aldehyde	7421-93-4	SW-846 8081A or 8270
Heptachlor	76-44-8	SW-846 8081A or 8270
Heptachlor epoxide	1024-57-3	SW-846 8081A or 8270
Kepone	143-50-0	SW-846 8270C
Methoxychlor	72-43-5	SW-846 8081A or 8270

<b>ANALYTE</b>	<b>CAS Number</b>	<b>Analysis Method</b>
PCB-1016	12674-11-2	SW-846 8082
PCB-1221	11104-28-2	SW-846 8082
PCB-1232	11141-16-5	SW-846 8082
PCB-1242	53469-21-9	SW-846 8082
PCB-1248	12672-29-6	SW-846 8082
PCB-1254	11097-69-1	SW-846 8082
PCB-1260	11096-82-5	SW-846 8082
Toxaphene	8001-35-2	SW-846 8081A or 8250
<b>Phenoxyacetic acid herbicides *</b>		
2,4-Dichlorophenoxy acetic acid (2,4-D)	94-75-7	SW-846 8151A
2,4,5-T	93-76-5	SW-846 8151A
2,4,5-TP (Silvex)	93-72-1	SW-846 8151A

\* When constituent specific analysis is conducted, these only have to be quantified if the waste stream is non-incinerator residue and contains one or more of these compounds and/or carries a K042 or K043 waste code.



## **Appendix 4**

### **HOC Screen**

## Appendix 4

### HOC Screen

#### **HOC SCREEN (Lab Test with a. ECD or b. Electrometric Detection) (SK-22 a / b)**

##### **SCOPE**

This method describes the preparation and analysis of samples for Halogenated Organic Compounds (HOCs) at the Grassy Mountain Landfill Facility. HOC listed compounds are specified in Appendix 3 of this WAP.

##### **INTRODUCTION**

GMF uses this method to screen wastes that will be land disposed for the presence of chemicals that may be incompatible with the landfill liner in organic halide concentrations above 1000 ppm or equivalent TCLP levels. It may also be used to determine total organic halide concentrations or equivalent TCLP halide concentrations.

**SK-22a** This method provides sample extraction and gas chromatographic conditions for the detection of halogenated organic compounds in waste samples. A 0.5  $\mu$ l to 2  $\mu$ l aliquot of the extract is injected into the gas chromatograph (GC) and compounds in the GC effluent are detected by an electron capture detector (ECD). A temperature program is used in the gas chromatograph to separate the HOC target compounds from the internal standard compound, decachlorobiphenyl (DCB).

**SK-22b** Alternatively, following the sample extraction (Steps 3.1 – 3.8 of SK-22a), the HOC screen may be conducted by converting the halogenated compounds in the extract to inorganic halide; the inorganic halide ions are extracted into an aqueous buffer solution; and the chloride content is measured using an ion specific chloride electrode. Conversion to inorganic halide, and measurement of chloride content is conducted using a Dexsil L2000 Analyzer (or equivalent) for chlorinated organics. Subsequent to extraction method SK-22b is based on EPA Method 9078.

Extraction is conducted using the same reagents and equipment for both methods SK-22a and SK-22b. Different matrix spike standards and calibration standards are used to suit the different instrumentation.

##### **SK-22a APPARATUS AND MATERIALS**

- 1.1 Gas chromatograph
  - 1.1.1 Gas Chromatograph - Analytical system complete with gas chromatograph suitable for cool on-column or split-splitless injections and all required accessories (including detector, analytical columns, data collection and storage device, gases, syringes, *etc.*).
  - 1.1.2 Column - capillary column, 25 or 30 meters in length (either 0.25 mm or 0.32 mm ID), DB-5 or DB-5MS (J&W Scientific or equivalent).
  - 1.1.3 Detector - Electron capture detector (ECD).
- 1.2 Volumetric flasks - 2 ml, class A (Note: 3 ml, 4 ml, or 5 ml volumetric flasks may be used in place of the 2 ml flask, but the amount of internal standard added shall be adjusted to account for the increased extract volume).
- 1.3 Balance - Analytical, capable of weighing 0.01 g.
- 1.4 Syringe - 2.5 ml or 5 ml, gas tight.
- 1.5 Microsyringe - 250 µl or 500 µl, gas tight.
- 1.6 Glass scintillation vials - 20 ml, with Teflon or aluminum foil-lined screw-cap.
- 1.7 Spatula - stainless steel or Teflon coated.
- 1.8 Vials and caps - 2 ml for GC autosampler.
- 1.9 Disposable pipets - Pasteur.
- 1.10 Centrifuge - capable of spinning at 2000 rpm.
- 1.11 Dispenser, digital bottle top - Brinkmann Inc., Cat No. 50-03-530-1 or equivalent.

## **SK-22a REAGENTS**

- 2.1 Internal standard solution - Decachlorobiphenyl at a nominal concentration of 100 mg/l in acetone.
- 2.2 HOC matrix spike standard - HOC standard in acetone at a total HOC concentration of 500 mg/l (this standard may also contain hexane and/or methanol as necessary to dissolve all of the selected HOC compounds). The HOC matrix spike standard should contain the same compounds used to prepare the calibration standards (step 2.3).
- 2.3 Calibration standards - HOC standards at a minimum of five concentration levels in isooctane (add acetone and/or methanol as necessary to dissolve all of the selected HOC compounds). One of the concentration levels shall be at a concentration near, but above the method detection limit. The remaining concentration levels define the working range of the GC. This standard contains from 10 to 15 HOC compounds including three or more compounds selected from the Volatiles list, four or more compounds from the Semivolatiles list, one or more compounds from the Organochlorine Pesticides list, and one or more PCB compounds as provided in Appendix 3. For example, the following compounds were used to prepare the calibration and matrix spike information provided in Tables 1 to 3:
  - 2.3.1 Hexachloroethane,
  - 2.3.2 Hexachlorobutadiene,
  - 2.3.3 Hexachlorocyclopentadiene,
  - 2.3.4 Hexachlorobenzene,
  - 2.3.5 3,3' Dichlorobenzidine,
  - 2.3.6 1,2 Dichloroethene
  - 2.3.7 Bromodichloromethane,
  - 2.3.8 1,2,3 Trichloropropane,
  - 2.3.9 Aldrin,
  - 2.3.10 Dieldrin,
  - 2.3.11 Decachlorobiphenyl (internal standard).
- 2.4 Daily calibration check standard - Identical to the mid-level calibration standard (section 2.3 above). Prepare fresh calibration check standards every 14 days at a minimum. Maintain the calibration check standards in sealed vials at  $4^{\circ} \pm 2^{\circ}$  C. Standards may equilibrate at room temperature (usually between  $60^{\circ}$  and  $80^{\circ}$ F) and be

maintained in sealed autosampler vials at room temperature while the standard is being prepared, loaded or analyzed.

- 2.5 Tune standard - Pentachlorophenol at a nominal concentration of 5 mg/l in methanol.
- 2.6 Sodium sulfate - Anhydrous, granular.
- 2.7 Extraction Solvent #1 - 2,2,4-Trimethyl-pentane (isooctane, pesticide quality or equivalent)
- 2.8 Extraction Solvent #2 - Methanol (pesticide quality or equivalent).

### **SK-22a / b SAMPLE PREPARATION PROCEDURE**

- 3.1 If TCLP has been approved for analytical comparison and the intent is to analyze a TCLP extract of the waste, use SW-846 Method 1311, section 7.2, to obtain that extract.
- 3.2 Place a 20 ml glass scintillation vial onto the balance and tare the balance to read 0.00 ± 0.05 grams.
- 3.3 Place approximately 1 gram of the waste or TCLP waste extract sample (Step 3.1) or blank matrix into the glass scintillation vial and record the sample weight to within 0.01 grams. A larger sample weight may be used provided the weight is accurately recorded. The sample matrix may be solid, liquid, solid/liquid, or sludge.
- 3.4 Add approximately 1-2 grams of anhydrous sodium sulfate to the glass scintillation vial. If the waste sample is primarily liquid, add additional sodium sulfate to produce a sludge or a sodium sulfate-sample slurry.
- 3.5 For the method blank and waste samples, add 10.0 ml of isooctane to the sample using a bottle top dispenser or another appropriate delivery device.
- 3.6 For matrix spike samples, add 1.0 ml of the HOC matrix spike standard followed by 9.0 ml of isooctane. Add the HOC matrix spike standard using a 2.5 ml or 5 ml



syringe or bottle top dispenser and add the isooctane in a manner analogous to the solvent addition in section 3.4.

- 3.7 Cap the glass scintillation vial and vigorously shake the contents for 2 minutes. Use a robotic shaker (Wrist action shaker, Burrell Inc., Model 75 or equivalent device) or a vortex mixer to shake the vials. Indicate in the sample preparation log occurrences in which samples are mixed by hand, otherwise use the robotic shaker to perform this task.
- 3.8 Centrifuge the sample and the extract liquid in the glass scintillation vial at approximately 2000 RPM for 5-10 minutes.

#### **SK-22a**

- 3.8 Transfer 2.0 ml of the supernatant into a 2 ml volumetric flask, class A. Larger volumes may be used provided that the final volume is known and accurately recorded.
- 3.9 Using a 250  $\mu$ l or 500  $\mu$ l syringe or equivalent, add 100  $\mu$ l of the internal standard solution (section 2.1) to the volumetric flask (the resulting volume is 2.1 ml). If an extract volume larger than 2 ml was used in step 3.8, increase the amount of internal standard accordingly (*i.e.*, add 50  $\mu$ l of the internal standard solution for each 1 ml extract volume).
- 3.10 Cap the volumetric flask and mix the contents. Mixing is achieved by inverting the volumetric flask numerous times (*i.e.*, invert the volumetric flask 10 or more times to assure adequate mixing of the flask contents) or by using a high speed mechanical mixer (Vortex Genie 2, VWR Scientific, or equivalent). Documentation detailing the number of times in which each volumetric flask is inverted is not required.
- 3.11 Fill a 2 ml GC autosampler vial with the extract liquid and internal standard mixture and cap the vial. The sample extract may be stored in the sealed autosampler vial under refrigeration at  $4^{\circ} \pm 2^{\circ}$  C for up to 14 days prior to GC analysis. Samples may equilibrate at room temperature (usually between 60° and 80 °F) and be maintained in sealed autosampler vials at room temperature while the sample is being prepared, loaded or analyzed.

Methanol Extraction: Wastes that are known (from generator knowledge or some other means) to contain halogenated phenols may be subjected to the methanol extraction (steps 3.12 through 3.19). Use this option as an additional analysis when requested by the facility manager or his/her designee (*e.g.*, laboratory manager, group leader, *etc.*). If the additional analysis is not specifically requested, proceed to section 8 of this SOP.

- 3.12 Decant the remaining isooctane from each of the sample vial(s) into an appropriate waste container.
- 3.13 Add 10.0 ml of methanol to the same sample container(s), referred to in step 3.12, in a manner analogous to section 3.4.
- 3.14 Cap the glass scintillation vial and vigorously shake the contents for 2 minutes (see section 3.6 above).
- 3.15 Centrifuge the sample and the methanol extract liquid in the glass scintillation vial at approximately 2000 RPM for 5-10 minutes.
- 3.16 Transfer 5.0 ml of the supernatant into a 5 ml volumetric flask, class A. Extract volumes smaller than 5 ml may be used provided that the final volume is known and accurately recorded.
- 3.17 Using a 500  $\mu$ l syringe or equivalent, add 250  $\mu$ l of the internal standard solution (section 2.1) to the volumetric flask (the resulting volume is 5.25 ml). If an extract volume smaller than 5 ml was used in step 3.16, decrease the amount of internal standard accordingly (*i.e.*, add 50  $\mu$ l of the internal standard solution for each 1 ml extract volume).
- 3.18 Cap the volumetric flask and mix the contents (see section 3.10 above).
- 3.19 Fill a 2 ml GC autosampler vial with the extract liquid and internal standard mixture and cap the vial. The sample extract may be stored in the sealed autosampler vial at  $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$  for up to 14 days prior to GC analysis. Samples may equilibrate at room temperature (usually between  $60^{\circ}$  and  $80^{\circ}\text{F}$ ) and be maintained in sealed autosampler vials at room temperature while the sample is being prepared, loaded or analyzed.

## SK-22a PROCEDURE AND CALCULATIONS

### 4.1 Gas chromatography operating conditions

- 4.1.1 Operate the GC in either splitless injection mode or cool on-column injection mode. See the Hewlett Packard GC reference manual for details. If the splitless mode is selected, install a clean injector port liner as recommended by the instrument manufacturer for splitless operation (Restek Corp., Cat No 20796 or equivalent). For cool on-column injections, a 0.53 mm ID guard column is recommended (Restek Corp., Cat No 10045 or equivalent).
- 4.1.2 Install a low-bleed injection port septum (Supelco, Inc., Cat No. 2-0654 or equivalent). Replace the septum whenever the conditions of section 9.1.2 are not obtained.
- 4.1.3 Carrier gas - Set the helium gas flow between 2 and 10 ml/min. Adjust the column flow so that DCB elutes within 25 minutes of injection.
- 4.1.4 Make-up gas - Set the nitrogen flow to  $75 \pm 25$  ml/min.
- 4.1.5 If splitless injection is selected, set the injection port temperature at a constant temperature in the range of 200° and 250°C, inclusive. If cool on-column injection is selected, injection port temperatures may range from ambient to 280 °C, inclusive. Temperature programming of the cool on-column injection port allows the extract to be deposited onto the GC column at lower temperatures (less than 150 ° C) and the final temperature may be ramped above 150 ° C in order to drive the least volatile compounds out of the injection port area.
- 4.1.6 Detector - Set the detector temperature at a constant temperature of  $280^{\circ} \pm 30$  °C. Calibration of the temperature monitoring thermocouple (or other similar device) is not a requirement of this procedure.
- 4.1.7 Program the oven temperature to hold at 100° C for 1 minute; then increase at a rate of 30° C/min to a final temperature of 280° C and hold for 8 minutes. Modifications to the oven temperature protocol are allowable in order to produce clear chromatographic resolution between the internal standard and

the HOC analytes, provided it is accurately documented. In addition, it may be necessary to sustain the oven temperature at 280 ° C longer than 8 minutes in order for all of the analytes to elute from the column prior to the next injection.

4.2 Calibration - Refer to SW-846 method 8000 for calibration techniques and response factor calculations.

4.2.1 Calibration must take place using the same sample introduction method (*e.g.*, oven temperature program, injection port temperature, detector temperature, GC column, *etc.*) used to analyze actual samples.

4.2.2 Each calibration standard shall contain an internal standard compound at a concentration that produces a signal near the mid-range for the ECD response. For example, a 1- $\mu$ l injection should produce a mid-range response at an internal standard concentration of about 5 mg/l (Note: instrument response may vary with time and between ECDs). Calculate the HOC response factor for each calibration standard as follows:

$$RF = (A_s C_{is}) / (A_{is} C_s)$$

where:

$A_s$  = Total HOC area (excluding the area of the internal standard and isooctane blank).

$A_{is}$  = Area of the internal standard.

$C_{is}$  = Concentration of the internal standard, mg/l.

$C_s$  = Total HOC concentration of the calibration standard, mg/l.

1.1.3. Calculate the mean response factor value,  $RF_x$ , as follows:

RFi

$$RF_x = \frac{\sum_i}{n}$$

where:

n = the number of calibration levels.

RF<sub>i</sub> = the response factor for each calibration level.

### 4.3 Gas chromatographic analysis

4.3.1 For each day of analysis, inject blank isooctane to establish the instrument baseline and determine any column contamination that may interfere with HOC quantitation (inject blank methanol when the methanol extraction is used).

4.3.2 Inject the tune standard (section 2.5) and check the resulting area against historical results (two standard deviations below the average of pentachlorophenol areas). If the pentachlorophenol area value is less than this control limit value, perform column maintenance as needed to rejuvenate instrumental performance. For splitless injections, maintenance may include replacing the septum and/or GC insert liner and/or replacing the gold plated column seal and/or trimming 3 to 9 inches from the head of the analytical column (the end attached to the injection port during operation) and/or replacing the analytical column. For cool on-column injections, maintenance may include replacing the septum and/or guard column and/or trimming 3 to 9 inches from the head of the analytical column and/or replacing the analytical column.

4.3.3 Prior to the analysis of actual samples, verify the instrument calibration by injecting the mid-level calibration standard onto the GC. Calculate the response factor (RF<sub>c</sub>) for the standard as outlined in step 4.2.2 above. If the RF<sub>c</sub> value varies from the predicted response (RF<sub>s</sub>) by more than ± 15%, perform maintenance as outlined above in section 4.3.1 and reinject the mid-level standard. If the RF<sub>c</sub> value continues to exceed the ± 15% criteria, prepare a fresh mid-level continuing calibration standard or new calibration curve.

4.3.4 The HOC concentration is calculated from the total area of all peaks excluding the internal standard area and any area associated with background, the methanol blank, the isooctane blank or instrument noise. Determine the total HOC concentration in a sample as follows:

$$\text{Concentration (mg/kg)} = (A_s C_{is} D) / (A_{is} RF_x W_s)$$

Where:

D = Equivalent dilution volume, 10.5 ml, provided that no additional dilution was performed.

$W_s$  = Weight of the composite sample, g.

$A_s$ ,  $C_{is}$ ,  $A_{is}$ , and  $RF_x$  are defined above.

4.3.5 The total HOC concentration is the sum of the HOC concentration in the isooctane extract plus 1.25 times the HOC concentration in the methanol extract if the additional analysis option is used. Otherwise, the total HOC concentration is the HOC concentration in the isooctane extract. (Should there be a limit to the value of the interference that can be subtracted? egc

4.3.6 If the total HOC concentration for a sample is less than 1000 mg/kg and a response for a peak exceeds the detector quantitation limit, prepare a dilution of the sample extract with the appropriate solvent (either isooctane or methanol depending upon which extract liquid contained the truncated peak). Add additional DCB to the sample such that the final concentration of the internal standard is moderately consistent (*i.e.*, accurate sample concentrations are obtainable with the DCB concentration held between 2 mg/kg and 8 mg/kg) among all sample injections (see section 4.2.2 above).

4.3.7 If the total HOC concentration of the sample is less than 1000 mg/kg and exceeds the linear range of the system, dilute the sample as outlined above in section 4.3.6.

4.3.8 Any sample having a total HOC concentration equal to or more than 1000 mg/kg or equivalent TCLP value shall be extracted and analyzed for the

specific chemicals in Appendix 3 of the WAP, unless the Grassy Mountain Facility elects to treat the waste or reject it.

## **SK-22a QUALITY CONTROL**

5.1 Before analyzing any samples, the criteria outlined in Step 7.4.3 of SW-846 method 8000 must be met. Failure to meet the criteria in section 5.1.1 of this SOP shall require re-running the initial calibration, whereas failure to meet the criteria outlined in 5.1.2 may result in re-running the initial calibration or the preparation and injection of a fresh daily calibration standard.

5.1.1 Section 7.4.3.3 of method 8000 requires that the  $RF_x$  is constant ( $< 20\%$  RSD) when comparing calibration factors.

5.1.2 Section 7.4.3.4 of method 8000 sets a limit of  $\pm 15\%$  difference when comparing daily HOC response versus the initial HOC response (see section 4.3.2 of this SOP).

5.2 Analyze matrix spikes of samples at a minimum frequency of 10% (1 for every 10 samples). If the total HOC recovery fails the acceptance criteria,  $X \pm 2s$  (where X is the average and s is the standard deviation of historical data), take corrective actions. Update control limits monthly at a minimum.

### 5.2.1 Corrective actions

5.2.1.1 Check the sample preparation records and associated calculations for errors.

5.2.1.2 If the unspiked sample contains HOCs, subtract the unspiked sample concentration from the HOC concentration detected in the spiked sample.

5.2.1.3 Analyze the daily calibration check standard to ensure that the GC/ECD is operating within normal parameters. If the response factor criteria are not met, take the corrective actions specified in section 4.3.2 and reanalyze the affected samples.

5.2.1.4 If none of the aforementioned actions lead to the elucidation of the problem, matrix interference forces are probable. If the results of the MS AND MSD confirm each other matrix interference are confirmed. If they do not confirm, freshly prepare the samples and matrix spikes from the associated batch to confirm the presence of a matrix interferant.

5.3 Analyze duplicate matrix spike samples at a minimum frequency of 10% (1 for every 10 samples). If the % RPD fails the acceptance criteria,  $X \pm 2s$  (where X is the average % RPD value and s is the standard deviation value of historical data), take corrective actions. Update control limits monthly at a minimum.

5.4 Analyze a method blank with each sample batch or 1 blank for every 10 unspiked samples. Add about 1 gram of blank sand to the scintillation vial and conduct the extraction process as outlined in section 3 above.

5.4.1 Method blank evaluation criteria - Section 2.3 of this SOP states that one of the calibration standards is at a concentration near, but above the method detection limit. If the total HOC area ( $A_s$  as defined in section 4.2.2 above) in the method blank does not exceed the total area in the least concentrated HOC calibration standard, the method blank contamination is acceptable.

## **SK-22a METHOD PERFORMANCE**

6.1 In a single laboratory, the average recoveries and standard deviations presented in Table 1 were obtained using GC/ECD techniques. Three replicate samples were spiked near the total HOC concentration of 500 mg/kg. A wide variety of sample matrices were studied. One of the test samples was primarily liquid (Sump Solids), one of the matrices was an organic sludge (Refinery Waste) and one of the samples contained both solids and liquid (Plating Sludge) at a ratio of about 9:1 respectively. The other samples were solids of various origins. All extractions were performed on composite samples containing liquids and/or solids that were consistent with the total sample composition.

6.2 Detection Limits - the method detection limits vary with each individual Appendix 3 listed compound. The detection limit for each Appendix 3 listed analyte has not yet



- been established. However, the initial studies indicate that Aroclors (PCBs) and other multi-component analytes may be detected at a concentration of 2 mg/kg while individual HOC compounds are usually observed at a concentration of 1 mg/kg.
- 6.3 The accuracy and precision of this method may be adversely influenced by the sample matrix. However, in a single laboratory, accuracy was determined within  $\pm 15\%$  of the theoretical value (Table 1) and precision was found within  $\pm 5\%$  (Table 3). Precision was determined by injecting a standard containing 25 mg/kg total HOC content. The standard was prepared in isooctane and contained each of the compounds listed in step 2.3 above at a concentration of 2.5 mg/kg each.
- 6.4 The data obtained during this study (Tables 1,2 and 3) were obtained using a calibration range that spanned from total HOC concentrations of 0.5 to 50 mg/kg, inclusive.

## Per- and Polyfluoroalkyl Substances (PFAS): Incineration to Manage PFAS Waste Streams

### Background

Per- and polyfluoroalkyl substances (PFAS) are a very large class of man-made chemicals that include PFOA, PFOS and GenX chemicals. Since the 1940s, PFAS have been manufactured and used in a variety of industries in the United States and around the globe. PFAS are found in everyday items such as food packaging, non-stick stain repellent, and waterproof products, including clothes and other products used by outdoor enthusiasts. PFAS are also widely used in industrial applications and for firefighting. PFAS can enter the environment through production or waste streams and can be very persistent in the environment and the human body. PFAS have many and varied pathways into waste streams, presenting challenges for ultimate disposal. Determining the appropriate method for ultimate disposal of PFAS wastes is a complex issue due to their volatility, solubility, and environmental mobility and persistence. EPA is currently considering multiple disposal techniques, including incineration, to effectively treat and dispose of PFAS waste.

### Options and Considerations for the Disposal of PFAS Waste via Incineration

One potential disposal method for PFAS waste is through high temperature chemical breakdown, or incineration. Incineration has been used as a method of destroying related halogenated organic chemicals such as polychlorinated biphenyls (PCBs) and ozone-depleting substances (ODSs), where sufficiently high temperatures and long residence times break the carbon-halogen bond, after which the halogen can be scrubbed from the flue gas, typically as an alkali-halogen. PFAS compounds are difficult to break down due to fluorine's electronegativity and the chemical stability of fluorinated compounds. Incomplete destruction of PFAS compounds can result in the formation of smaller PFAS products, or products of incomplete combustion (PICs), which may not have been researched and thus could be a potential chemical of concern.



Incineration of halogenated organic compounds occurs via unimolecular decomposition and radical reaction. For unimolecular decomposition, fluorinated organic compounds likely require higher temperatures to achieve 99.99% destruction in 1 second residence time than do their chlorinated counterparts. Unimolecular decomposition of highly fluorinated organics most likely occurs through breakage of C-C or C-F bonds (Tsang et al., 1998). The most difficult fluorinated organic compound to decompose is  $CF_4$ , requiring temperatures over  $1,400^{\circ}C$ , but is easily monitored, making it a potential candidate for destructibility trials.

Fluorinated organic compounds can also be degraded via incineration by free radical initiation, propagation, and branching mechanisms. Although hydroxyl radical reaction with hydrocarbons is a common combustion flame-propagating mechanism, the strength of the C-F bond makes this pathway unlikely and would instead leave atomic hydrogen, formed at high temperatures, as the likely radical reacting with the carbon-bonded fluorine.

Radical reactions are more likely for chloroalkanes than fluoroalkanes, due to the lower bond energy of C-Cl (Tsang et al., 1998). If formed, the extremely high electronegativity of fluorine radicals results in their quick combination with other radical species, preventing flame-sustaining free radical propagation and branching processes. This propensity to terminate free radical chemistry make PFAS effective fire suppressants.

The stability of perfluorinated radicals leads to higher concentrations and correspondingly increased propensity to recombine, creating larger molecules that are products of incomplete combustion (PIC) and distinctive from the original fluorinated organics. These reactions are promoted by partial organic combustion resulting from insufficient temperatures, time, and mixing. In addition, the presence of catalytic surfaces, often metals, promotes further reaction and PIC formation in post-combustion regions. This scenario has been most studied related to the formation of polychlorinated dibenzo-*p*-dioxins and dibenzofurans (PCDDs/PCDFs) in the cool-down regions of waste incinerators.

The effectiveness of incineration to destroy PFAS compounds and the tendency for formation of fluorinated or mixed halogenated organic byproducts is not well understood. Few experiments have been conducted under oxidative and temperature conditions representative of field-scale incineration. Limited studies on the thermal destructibility of fluorotelomer-based polymers found no detectable levels of perfluorooctanoic acid after 2 second residence time and 1,000°C (Yamada et al., 2005; Taylor et al., 2014). Emission studies, particularly for PICs, have been incomplete due to lack of necessary measurement methods suitable for the comprehensive characterization of fluorinated and mixed halogenated organic compounds.

## Addressing Gaps in Research for PFAS Waste

The extent to which PFAS-containing waste material in the United States is incinerated is not fully documented or understood. PFAS compounds are not listed as hazardous wastes under the Resource Conservation and Recovery Act (RCRA) nor as hazardous air pollutants under Clean Air Act regulations, so they are not subject to the tracking systems associated with these regulations.

EPA is currently considering multiple disposal techniques, including incineration, to effectively treat and dispose of PFAS wastes. EPA researchers are currently studying PFAS incineration, sampling and analytical methods development, and industrial field sampling. Research on thermal stability of PFAS compounds, the ability to fully

capture and identify PFAS compounds and their thermal decomposition byproducts, and the efficacy of emission control technologies are areas of targeted research. These efforts, in cooperation with states and industries, is aimed at proper disposal of PFAS-laden wastes without media-to-media transfer or environmental release.

## References

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## Contacts

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*Note: This technical brief is a summary of the science and does not necessarily reflect EPA policy.*

**Smith, Sean D. (ECY)**

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**From:** Sonya Lunder <sonya.lunder@sierraclub.org>  
**Sent:** Monday, September 21, 2020 9:56 AM  
**To:** Smith, Sean D. (ECY)  
**Subject:** Sierra Club legal documents for military incineration lawsuit  
**Attachments:** 059. Decl. of W. Rickman 06 19 2020.pdf; 058. Decl. of P. Grandjean 06 19 2020.pdf; filed\_complaint\_-\_pfas\_incineration\_suit.pdf

**THIS EMAIL ORIGINATED FROM OUTSIDE THE WASHINGTON STATE EMAIL SYSTEM - Take caution not to open attachments or links unless you know the sender AND were expecting the attachment or the link**

Hello Sean,

In advance of our technical comments on the Washington state proposal to incinerate its PFAS stockpiles at Clean Harbors Aragonite, I am sharing our legal materials related to the lawsuit against the Department of Defense for its PFAS incineration contracts. Attached you'll find our legal complaint, and declarations from Philippe Grandjean on the health impacts of PFAS chemicals, and William Rickman on the issues related to PFAS incineration.

We are very interested in the prospects of the state contracting with Clean Harbors to stockpile the state's inventory of AFFF. Please keep me updated if you have any new developments in this regard.

Thank you,

Sonya

--

Sonya Lunder (she/her)  
Senior Toxics Policy Advisor  
Gender, Equity & Environment Program  
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**\*\*Like millions of others, I'm working with kids at home for the foreseeable future\*\***

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10 *Counsel for Plaintiffs*

11  
 12 IN THE UNITED STATES DISTRICT COURT  
 13 FOR THE NORTHERN DISTRICT OF CALIFORNIA  
 OAKLAND DIVISION

14 )  
 15 SAVE OUR COUNTY, COMMUNITY IN- )  
 POWER AND DEVELOPMENT )  
 16 ASSOCIATION INC., UNITED )  
 CONGREGATIONS OF METRO EAST, and )  
 17 SIERRA CLUB, )

Case No. 4:20-cv-01267-SBA

18 )  
19 Plaintiffs, )

20 v. )

**DECLARATION OF  
PHILIPPE GRANDJEAN, MD**

21 UNITED STATES DEFENSE LOGISTICS )  
 AGENCY, DARRELL K. WILLIAMS, in his )  
 22 official capacity as Director of the Defense )  
 Logistics Agency, UNITED STATES )  
 23 DEPARTMENT OF DEFENSE, MARK T. )  
 24 ESPER, in his official capacity as Secretary of )  
 the Department of Defense, HERITAGE )  
 25 ENVIRONMENTAL SERVICES, LLC, and )  
 26 TRADEBE TREATMENT AND RECYCLING, )  
 LLC, )  
 27 Defendants. )

1 **DECLARATION OF PHILIPPE GRANDJEAN**

2  
3 I, PHILIPPE GRANDJEAN, hereby affirm and state:  
4

5 **INTRODUCTION AND QUALIFICATIONS**

6 1. I serve as Adjunct Professor of Environmental Health at the Harvard School of  
7 Public Health (since 2003) and as Professor and Chair of Environmental Medicine at the  
8 University of Southern Denmark (since 1982). I was previously an Adjunct Professor of  
9 Neurology and Environmental Health at Boston University Schools of Medicine and Public  
10 Health (1994–2002). I served for more than 30 years as the Consultant in Toxicology to the  
11 Danish Health Authority, where I reviewed and commented on case reports, research studies, and  
12 proposed regulations on environmental chemicals. I also serve on the Scientific Committee of  
13 the European Environment Agency (EEA).  
14

15  
16 2. I hold an M.D. and D.M.Sc. degrees from the University of Copenhagen.

17 3. My research in environmental epidemiology focuses on the health effects of  
18 exposures to environmental chemicals, including perfluorinated alkylate substances (PFASs).  
19 Most of my efforts have concentrated on epidemiology studies of the effects of environmental  
20 pollutants on early human development.  
21

22 4. I have published more than 500 scientific papers, most of which are research  
23 articles in peer reviewed international scientific journals, and I have authored or edited more than  
24 20 books. Seven of my articles published in the last 10 years have earned the attribute “Highly  
25 Cited Paper,” i.e., they received enough citations to place them in the top 1% of published papers  
26 in the field. This list includes an article on PFAS immunotoxicity published in the Journal of the  
27 American Medical Association (JAMA) in 2012 (Grandjean et al. 2012).  
28

1           5.       My research has been entirely funded by public sources, mainly the National  
2 Institutes of Health. My current funding includes an \$8 million center grant from the Superfund  
3 Research Program (National Institute of Environmental Health Sciences, NIEHS), where I serve  
4 as the co-lead and Principal Investigator for one of the four center projects. The Center focuses  
5 entirely on PFASs, how they disseminate, biomagnify and cause adverse health effects. I am also  
6 the joint PI of one of the seven U.S. centers funded for five years by the Agency for Toxic  
7 Substances and Disease Registry (ATSDR) to conduct health examinations of residents exposed  
8 to PFASs through contaminated drinking water. I lead or participate in three additional federally  
9 supported projects on PFAS toxicity.  
10

11           6.       I am (Founding) Editor-in-Chief of the open-access scientific journal,  
12 Environmental Health (since 2002), which ranks among the most highly cited journals in the  
13 field. I serve or have served on editorial boards of about a dozen journals within medicine,  
14 environmental science, and toxicology. As editor and as reviewer for other major journals, I  
15 frequently evaluate manuscripts on environmental epidemiology and toxicology.  
16

17           7.       I have served on, sometimes chaired, or acted as rapporteur, for expert  
18 committees on environmental hazards to human health under the auspices of the World Health  
19 Organization (WHO), the International Agency for Research on Cancer (IARC), the U.S.  
20 Environmental Protection Agency (EPA), the European Commission, the European Food Safety  
21 Authority (EFSA), and other organizations. During my six-year membership of an EFSA expert  
22 panel, I participated in developing the first opinion on “Perfluorooctane sulfonate (PFOS),  
23 perfluorooctanoic acid (PFOA) and their salts” (EFSA 2008), and the “Guidance of the Scientific  
24 Committee on Use of the Benchmark Dose Approach in Risk Assessment” (EFSA 2009).  
25  
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28

1 Recently, EFSA started developing updated opinions on PFASs and invited me to serve as an ad  
2 hoc expert to help complete those assessments (EFSA 2018, 2020).

3 8. I am regularly invited as a speaker at international conferences and other scientific  
4 events. In 2012, I was invited to give a special presentation on the immunotoxicity of PFASs at  
5 the meeting of the (U.S.) National Advisory Environmental Health Sciences Council (at the  
6 NIEHS) and at a meeting of the Emerging Chemicals Workgroup of EPA. In the fall of 2016, I  
7 was invited to give a special presentation on PFOA at the committee meeting of the United  
8 Nations Stockholm Convention. In June 2018, I presented on health risks from PFAS exposure at  
9 a meeting of the Society for Risk Analysis. Later that year, I gave a special seminar on PFASs at  
10 the ATSDR in Atlanta. I was on the planning committee of last year's PFAS conference at  
11 Northeastern University in Boston, and I am a co-organizer of the forthcoming FLUOROS  
12 conference (postponed to October 2021).

13 9. By virtue of my education, training, research, publications, and my knowledge of  
14 the pertinent scientific literature, I am considered an expert on human health effects from  
15 exposure to PFASs. A more complete description of my education and work experience, as well  
16 as a complete list of my publications, is attached to this declaration as Exhibit A.

17 10. For the purposes of this declaration, I have relied in part on my own  
18 epidemiological research and publications concerning PFASs. I have also reviewed the  
19 epidemiological literature concerning other studies on the human health risks associated with  
20 exposure to PFASs, including data provided by the C8 panel, a court mandated series of studies  
21 examining the health effects of PFOA exposure, that found important disease risks associated  
22 with PFAS exposure (C8 Science Panel 2013). The C8 Panel determined that exposure to PFOA  
23 had probable links to adverse effects on the following human health conditions: ulcerative colitis,  
24  
25  
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1 pregnancy-induced hypertension/preeclampsia, thyroid disease, high cholesterol, kidney cancer,  
2 and testicular cancer (C8 Science Panel 2013). These findings have generally been supported  
3 and extended by more recent studies.

4 11. Additionally, I have relied upon the following items: the most recent version of  
5 ATSDR draft ToxProfile for select PFASs, including PFOS and PFOA (ATSDR 2018); the  
6 evaluation of immunotoxicity by the National Toxicology Program (NTP) for PFOS and PFOA  
7 (NTP 2016); the assessment of PFOA’s carcinogenicity by the International Agency for  
8 Research on Cancer (IARC) (IARC 2016); and the opinions of the European Food Safety  
9 Authority (EFSA 2018, 2020).

10 12. I have also relied on toxicological information from laboratory animal studies and  
11 *in vitro* models to supplement existing epidemiological studies.

12 13. Additionally, I have read and relied upon the expert opinions set forth in the  
13 declaration of Dr. William Rickman, also submitted in support of Plaintiffs’ motion summary  
14 judgment. In particular, Dr. Rickman concludes that the incineration of aqueous film forming  
15 foam (“AFFF”) and other PFAS-containing materials present a risk of PFAS air emissions and  
16 increased exposure to PFASs and other hazardous chemicals.

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19  
20 **SUMMARY OF CONCLUSIONS**

21 14. It is my opinion, based on the weight of the epidemiological evidence and  
22 supporting laboratory toxicology evidence that PFASs pose a substantial present and potential  
23 hazard to human health, including immune system functions, reproductive and developmental  
24 functions, endocrine functions, liver and kidney functions, and an increased risk of  
25 cardiovascular disease and certain types of cancer.

1           15.       Given that virtually all Americans already have measurable quantities of PFASs  
2 in their bodies, and that adverse effects have been documented within ranges of background  
3 exposures, any additional PFAS exposures from the air, water sources, and/or food chain  
4 resulting from the incineration of AFFF would increase the risks of adverse health effects for  
5 communities surrounding the incinerators. Within this class, PFOA, PFOS, and PFHxS have the  
6 greatest evidence of adverse health effects, but many different types of PFASs are considered to  
7 have similar health effects (Ritscher et al. 2018) .  
8

9  
10           **BACKGROUND ON PFASs AND ENVIRONMENTAL CONTAMINATION**

11           16.       PFASs do not occur naturally. Rather, PFASs constitute a large, complex, and  
12 ever-expanding class of synthetic chemicals (ATSDR 2018). PFASs have a carbon “backbone,”  
13 characterized by the replacement of hydrogen (H) atoms with fluorine (F) atoms that are bonded  
14 to the carbon backbone. The bond between carbon and fluorine is one of the strongest chemical  
15 bonds. PFASs show high thermal, chemical, and apparent biological inertness; properties that  
16 make them useful for industrial purposes because those properties allow PFASs to repel oil, gas,  
17 and water (ATSDR 2018; Paul et al. 2009).  
18

19           17.       Accordingly, PFASs are used in a broad host of commercial and consumer  
20 products including as a surface protectant, coating on paper packaging, and most relevant here, in  
21 firefighting foams, i.e., AFFF (ATSDR 2018).  
22

23           18.       Yet, the same properties that make these chemicals attractive for industrial use are  
24 precisely why PFASs pose a substantial risk to the environment and human health and are known  
25 as “forever chemicals” (Faber 2019). PFASs are known to be virtually indestructible in the  
26 environment and in the human body which allows for their persistence and bioaccumulation in  
27 both (ATSDR 2018; EPA 2016). In the beginning, the PFASs most commonly used in the  
28

1 United States were PFOA and PFOS (EPA 2006a; Vestergren and Cousins 2009). These  
2 chemicals were largely discontinued after their harmful effects to human health became known  
3 (ATSDR 2018).

4 19. For humans, the PFASs in general share the same exposure pathways; mainly,  
5 discharges to air and water contaminate food and drinking water; breast-feeding is also a  
6 significant exposure route for infants (ATSDR 2018).

7 20. Direct sources of PFASs include emissions throughout the chemicals' life-cycles,  
8 from manufacturing, processing, use and disposal, and leaching from products that contain  
9 PFASs, both intentionally and as an impurity (such as food packaging) (Buck et al. 2011).  
10 Inappropriate treatment of wastes containing PFASs at manufacturing sites or at industrial and  
11 commercial user sites also contribute direct PFAS emissions to air, water, and soil (Prevedouros  
12 et al. 2006).

13 21. Many PFASs are highly mobile, meaning that they can travel long distances from  
14 their original sources. Elevated PFAS concentrations have been detected in Arctic glaciers and  
15 wildlife, evidence of their long-distance transport (MacInnis et al. 2019; Tartu et al. 2018). Most  
16 PFASs or their precursors have sufficient vapor pressure to allow their dissemination via the  
17 atmosphere and eventual deposition on land and water (ATSDR 2018). Increasing evidence  
18 demonstrates airborne transport of PFASs currently serves as a major route of environmental  
19 distribution and potential for human exposure (Shafer 2020). PFASs have also been detected in  
20 rainwater in many parts of the United States, another pathway for long-range transport and  
21 deposition (Scott et al. 2006).

22 22. PFASs (or their salts and precursors) are also highly mobile in water, which  
23 facilitates their ability to widely disperse and potentially leach through soil to reach groundwater.  
24  
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1 As they disperse, PFASs break down to terminal products, which do not degrade under normal  
2 conditions, thus subsequently endangering water sources and the whole food chain system that is  
3 relied upon for agricultural production and human consumption.

4 23. Because PFASs are highly mobile and do not degrade easily, exposure is  
5 widespread in the United States (CDC 2019): more than 99% of American adults have  
6 measurable amounts of at least one PFAS in their blood. PFAS contamination can now be found  
7 in all environmental compartments and will continue to migrate through physical and biological  
8 systems. As of October 2019, nearly 1,400 known locations in all but one state have been  
9 affected by PFAS contamination, including at least 446 communities where PFASs have been  
10 detected in drinking water supplies (Environmental Working Group 2020; Hu et al. 2016;  
11 Walker 2019). At the macro-level, global ocean current patterns represent a significant pathway  
12 for long-range transport of these toxic chemicals, for example, transporting between two to 12  
13 metric tons of PFOA to the Arctic every year and causing PFAS pollutants to aggregate and  
14 accumulate in high latitude regions (Muir 2019; Prevedouros et al. 2006).

15 24. Individuals living in PFAS-contaminated communities accumulate higher blood  
16 concentrations of PFASs than average Americans. For example, one study showed that residents  
17 living near a 3M manufacturing plant in Oakdale, Minnesota had a 100-fold exceedance for  
18 PFOA and 10-fold for PFOS in comparison to the average U.S. resident due to the substantial  
19 contamination of the local drinking water (Minnesota Department of Health 2015).

20 25. Studies confirm that PFASs are easily absorbed once ingested from contaminated  
21 sources and through inhalation of contaminated air (ATSDR 2018). When humans are exposed,  
22 the PFASs bind to blood plasma proteins and also accumulate in the human body, possibly for  
23 decades before being eliminated. PFASs accumulate in internal organs such as the liver, the  
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1 kidneys and the thyroid gland (Perez et al. 2013), as documented even in fetal tissues (Mamsen  
2 et al. 2019).

3 26. The latest science shows that PFASs impact a large number of organs and body  
4 systems and that ambient exposures to PFASs in the American population already increase the  
5 risks of a number of serious health conditions (ATSDR 2018), as discussed further below.  
6

7 27. Since current PFAS exposures affecting average Americans already reach  
8 unsafe levels, and because adverse effects have been documented within the range of background  
9 exposure levels, a person's exposure to any additional PFAS through, for example, the  
10 incineration of AFFF, will increase the associated health risks.  
11

### 12 ADVERSE HEALTH EFFECTS

13 28. As stated earlier, it is my opinion, based on the weight of the epidemiological and  
14 supporting toxicology evidence, that PFASs pose a substantial present and potential hazard to  
15 human health. PFASs interfere with the development and functioning of critical human organ  
16 functions and exacerbate disease risks. My below evaluation relies on the most recent evidence  
17 but is in general agreement with previous risk assessments (ATSDR 2018; EFSA 2018, 2020).  
18

19 29. Upon review of my own research and published studies on PFASs, I conclude that  
20 an association between PFAS exposure and adverse effects on the human immune system is  
21 strong and is supported by ample toxicological and epidemiological evidence demonstrating a  
22 causal link between the two. On the basis of available evidence, the immune system may be the  
23 most sensitive target for PFAS toxicity, as has been concluded by EFSA (EFSA 2020).  
24

25 30. Recently, the NTP has recognized both PFOS and PFOA as "presumed" human  
26 immunotoxicants, i.e., the level of evidence just below "known" (NTP 2016). Additional  
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28

1 evidence shows that PFHxS and PFNA are also associated with weakened immune resistance to  
2 infectious disease in children (Budtz-Jorgensen & Grandjean 2018).

3 31. These conclusions rely on studies that show lower concentrations of specific  
4 antibodies in children with elevated exposures to PFAS and an increased risk of not having  
5 reached the established clinically protective level, even after four vaccinations (Grandjean et al.  
6 2012). Thus, the prospective study that I conducted of 587 children up to 7 years of age showed  
7 that a doubling in exposure to PFOS and PFOA was associated with an overall decrease by about  
8 50% in the children's antibody concentrations (Grandjean et al. 2012; Mogensen et al. 2015a).  
9 EFSA relied on these findings in the most recent risk assessment (EFSA 2020) and also took into  
10 account the parallel findings in a new study from Germany (Abraham et al. 2020).  
11

12 32. As the adaptive immune system is programmed during early postnatal  
13 development, an immunotoxicity assessment is particularly relevant in subjects with PFAS  
14 exposures during early life (Grandjean et al. 2017). While infants may be at risk due to the  
15 presence of PFASs in air and water, the major exposure source is human milk (Mogensen et al.  
16 2015b), through which a mother may transfer a substantial part of her body burden of PFASs.  
17

18 33. To understand the significance of these findings, a brief explanation of routine  
19 immunizations may be helpful. Vaccination is considered one of the cornerstones of modern  
20 disease prevention. A vaccine causes the body to develop resistance to a particular infection  
21 through the body's natural internal defense mechanism: an increase in responsive antibodies. As  
22 a primary defense mechanism, antibody production generates long-term health resistance against  
23 infectious disease.  
24

25 34. In the long term, insufficient antibody responses to vaccinations thwarts the  
26 desired long-term protection against the infectious diseases, likely also beyond the diseases  
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1 targeted by the individual immunizations. Thus, in a study conducted in Norwegian children,  
2 researchers found that increased concentrations of PFOA, PFNA, and PFHxS were linked to  
3 statistically significant increases in the frequency of infections such as the common cold and  
4 gastroenteritis (Granum et al. 2013; Impinen et al. 2019). A lowered antibody response has also  
5 been found in adults (Kielsen et al. 2016; Looker et al. 2014). The role of PFAS exposure in  
6 varying outcomes of coronavirus infection is currently being researched.

8 35. While little evidence suggests an increased risk of allergic disease (Timmermann  
9 et al. 2017), increased PFAS exposure may be linked to auto-immune diseases in which the  
10 body's immune system attacks its own tissues, such as ulcerative colitis (C8 Science Panel 2013;  
11 Steenland et al. 2015). Although these effects are less solidly documented (NTP 2016), the  
12 implications can be substantial for vulnerable populations including children, the elderly, and  
13 individuals with pre-existing immune system disorders. ATSDR concludes that decreased  
14 vaccine responses occur at elevated exposures to PFOA, PFOS, PFHxS, PFDA, and that PFOA  
15 is linked to increased risk of asthma diagnosis (ATSDR 2018).

17 36. It is also my opinion, based on the weight of the epidemiological evidence, and  
18 supporting toxicity evidence, that PFASs pose a substantial present and potential hazard to  
19 human health as carcinogens. Because the immune system is also crucial in detecting and  
20 eliminating cancer cells, immunotoxicity may play a role as a possible mechanism (IARC 2016).  
21 However, PFASs possess several additional key characteristics linked to carcinogenicity  
22 (Temkin et al. 2020).

24 37. As far back as 2006, when the EPA's Science Advisory Board reviewed the  
25 information available on PFOA at the time, it affirmed that the cancer data was consistent with  
26 the EPA Guidelines for Carcinogen Risk Assessment descriptor finding PFOA is "likely to be  
27

1 carcinogenic to humans” (EPA 2006b). Along with these studies, the C8 Science Panel  
2 concluded that there is a probable link from PFOA exposure to testicular cancer and kidney  
3 cancer (C8 Science Panel 2012c). In 2016, the IARC concluded that PFOA is a possible (Group  
4 2B) human carcinogen (IARC 2016). Further support for these conclusions is found in a  
5 statistical analysis study by Professor David Sunding, prepared for the State of Minnesota,  
6 showing a pattern of increased occurrences of total cancer where PFAS concentrations in  
7 drinking water were comparably higher than in surrounding areas (Sunding 2017).  
8

9 38. In addition to the substantial potential to cause cancer of the kidneys and the  
10 testicles (C8 Science Panel 2013; IARC 2016), available evidence shows it is also likely to cause  
11 cancer of the prostate (Eriksen et al. 2009; Hardell et al. 2014), bladder (Alexander & Olsen  
12 2007), breast (Mastrantonio et al. 2018), and other sites (Girardi & Merler 2019; Sunding 2017;  
13 Vieira et al. 2013).  
14

15 39. In addition to cancer and immune system deficiencies, PFASs also pose a  
16 substantial present and potential hazard to a range of organ functions, thereby likely contributing  
17 to disease development.  
18

19 40. In regard to human reproductive system functions, PFAS exposure is associated  
20 with a broad range of adverse effects on reproduction in adult women and men. For women,  
21 PFAS exposure can lead to higher rates of infertility, miscarriage, pre-eclampsia and higher  
22 blood pressure during pregnancy (C8 Science Panel 2011). In addition, a Danish study  
23 established that women with a higher serum-PFOS had a 26% reduced chance of becoming  
24 pregnant compared with women in the lowest quartile of serum-PFOS (Fei et al. 2009), and  
25 similar results were found in Canada for elevated serum concentrations of both PFOA and  
26 PFHxS (Velez et al. 2015). Although effects at lower exposure levels may be weaker (Whitworth  
27  
28



1 et al. 2012), these abnormalities interfere with a woman's ability to have a safe and healthy  
2 pregnancy and delivery.

3 41. In men, PFAS exposure can result in lower sperm counts and fertility rates  
4 (Joensen et al. 2009; Toft et al. 2012; Vested et al. 2013). A joint analysis of data from three  
5 countries suggested a substantially lower proportion of morphologically normal sperm cells at  
6 increased serum concentrations of PFOA and PFHxS (Toft et al. 2012). These abnormalities may  
7 be mediated by endocrine disruption. Thus, increased PFAS exposure in early life was associated  
8 with changes in sex hormone concentrations both in boys and in girls during or after puberty  
9 (Lopez-Espinosa et al. 2016; Maisonet et al. 2015). Hormonal disruptions at elevated PFAS  
10 exposures can be detected already in early infancy (Jensen et al. 2020).  
11

12 42. Prenatal exposure to PFASs can result in preterm birth, low birth weight, and  
13 delayed fetal growth (Apelberg et al. 2007; Johnson et al. 2014; Waterfield et al. 2020). In the  
14 long term, infants with elevated developmental exposure are likely to suffer from developmental  
15 defects and developmental delays during early adolescence including reduced hormonal output  
16 and interference with puberty development in both boys and girls (Kristensen et al. 2013; Lopez-  
17 Espinosa et al. 2011; Lopez-Espinosa et al. 2016). While the evidence on impact on menopause  
18 is somewhat uncertain, elevated PFAS exposure is also associated with increased osteoporosis  
19 (Hu et al. 2019). ATSDR concluded in 2018 that PFOS and PFOA exposure is associated with an  
20 increased pre-eclampsia risk, decreased fertility, and decreased birth weight (ATSDR 2018).  
21 Thus, I conclude that a range of PFASs create a risk of adverse effects on a person's reproductive  
22 development and function.  
23

24 43. Epidemiological and toxicity evidence show that PFAS exposure poses a  
25 substantial present and potential hazard to several additional endocrine functions in humans. The  
26  
27  
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1 endocrine system produces hormones that regulate metabolism, growth and development, tissue  
2 function, sexual function, reproduction, sleep, and mood. Because a wide range of hormones  
3 play a crucial role in sustaining and operating physiological functions, disruptions to the  
4 endocrine system represent a confluence of deleterious impacts on the body as a whole. Of note,  
5 research shows that exposure to PFASs is associated with disruptions in the production and  
6 functions of thyroxin and insulin.  
7

8 44. The thyroid gland, as part of the endocrine system, appears to be a target organ  
9 for PFAS exposure, as supported by the C8 panel's study recognizing the association between  
10 PFOA and PFOS exposure and thyroid disruption (C8 Science Panel 2012). These associations  
11 have also been reported at background exposures (Melzer et al. 2010), as also recognized by  
12 ATSDR (ATSDR 2018). Recent studies on thyroid effects have included pregnant women and  
13 newborns (Reardon et al. 2019; Xiao et al. 2020). Because the thyroid gland is the target for a  
14 substantial number of other environmentally toxic chemicals, PFAS exposure may contribute to  
15 adverse health effects to the thyroid gland from complex exposures, possibly exacerbated by  
16 borderline or frank iodine deficiency (Webster et al. 2016).  
17

18 45. Due to the strong link between hormone delivery and early neurological  
19 development, disruptions of the thyroid gland also adversely impact neurological functions. Even  
20 a marginal diminution in hormone output is a health concern, as fetal brain development is highly  
21 vulnerable to deficiencies in maternal thyroid hormone supplies (Zoeller & Rovet 2004). While  
22 several studies have pointed to developmental neurotoxicity as a likely effect of prenatal and early  
23 postnatal PFAS exposure (Hoyer et al. 2015; Oulhote et al. 2016; Vuong et al. 2016), it is not yet  
24 clear to which extent early-life exposure to PFASs affect brain development. Neurobehavioral  
25 impairments can have lasting negative impacts on a subject's educational  
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1 achievements, social relationships, and ability to secure work (Bellinger 2018), and these risks  
2 should therefore not be disregarded.

3 46. Although the C8 Science Panel did not find any indication that PFOA exposure  
4 was related to diabetes mortality in a questionnaire study (C8 Science Panel 2012a), a later study  
5 showed that fasting serum insulin decreased at higher PFOA exposures (Abbott et al. 2012).  
6 Cross-sectional studies also support this link (Lin et al. 2009; Zong et al. 2016). Data on  
7 prepubertal children showed that background exposures to PFASs were linked to increased risk  
8 of overweight and deficient glucose homeostasis (Braun et al. 2016; Mora et al. 2017;  
9 Timmermann et al. 2014), and further follow-up supported a causal link between PFAS exposure  
10 and metabolic dysfunction (Domazet et al. 2016). Perhaps the strongest support for a  
11 diabetogenic effect of PFAS exposure originates from the follow-up of U.S. nurses who had  
12 provided blood samples in the late 1990s (Sun et al. 2018). In a nested case-control design,  
13 higher plasma concentrations of PFOS and PFOA were significantly associated with an elevated  
14 risk of developing T2D during the subsequent 11 years.

17 47. Gestational diabetes has been the focus of multiple recent studies (Jensen et al.  
18 2018; Liu et al. 2019; Matilla-Santander et al. 2017; Rahman et al. 2019; Zhang et al. 2015), with  
19 mostly positive findings. These results are of importance also because gestational diabetes seems  
20 to promote the transfer of PFASs across the placenta to the fetus (Eryasa et al. 2019) and may  
21 also impact birth size and the risk of complications.

23 48. It is also my opinion that PFAS exposure poses a substantial present and potential  
24 hazard to human liver functions with related adverse health effects. ASTDR concludes that  
25 PFOA, PFOS, and PFHxS are hepatotoxic (ATSDR 2018).  
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1           49.     The liver is a highly important target organ for PFAS toxicity in humans (Costa et  
2 al. 2009). PFAS's adverse effects on liver functions are reflected by elevations of serum-  
3 cholesterol concentrations and other important serum lipid parameters that have adverse  
4 implications regarding cardiovascular disease and mortality. In this regard, the C8 Panel  
5 concluded that PFOA is linked to an increased risk of elevated serum-cholesterol, but not  
6 (yet) hypertension and coronary artery disease (C8 Science Panel 2012b). The C8 Panel that  
7 examined over 47,000 adults found an association between PFOA and PFOS exposure and liver  
8 damage due to increased liver enzymes (Darrow et al. 2016; Gallo et al. 2012). Elevated liver  
9 enzymes indicate that a pathology is present in the liver including inflammation and cellular  
10 breakdown of liver tissue.

11  
12           50.     Similarly, increased PFOA exposure has been associated with elevated serum-  
13 cholesterol concentrations, often exceeding the reference range (Costa et al. 2009; Sakr et al.  
14 2007a; Sakr et al. 2007b), and associations have also been found in regard to PFOS exposure  
15 (Frisbee et al. 2010; Nelson et al. 2010; Steenland et al. 2009). ATSDR concludes that PFOA,  
16 PFOS, PFNA, and PFDA are associated with increases in serum-lipid concentrations (ATSDR  
17 2018). Recent research has shown that certain subfractions of cholesterol and triglycerides play a  
18 particular role in regard to subsequent cardiovascular risk. The subfractions are bound to  
19 different lipoproteins, and a recent study shows that plasma-PFAS concentrations were more  
20 strongly associated with the apoC-III subfraction that is more predictive of adverse  
21 cardiovascular risks (Liu et al. 2020).

22  
23           51.     Overweight and obesity have also been linked to increased exposure to PFASs.  
24 Several prospective studies related to child cohorts from Denmark (Domazet et al. 2016),  
25 Norway (Lauritzen et al. 2018), and the Faroe Islands (Karlsen et al. 2017) are in support of a  
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1 causative association of weight gain as a result of elevated PFAS exposure. Perhaps the most  
2 convincing evidence resulted from a randomized clinical trial, where obese subjects underwent  
3 calorie-restricted diets (Liu et al. 2018). After multivariate adjustment, baseline plasma-PFAS  
4 concentrations were not significantly associated with the concurrent body weight or the weight  
5 loss achieved during the first 6 months. In contrast, higher baseline levels of PFASs were  
6 significantly associated with a greater weight regain, primarily in women, where significant  
7 results were obtained for PFOS, PFOA, PFNA, PFDA, and PFHxS.

9         52. Cardiovascular risks are also present in individuals with notable concentrations of  
10 PFASs, perhaps mediated in part by elevated serum-cholesterol, overweight, and diabetes. Some  
11 of the cardiovascular risks associated with elevated levels of PFASs also include hypertension,  
12 and coronary disease (C8 Science Panel 2012b). A population-based study relied on the  
13 NHANES data on self-reported physician diagnosis of congestive heart failure, coronary heart  
14 disease, angina pectoris, heart attack, and stroke in more than 10,000 participants representing the  
15 U.S. population (Huang et al. 2018). Although based on cross-sectional comparisons, the  
16 statistically significant results support the notion that elevated PFAS exposure leads to an  
17 increased risk of cardiovascular disease. The same is true for the ecological study of the Italian  
18 communities with PFOS and PFOA contamination where elevated mortality was found for  
19 cerebrovascular disease and myocardial infarction (Mastrantonio et al. 2018). Since  
20 cardiovascular disease is the leading cause of death in the United States, the increase in such risks  
21 from exposure to PFAS exposure can have a substantial impact.

### 25                   **GOVERNMENTAL RESPONSES ADDRESSING PFAS TOXICITY**

26         53. As a result of mounting concerns amongst the scientific community, public health  
27 officials at the U.S. state and federal level have responded to this global health concern by  
28

1 taking measures to address the adverse effects of PFASs, including the imposition of new  
2 restrictions on PFAS concentrations in drinking water supplies. In 2009, EPA set a  
3 “provisional” health advisory level for PFOA and PFOS in drinking water of 400 parts per trillion  
4 (ppt). In 2016, EPA significantly lowered the advisory to a combined health advisory level of 70  
5 ppt (EPA 2016). EPA has recently announced that the advisories are being revised.  
6

7 54. While EPA has not acted since that time to lower the limit for its health  
8 advisory, in 2018, the ATSDR identified minimal risk levels that correspond to approximately  
9 21 parts-per-trillion and 14 parts-per-trillion for PFOA and PFOS, respectively, in drinking water  
10 (ATSDR 2018). The Director of the Center for Disease Control and Prevention’s (“CDC”)  
11 Center for Environmental Health, Dr. Patrick Breysse, raised alarm related to this growing  
12 concern, describing the management of these “forever chemicals” as “one of the most seminal  
13 public health challenges” of the coming decades (Turkewitz 2019).  
14

15 55. In addition to federal agencies, several states, including California, New Jersey,  
16 New Hampshire, Massachusetts, Michigan, Minnesota, and Vermont, have taken affirmative  
17 steps to address PFAS contamination and exposure risks to their residents. For example, New  
18 Jersey, New Hampshire, Massachusetts, and Vermont established required actions at levels as  
19 low as 8 ppt for PFOA and 10 ppt for PFOS and not higher than 35 ppt for PFOA and 16 ppt for  
20 PFOS (Association of State Drinking Water Administrators 2019). In Minnesota, the revised  
21 exposure limits were calculated with the express purpose to protect the fetus and the infant  
22 against developmental toxicity from PFAS exposure (Goeden et al. 2019).  
23

24 56. Efforts to combat the harms associated with PFAS exposure are also occurring  
25 worldwide and are particularly aggressive in Europe. As the PFASs are “known to persist in the  
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1 environment longer than any other man-made substance,” the EU has announced a plan to  
2 eliminate PFAS uses by 2030 (European Chemicals Agency 2020).

3 57. Additionally, based on the European Commission’s urging, the European Food  
4 Safety Authority (EFSA) has proactively responded to concerns over PFAS contamination and  
5 adverse health effects by proposing updated intake limits (EFSA 2020). Back in 2008, EFSA  
6 released a recommended Tolerable Daily Intake (TDI) at 2  $\mu\text{g}/\text{kg}\cdot\text{day}$  for PFOA and  $<1$   $\text{ng}/\text{kg}$   
7 (0.15  $\mu\text{g}/\text{kg}\cdot\text{day}$ ) for PFOS as based on the evidence available at the time. These limits were  
8 reduced by roughly 100-fold in an updated report in 2018 that provided tolerable intake limits of  
9 6  $\text{ng}/\text{week}$  for PFOA and 13  $\text{ng}/\text{week}$  for PFOS (EFSA 2018). In February 2020, EFSA  
10 published a draft opinion recommending an even further reduction and widening of its scope—  
11 that the total combined intake for the four major PFASs should be no greater than 8  $\text{ng}/\text{week}$   
12 (EFSA 2020). Using the EPA’s method of calculation, this tolerable intake corresponds to a  
13 water limit of 5  $\text{ng}/\text{L}$  for the sum of the four major PFASs (as compared to EPA’s guideline of  
14 70  $\text{ng}/\text{L}$  jointly for PFOS and PFOA).  
15

16  
17 58. Together, these governmental responses indicate a rising global concern over the  
18 harmful effects of PFASs on human populations and the urgent need to prevent and reduce  
19 human exposures to them. Given that science over time has documented adverse health effects at  
20 lower and lower background exposure levels, it would be extremely unwise to augment  
21 population exposures that are already considered hazardous.  
22  
23

## 24 CONCLUSIONS

25 59. Based on the above-referenced studies, which represent examples of major  
26 research that has been conducted into the health risks associated with PFAS exposure, there is  
27 substantial evidence indicating an association between PFAS exposure and adverse human health  
28

1 effects in the general population. Such adverse health effects include impairments to the  
2 immune system, liver and kidney toxicity, reproductive abnormalities, endocrine disruption,  
3 cardiovascular disease, and heightened risk of certain cancers.

4           60. PFAS' attributes, including atmospheric dissemination, inertness, and stability of  
5 its chemical bonds collectively contribute to the persistence and mobility in the environment  
6 through air and water and the accumulation in the environment and in animal species, including  
7 humans. Due to the slow degradability, PFASs accumulate over time, and increasing burdens of  
8 it in the body lead to elevated health risks associated with these chemicals. For communities  
9 living near point sources or in communities with existing PFAS contamination of air, soil, or  
10 drinking water, these risks are especially worrisome and must be prevented.

11  
12           61. Based on this information, I conclude that any increase in PFAS emissions from  
13 incineration of AFFF stockpiles is likely to increase the risk of serious adverse health effects on  
14 surrounding communities as a result of PFAS contamination of the air and local food and  
15 drinking water sources.

16  
17  
18 I declare under penalty of perjury that the foregoing is true and correct.

19 Executed on June 11, 2020.

20  
21  
22   
23 \_\_\_\_\_  
24 Philippe Grandjean, MD  
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**DECLARATION OF WILLIAM S. RICKMAN, P.E.**

I, WILLIAM S. RICKMAN, P.E., declare and state as follows:

1. I am a chemical engineer who specializes in the incineration of chemicals and wastes. For nearly 50 years, I have developed, commercialized, and analyzed methods for the thermal treatment of hazardous materials, and I have a detailed knowledge of incineration facilities and processes. I am a licensed professional engineer, with a bachelor's degree in chemical engineering from Tennessee Technological University.

2. I submit this declaration in support of Plaintiffs' Cross-Motion for Summary Judgment and in opposition to Defendants' Motion to Dismiss. As set forth below, the incineration of per- and polyfluoroalkyl substances ("PFAS") presents serious risks that have yet to be fully studied or characterized. PFAS chemicals are designed to resist incineration, and their incomplete combustion threatens to release additional PFAS and other hazardous chemicals into air. In order to evaluate and minimize those effects, further analysis of Defendants' PFAS incineration is needed.

**Background and Credentials**

3. I am currently the owner of TSD Management Associates, a chemical engineering services firm. A true and correct copy of my CV is attached hereto as **Exhibit A**.

4. Over the course of my career, I have designed and tested equipment for chemical agent destruction, advised governments and private parties concerning incineration technologies, and published reports and texts on those subjects. Among those publications, I am the editor of *The Handbook of Incineration of Hazardous Wastes*, a technical resource text (CRC Press 1991) on the regulatory and technical requirements for hazardous waste incineration.

1           5.       I was appointed by the Governor of Tennessee to serve on a committee  
2 investigating a polychlorinated biphenyl (“PCB”) mixed-waste incinerator in Oak Ridge, TN. I  
3 was also extensively involved with the development of the Blue Grass Chemical Agent-  
4 Destruction Pilot Plant, a facility constructed pursuant to the United Nations Chemical Weapons  
5 Convention to destroy hundreds of tons of chemical nerve agents from the United States.  
6

7  
8 The Risks Associated With PFAS Incineration

9           6.       As a result of my experience, I am familiar with the incineration process, the  
10 testing and information required to ensure successful incineration, and the fact that there are risks  
11 associated with incomplete incineration.

12           7.       The purpose of hazardous waste incineration is to heat organic waste molecules  
13 until they combust and form carbon dioxide, water, and other constituents (such as particulate  
14 matter, chlorine, fluorine, sulfur, nitrogen, etc.) that are removed from the gas stream to meet  
15 regulatory limits prior to discharge.  
17

18           8.       For incineration to be successful, however, the combustion of the hazardous  
19 compounds in the waste material must either be complete or attained to a degree specified in  
20 applicable regulations. Otherwise, those compounds can be emitted, along with other products  
21 of incomplete combustion (“PICs”).  
22

23           9.       In order to understand the effects of incineration, it is critical to understand the  
24 proportion of a compound that is destroyed by the incinerator (often referred to as destruction  
25 and removal efficiency, or “DRE”) and the nature of any PICs that are created in the incineration  
26 process. The conditions required for successful incineration—including minimum incinerator  
27 temperatures, residence time, turbulence and oxygen content of the gas stream—are chemical  
28

1 specific, and careful monitoring and enforcement is needed to ensure that incinerators maintain  
2 those conditions.

3 10. The incineration of hazardous waste is regulated under the Resource Conservation  
4 and Recovery Act (“RCRA”) and the Clean Air Act (“CAA”). Under RCRA, incinerators must  
5 remove at least 99.99% of the designated principal organic hazardous constituents, or “POHCs,”  
6 from its waste stream, with a more stringent 99.9999% destruction and removal efficiency  
7 required for certain chemicals. In addition, the CAA limits incinerators’ emissions of many  
8 hazardous PICs.  
9

10 11. While exposure to PFAS are associated with a broad range of adverse health  
11 effects—including cancer, immune system suppression, and liver disease—PFAS chemicals are  
12 not regulated as hazardous waste under RCRA or hazardous air pollutants under the CAA. This  
13 means that hazardous waste incinerators have not been required to demonstrate their ability to  
14 attain any specific destruction and removal efficiency for PFAS constituents in waste, and there  
15 are no limits on the emission of PFAS as products of incomplete combustion. Hazardous waste  
16 incinerators have therefore not been required to demonstrate their ability to safely destroy PFAS  
17 chemicals, as they have for other chemicals that are regulated under RCRA and the CAA.  
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20 12. According to EPA, PFAS compounds are particularly “difficult to break down”  
21 via incineration “due to fluorine’s electronegativity and the chemical stability of fluorinated  
22 compounds” (EPA 2020). When PFAS-containing wastes, such as aqueous film forming foam  
23 (“AFFF”), are fed to an incinerator, residual PFAS will be emitted by the incinerator and enter  
24 the environment.  
25

26 13. Moreover, even if a specific PFAS chemical in firefighting foam (such as PFOA  
27 or PFOS) is “destroyed” by removing one or more of its atoms, if the carbon-fluorine bond is not  
28

1 broken then new PFAS chemicals are likely to be generated as PICs. These PICs can be just as  
2 or more toxic than the original waste. As acknowledged by the EPA: “Incomplete destruction of  
3 PFAS compounds can result in the formation of smaller PFAS products, or products of  
4 incomplete combustion (PICs), which may not have been researched and thus could be a  
5 potential chemical of concern” (EPA 2020).

6  
7 14. The Department of Defense has similarly found that “many likely byproducts” of  
8 PFAS incineration “will also be environmentally unsatisfactory ... or toxic,” such as  
9 fluoroacetates or perfluoroisobutylene (DOD 2017). Recent research has confirmed the  
10 generation of these and other toxic PICs from PFAS incineration.

11 15. Indeed, even the complete combustion of PFAS results in the formation of  
12 hydrogen fluoride, a toxic and corrosive gas.

#### 13 Additional Research Needs

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16 16. In addition to presenting unique challenges and risks, the incineration of PFAS—  
17 and in particular the conditions required to ensure PFAS destruction—are poorly understood. To  
18 date, research into PFAS incineration has been limited, and has largely consisted of “bench-  
19 scale” laboratory tests, as opposed to actual field measurements. As recently as April 2020, EPA  
20 acknowledged that “very little information is published on PFAS destruction,” and both EPA and  
21 DOD have called for additional research into the effects of PFAS incineration (EPA 2020b;  
22 SERDP 2019; EPA 2020).

23  
24  
25 17. In order to evaluate the effects of PFAS incineration and ensure that it is properly  
26 regulated, EPA would need to take several additional steps, all of which the agency is capable of  
27 but has not yet undertaken. Until those steps are completed and incinerators have established  
28

1 their ability to destroy PFAS without the generation of excess PICs, no PFAS incineration can be  
2 considered safe.

3 18. First, EPA must determine the destruction and removal efficiency and PIC limits  
4 that are needed in order to adequately protect public health and the environment from PFAS  
5 incineration. For most regulated chemicals, EPA requires hazardous waste incinerators to  
6 destroy at least 99.99% of the POHCs in the waste. However, for chemicals that are toxic at low  
7 exposure concentrations, such as polychlorinated biphenyls, a more stringent destruction and  
8 removal efficiency of 99.9999% is necessary, since even 99.99% destruction can still result in  
9 unsafe levels of the chemical being emitted. Many PFAS chemicals cause adverse health effects  
10 in the low parts-per-trillion range—exposure levels even lower than those associated with harm  
11 from PCBs (ATSDR 2018).  
12

13 19. Second, once EPA has established destruction and removal efficiency  
14 requirements, it must then evaluate and set health-protective limits on PICs, including other  
15 PFAS chemicals that can be created during the incineration of AFFF. According to EPA,  
16 however, “information regarding potential products of incomplete combustion (PICs) is lacking”  
17 (EPA 2020b). This information must be developed and incorporated into regulatory standards  
18 before incineration can be allowed to safely proceed.  
19

20 20. Further complicating the analysis of AFFF incineration, incinerators lack the  
21 capacity to monitor for many PFAS chemicals, including PFAS that could be emitted as PICs.  
22 EPA has yet to approve incineration stack sampling methods for most PFAS, leaving incinerators  
23 unable to determine whether their incineration of AFFF is simply spreading PFAS chemicals as  
24 opposed to destroying them. EPA itself recently stated that PFAS “[e]mission studies,  
25 particularly for PICs, have been incomplete due to lack of necessary measurement methods  
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1 suitable for the comprehensive characterization of fluorinated and mixed halogenated organic  
2 compounds” (EPA 2020).

3 21. In the contracts challenged in this suit, the Defense Department has not required  
4 incinerators to measure PFAS emissions from AFFF incineration, to analyze the potential  
5 formation of PICs, or to establish that they are capable of destroying PFAS-containing AFFF  
6 without harming the surrounding community. The absence of these safeguards, combined with  
7 the hazards inherent to PFAS incineration, present a significant risk to the communities  
8 surrounding the authorized PFAS incinerators.

9  
10 22. I have reviewed the following papers from the Administrative Record filed by  
11 Defendants in this matter: *Remediation Technologies for Perfluorinated Compounds, Including*  
12 *Perfluorooctane Sulfonate (PFOS) and Perfluorooctanoic Acid (PFOA)* (Hawley 2012);  
13 *Treatment Technologies for Aqueous Perfluorooctane Sulfonate (PFOS) and Perfluorooctanoate*  
14 *(PFOA)* (Vecitis 2009); and *Perfluorinated Chemicals (PFCs): Perfluorooctanoic Acid (PFOA)*  
15 *& Perfluorooctane Sulfonate (PFOS) Information Paper* (ASTSWMO 2015), along with several  
16 of the incineration-related studies referenced therein. Those reports do not change any of my  
17 conclusions set forth in this declaration. The reports rely largely on laboratory-scale testing  
18 involving the incineration of a small number of PFAS. They do not evaluate actual operating  
19 conditions at commercial hazardous waste incinerators or address the health effects of PICs  
20 generated from PFAS incineration. In fact, the Hawley paper acknowledges that “total  
21 destruction of the fluorinated chain was not documented” in one of those laboratory-scale tests  
22 (indicating the potential formation of PFAS PICs), and the Vecitis paper cites to a 2003  
23 University of Dayton Research Institute report that reported a number of potentially hazardous  
24 PICs from PFOS incineration.  
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1  
2           The Incinerators' Compliance History

3           23.     Given the absence of necessary information and analysis, it has not been shown  
4 that *any* commercial incinerator can safely incinerate PFAS-containing waste. Under the  
5 challenged contracts, the Defense Department's AFFF must be sent to hazardous waste  
6 incinerators on the Defense Logistics Agency's Qualified Facilities List. Many of those  
7 incinerators are located in overburdened communities and have a history of environmental  
8 violations that raise further concerns about their ability to safely incinerate PFAS.  
9

10           24.     One such facility is the Heritage Thermal Solutions in East Liverpool, Ohio, the  
11 home of Plaintiff Save Our County. The East Liverpool incinerator has previously incinerated  
12 AFFF from the Defense Department, and it is authorized to receive AFFF under the challenged  
13 contracts. However, according to EPA, it has violated its Clean Air Act permit in eleven of the  
14 previous twelve quarters and has violated its RCRA permit in three of the previous twelve  
15 quarters.  
16

17           25.     Those violations include at least 38 exceedances of the incinerator's permitted  
18 emission standard for total hydrocarbons since the beginning of 2018. EPA uses total  
19 hydrocarbon exceedances as a proxy for hazardous operating conditions more broadly, since  
20 high levels of total hydrocarbons "are indicative of poor combustion conditions and the potential  
21 for increased emissions [of] organic [air pollutants]," either from the waste feedstock or from  
22 PICs (EPA 2005). Several of the incinerator's total hydrocarbon exceedances were severe, with  
23 records showing total hydrocarbon levels more than four times the permissible level under the  
24 Clean Air Act.  
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1           26.     Indeed, the Department of Justice has charged Heritage with “systemic failures to  
2 comply with the Clean Air Act” at its East Liverpool incinerator, resulting in a 2018 consent  
3 decree to resolve “hundreds of days” of non-compliance (DOJ 2018). In its complaint against  
4 Heritage, DOJ also identified “numerous” violations of the maximum flue gas flowrate operating  
5 parameter limit, which indicates poor operating conditions that increase the propensity for PIC  
6 formation. *U.S. v. Heritage Thermal Services Inc.*, Complaint ¶ 108, 4:18-cv-02419 (N.D.  
7 Ohio), <https://www.justice.gov/enrd/consent-decree/file/1101891/download>. Several states have  
8 cancelled shipments of AFFF to the incinerator because of its environmental non-compliance.  
9

10           27.     The contracts also authorize the shipment of AFFF to Veolia Environmental  
11 Solutions in Port Arthur, Texas, the home of Plaintiff Community In-Power and Development  
12 Association, Inc. Publicly available records indicate that, since the beginning of 2018, the  
13 facility reported at least 86 instances of non-compliance with emission standards or operating  
14 parameter limits. Operating parameter limits (“OPLs”), which are enforceable limits on aspects  
15 of the combustion process, are established on a site-specific basis as an indirect control for  
16 various emission standards promulgated under the Clean Air Act. There were 40 unique  
17 exceedances of the emissions standard for carbon monoxide, which EPA has also identified as a  
18 proxy for unsafe incineration conditions, and an additional six deviations from the facility’s  
19 minimum combustion chamber temperature limit. As recently as May of 2020, the facility was  
20 cited by state regulators for minimum temperature deviations and carbon monoxide exceedances  
21 (TCEQ 2020). These ongoing minimum temperature deviations and carbon monoxide  
22 exceedances raise serious concerns about the incinerator’s ability to process PFAS chemicals.  
23

24           28.     Under the contracts, large volumes of AFFF have also been sent to the Norlite  
25 incineration facility in Cohoes, New York. In a January 2020 administrative complaint, EPA  
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1 found that Norlite had exceeded its Clean Air Act standards for multiple contaminants in 2017  
2 (EPA Case No. CAA-02-2020-1004, Complaint ¶ 48 (Jan. 30, 2020)). EPA also noted “several  
3 non-compliance issues” from 2012 to 2014, with violations of various OPLs totaling more than  
4 three million hourly average periods (*Id.* ¶ 39). (Hourly rolling averages are calculated by  
5 averaging 60 consecutive one-minute averages; thus, each consecutive 60-minute period where  
6 an operating parameter exceeds its hourly limit is considered a separate violation of an hourly  
7 average period.) Norlite subsequently entered a consent decree settling that complaint for a civil  
8 penalty of \$150,000.  
9

10 29. Dating back to 2010, Norlite has also been cited on numerous occasions by the  
11 New York State Department of Environmental Conservation for violations of its hazardous waste  
12 and CAA permits. In 2016, the New York State Department of Environmental Conservation  
13 issued two Orders on Consent to Norlite, noting over a dozen distinct violations of Norlite’s  
14 hazardous waste and CAA permits and requiring the payment of over \$44,000 in fines (DEC  
15 Case No. R4-2016-0718-127, Order on Consent ¶ 17 (Nov. 7, 2016)). Among the violations  
16 cited by NYSDEC are Norlite’s failure to adequately train personnel in responding to and  
17 preventing malfunctions, and failure to cut off hazardous waste feeds when permit terms are  
18 exceeded. Such violations increase the propensity for PIC emissions. A September 2014 Order  
19 on Consent found that Norlite emitted air contaminants that “interfered with the comfortable  
20 enjoyment of City residents,” in violation of state regulations (DEC Case No. R4-2014-0017-6,  
21 Order on Consent ¶ 7 (Sept. 2, 2014)). The September 2014 order also found seven violations of  
22 Norlite’s RCRA permit or state hazardous waste regulations, including “45 instances of  
23 inconsistent information” in required inspection reports (*Id.* ¶ 11).  
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1 Conclusion

2           30.     The incineration of chemicals presents serious health concerns and should be  
3 undertaken only after careful analysis and under closely regulated conditions. To date, despite  
4 its known risks, PFAS incineration has not been adequately analyzed or regulated. Defendants'  
5 contracts to incinerate AFFF in the absence of sufficient information and controls create a direct  
6 threat to the communities surrounding the incinerators and the environment more broadly.  
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I declare under penalty of perjury that, to the best of my knowledge, the foregoing  
is true and correct. Executed this 16<sup>th</sup> day of June 2020, in Newport, WA.

Dated: June 16, 2020

William S. Rickman, P.E.  
William S. Rickman, P.E.

1 References List

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22 [x.cfm?fuseaction=iwr.novdetail&addn\\_id=480298012011285&re\\_id=671734772002164](https://www15.tceq.texas.gov/crpub/index.cfm?fuseaction=iwr.novdetail&addn_id=480298012011285&re_id=671734772002164) (last  
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13  
14 IN THE UNITED STATES DISTRICT COURT  
FOR THE NORTHERN DISTRICT OF CALIFORNIA

15 SAVE OUR COUNTY, COMMUNITY IN- )  
16 POWER AND DEVELOPMENT )  
17 ASSOCIATION INC., UNITED ) Case No. \_\_\_\_\_  
18 CONGREGATIONS OF METRO EAST, and )  
19 SIERRA CLUB, )  
20 Plaintiffs, ) **COMPLAINT FOR DECLARATORY AND**  
v. ) **INJUNCTIVE RELIEF**  
)  
21 ) (National Environmental Policy Act,  
22 UNITED STATES DEFENSE LOGISTICS ) Administrative Procedure Act)  
23 AGENCY, DARRELL K. WILLIAMS, in his )  
24 official capacity as Director of the Defense )  
25 Logistics Agency, UNITED STATES )  
26 DEPARTMENT OF DEFENSE, MARK T. )  
27 ESPER, in his official capacity as Secretary of )  
the Department of Defense, HERITAGE )  
28 ENVIRONMENTAL SERVICES, LLC, and )  
TRADEBE TREATMENT AND RECYCLING, )  
LLC, )  
Defendants. )

**INTRODUCTION**

1  
2           1.       This case challenges the U.S. Department of Defense’s (the “Defense Department”  
3 or “Department”) failure to conduct any environmental review and to comply with applicable  
4 environmental requirements before approving the incineration of millions of gallons of toxic  
5 firefighting foam, in violation of the National Environmental Policy Act (“NEPA”) and the  
6 National Defense Authorization Act (the “NDAA”).

7           2.       The Defense Department is the nation’s largest user of firefighting foam made  
8 from per- and polyfluoroalkyl substances (“PFAS”), a class of highly persistent and toxic  
9 chemicals that cause cancer, liver disease, infertility, and other serious health effects. Hundreds of  
10 PFAS releases from military bases and installations across the country have resulted in widespread  
11 soil and drinking water contamination. Facing multiple lawsuits and billions of dollars in potential  
12 liability from those releases, the Defense Department recently chose to incinerate its unused  
13 stockpiles of firefighting foam.

14           3.       Over the last two years, the Defense Department—through its contracting sub-  
15 agency, the Defense Logistics Agency—approved and awarded three contracts for the large-scale  
16 incineration of PFAS-containing foam. However, the same properties that have made PFAS a  
17 widely-used fire suppressant also make them difficult and dangerous to incinerate. Because of the  
18 strength of their chemical bonds, PFAS do not readily burn and are not destroyed under typical  
19 incineration conditions. Instead, uncombusted PFAS are emitted into the air along with other  
20 hazardous chemicals, contaminating the communities surrounding the incinerators.

21           4.       NEPA requires federal agencies to take a “hard look” at the environmental  
22 impacts of their proposed actions before approving them. Yet Defendants conducted no  
23 environmental review before awarding the challenged incineration contracts, despite the Defense  
24 Department’s express concerns about the dangers posed by such incineration and admitted lack  
25 of information about the extent of those impacts.

26           5.       Those concerns are shared by Congress, which last December enacted new  
27 restrictions on PFAS incineration in the NDAA, a military spending bill. The NDAA provides  
28



1 that, prior to incinerating any PFAS-containing material, the Defense Department “shall ensure”  
2 that the incineration “is conducted at a temperature range adequate to break down PFAS  
3 chemicals” and attains “the maximum degree of reduction in emission of PFAS, including  
4 elimination of such emissions where achievable.” Pub. L. No. 116-92, § 330, 133 Stat. 1198  
5 (enacted Dec. 20, 2019). Even after the passage of that law, Defendants continued to incinerate  
6 firefighting foam and other PFAS containing-material without specifying the temperatures  
7 needed to destroy PFAS, much less ensuring that all incinerators attain those temperatures.

8         6. Plaintiffs’ members live, work, and play in the communities where Defendants  
9 are sending firefighting foam for incineration. These communities are already overburdened by  
10 pollution, both from those incinerators and from other industrial facilities, which will be made  
11 worse by Defendants’ unstudied and unlawful PFAS incineration. Plaintiffs thus request that this  
12 Court enter an order: (1) declaring Defendants to be in violation of NEPA and the NDAA, (2)  
13 annulling each of the PFAS incineration contracts, and (3) enjoining Defendants’ PFAS  
14 incineration until they have complied with their NEPA and NDAA obligations.

#### 15                   **JURISDICTION, VENUE, AND INTRADISTRICT ASSIGNMENT**

16         7. This action is brought pursuant to NEPA, 42 U.S.C. §§ 4321–4347, the NDAA,  
17 Pub. L. 116-92, § 330, 133 Stat. 1198 (enacted Dec. 20, 2019), and the Administrative Procedure  
18 Act (“APA”), 5 U.S.C. §§ 701–706. This Court has jurisdiction pursuant to 28 U.S.C. § 1331  
19 (federal question).  
20

21         8. An actual controversy exists between the parties within the meaning of 28 U.S.C.  
22 § 2201(a), and this Court may grant declaratory relief, injunctive relief, and other relief pursuant  
23 to 28 U.S.C. §§ 2201–2202 and 5 U.S.C. §§ 705–706.

24         9. Venue is properly vested in this Court under 28 U.S.C. § 1391(e), and assignment  
25 to the San Francisco or Oakland Division is proper under Local Rule 3-2(c) because Plaintiff  
26 Sierra Club is headquartered in Oakland and has members residing in the Northern District of  
27 California.  
28

**PARTIES**

1  
2           10. Plaintiffs are non-profit organizations whose members who live, work, and  
3 recreate in and around the communities where Defendants have authorized the incineration of  
4 firefighting foam and other PFAS-contaminated material. These members are threatened by  
5 emissions from that incineration, including the emission of PFAS chemicals and other hazardous  
6 substances resulting from the incomplete incineration of PFAS.

7           11. Plaintiff SAVE OUR COUNTY is a not-for-profit membership organization  
8 based in East Liverpool, Ohio. Save Our County was founded to oppose the construction and  
9 operation of a hazardous waste incinerator in East Liverpool, Ohio, and it is devoted to the  
10 protection of the East Liverpool community from pollution emitted by that incinerator, which is  
11 one of the authorized locations for PFAS incineration under the challenged contracts (the  
12 “Contracts”). Save Our County has members who live, work, and recreate in and around East  
13 Liverpool and who breathe in or are otherwise exposed to pollutants from the East Liverpool  
14 incinerator.

15           12. Plaintiff COMMUNITY IN-POWER AND DEVELOPMENT ASSOCIATION  
16 INC. is a not-for-profit membership organization based in Port Arthur, Texas. It works to  
17 empower residents in low-income communities in Port Arthur to take action against neighboring  
18 chemical manufacturers, refineries, and incinerator facilities. Community-In Power and  
19 Development Association also advocates for “fence line” communities surrounding polluting  
20 facilities, including a hazardous waste incinerator in Port Arthur that is one of the authorized  
21 locations for PFAS incineration under the Contracts. The organization has members who live,  
22 work, and recreate around that incinerator, and who breathe in or are otherwise exposed to  
23 pollutants from that incinerator.  
24

25           13. Plaintiff UNITED CONGREGATIONS OF METRO EAST is a not-for-profit  
26 membership organization based in Cahokia, Illinois. It represents thirty-four congregations with  
27 approximately 27,000 members in the metropolitan area known as Metro East, an area of Illinois  
28 east of St. Louis, Missouri. United Congregations of Metro East operates an environmental

1 justice campaign aimed at combatting air pollution in Metro East, and it has advocated for  
2 stronger emissions monitoring and pollution controls at a hazardous waste incinerator in Sauget,  
3 Illinois that is one of the authorized locations for PFAS incineration under the Contracts. It has  
4 members who live, work, and recreate around that incinerator, and who breathe in or are  
5 otherwise exposed to pollutants from that incinerator.

6 14. Plaintiff SIERRA CLUB was founded in 1892 and is the nation's oldest  
7 grassroots environmental organization. Sierra Club's headquarters is located in Oakland,  
8 California. Sierra Club is a national non-profit membership organization incorporated in  
9 California with more than 825,000 members in all fifty states and the District of Columbia.  
10 Sierra Club's purpose is to explore, enjoy, and protect the wild places of the earth; to practice  
11 and promote the responsible use of the earth's ecosystems and resources; to educate and enlist  
12 humanity to protect and restore the quality of natural and human environments; and to protect  
13 public health and the environment, including from PFAS contamination.

14 15. Sierra Club brings this action on behalf of itself and its members, many of whom  
15 live, work, and recreate in the community surrounding the incinerators authorized for PFAS  
16 incineration under the challenged contracts (the "Contracts"), and who breathe in or are  
17 otherwise exposed to pollutants from those incinerators. Specific incinerators near which Sierra  
18 Club has members include the Clean Harbors incinerator in El Dorado, Arkansas; the Veolia  
19 incinerator in Arkadelphia, Arkansas; the Ross Incineration Services incinerator in Grafton,  
20 Ohio; the Clean Harbors incinerator in Deer Park, Texas; and the Norlite lightweight aggregate  
21 kiln in Cohoes, New York.

22 16. In addition to the Contracts' harm to their members, under NEPA Plaintiffs have a  
23 right to review and submit comments on an environmental impact statement ("EIS") analyzing  
24 the Contracts' significant adverse effects. DLA's failure to evaluate the Contracts under NEPA  
25 deprived Plaintiffs and their members of that statutorily required information and precluded them  
26 from participating in the Contracts' environmental review.  
27  
28



1 *inter alia*, “provide full and fair discussion of significant environmental impacts” of the proposed  
2 action, as well as “reasonable alternatives which would avoid or minimize adverse impacts or  
3 enhance the quality of the human environment.” 40 C.F.R. §§ 1502.1, 1502.16. An EIS must be  
4 published for public review and comment. *Id.* § 1503.1(a)(4).

5 25. Second, to determine whether a proposed action may result in significant adverse  
6 impacts requiring the preparation of an EIS, an agency may prepare an Environmental  
7 Assessment (“EA”). *Id.* § 1501.4. An EA must “provide sufficient evidence and analysis for  
8 determining whether to prepare an environmental impact statement or a finding of no significant  
9 impact.” *Id.* § 1508.9. EAs must be published for public review on DLA’s website. *See DLA,*  
10 *DLA Regulation 1000.22: Environmental Considerations in Defense Logistics Agency Actions*  
11 *(“DLA NEPA Regulations”)* at 13 (Dec. 2, 2011).

12 26. Finally, if the action falls within a category that the agency has already  
13 determined “do[es] not individually or cumulatively have a significant effect on the human  
14 environment,” the agency may approve the action pursuant to a Categorical Exclusion (“CE”).  
15 40 C.F.R. § 1508.4. In establishing lists of CEs, however, agencies must also “provide for  
16 extraordinary circumstances in which a normally excluded action may have a significant  
17 environmental effect,” in which case the action would not be covered by the CE and would  
18 instead require an EA or an EIS. *Id.*

19 27. DLA’s NEPA procedures are set forth in the DLA NEPA Regulations. Those  
20 regulations, which “establish[] DLA policy and responsibilities for the early integration of  
21 environmental considerations into planning and decision-making,” 76 Fed. Reg. 28,757 (May 18,  
22 2011), list forty-five CEs.

23 28. The DLA NEPA Regulations also state that “to use a [CE],” the agency “must”  
24 establish that “[n]o ‘extraordinary circumstances’ exist.” DLA NEPA Regulations at 18. The  
25 DLA NEPA Regulations identify eight extraordinary circumstances that “preclude the use of a  
26 [CE].” *Id.* They include, as relevant here:  
27  
28

1 a. “Reasonable likelihood of significant effects on public health, safety or the  
2 environment,” *id.*;

3 b. “Effects on the environment which are likely to be highly controversial, uncertain  
4 or involve unique or unknown risks,” *id.*;

5 c. “Reasonable likelihood of violating any federal, state or local law or requirement  
6 imposed for the protection of the environment,” *id.*; and

7 d. “Potential for degradation of already existing poor environmental conditions.” *Id.*  
8 at 19.

9 **The National Defense Authorization Act for Fiscal Year 2020**

10 29. The NDAA authorizes fiscal year 2020 Defense Department funding and sets  
11 forth policies governing the Department’s programs and activities.

12 30. The NDAA contains provisions addressing the risks posed by PFAS chemicals,  
13 which have been widely used and broadly released by the Defense Department. More than 400  
14 active or closed military installations have known or suspected PFAS releases.

15 31. Section 330 of the NDAA regulates the incineration and disposal of firefighting  
16 foam and other PFAS-containing materials. That provision states that “[t]he Secretary of Defense  
17 shall ensure that when materials containing per- and polyfluoroalkyl substances (referred to in  
18 this section as ‘PFAS’) or aqueous film forming foam (referred to in this section as ‘AFFF’) are  
19 disposed ... all incineration is conducted at a temperature range adequate to break down PFAS  
20 chemicals while also ensuring the maximum degree of reduction in emission of PFAS, including  
21 elimination of such emissions where achievable.” NDAA § 330, 133 Stat. at 258–259.

22 32. Section 330 further provides that the Secretary of Defense “shall ensure” that: (1)  
23 “all [PFAS] incineration is conducted in accordance with the requirements of the Clean Air Act  
24 (42 USC 7401 et seq.), including controlling hydrogen fluoride,” (2) “any materials containing  
25 PFAS that are designated for disposal are stored in accordance with” U.S. Environmental  
26 Protection Agency hazardous waste storage regulations, and (3) any incineration of materials  
27  
28

1 containing PFAS shall be “conducted at a facility that has been permitted to receive waste  
2 regulated under subtitle C of the Solid Waste Disposal Act.” *Id.*

3 **The Administrative Procedure Act**

4 33. The APA governs judicial review of an agency’s compliance with NEPA and the  
5 foregoing provisions of the NDAA.

6 34. Under the APA, a reviewing court shall “hold unlawful and set aside agency  
7 action, findings, and conclusions found to be... arbitrary, capricious, an abuse of discretion, or  
8 otherwise not in accordance with law,” “in excess of statutory jurisdiction [or] authority,” or  
9 “without observance of procedure required by law.” 5 U.S.C. § 706(2).

10 35. The APA authorizes the award of declaratory and injunctive relief. *Id.* § 703.

11 **STATEMENT OF FACTS**

12 **I. PFAS Chemicals Present “One of the Most Seminal Public Health Challenges for  
13 the Next Decades”**

14 36. PFAS are a class of approximately 6,000 chemicals, all of which contain fluorine  
15 atoms bound to a carbon chain.

17 37. The carbon-fluorine connection is one of the strongest chemical bonds ever  
18 created, making PFAS chemicals extremely persistent in the environment and difficult to break  
19 down or remediate.

20 38. PFAS chemicals do not occur naturally. They were invented by E. I. du Pont de  
21 Nemours and Company (“DuPont”) and the 3M Company (“3M”) in the 1930s. Less than a  
22 century later, PFAS chemicals have spread across the globe and contaminated the blood of  
23 approximately ninety-nine percent of Americans. PFAS chemicals have also been detected in  
24 breast milk and umbilical cord blood, indicating exposures to newborns and fetuses who are  
25 particularly vulnerable to chemical impacts.

26 39. The two most widely studied PFAS chemicals are perfluorooctane sulfonate  
27 (“PFOS”) and perfluorooctanoic acid (“PFOA”), both of which contain eight carbon atoms.  
28 PFOA and PFOS were among the first PFAS chemicals invented, and they are widely used in

1 Teflon cookware, GORE-TEX fabrics and clothing, Scotchgard sprays, and a range of other  
2 products, including, as relevant here, firefighting foam commonly known as “Aqueous Film  
3 Forming Foam” or “AFFF”.

4 40. PFOS and PFOA have shared properties that make them: (i) mobile, meaning they  
5 spread broadly once released, (ii) persistent, meaning they break down very slowly, (iii) bio-  
6 accumulative, meaning that even low level exposures build up over time in humans and animals,  
7 and (iv) toxic, meaning they pose serious health risks. As a result of these properties, PFOA and  
8 PFOS pose significant threats to human health and the environment.

9 41. Human health effects associated with PFOA exposure include kidney and  
10 testicular cancer, thyroid disease, high cholesterol, ulcerative colitis, liver damage, and  
11 pregnancy-induced hypertension (also known as preeclampsia).

12 42. Human health effects associated with PFOS exposure include immune system  
13 effects, changes in liver enzymes and thyroid hormones, low birth weight, high uric acid, and  
14 high cholesterol.

15 43. Numerous federal and state agencies have acknowledged the risks associated with  
17 PFAS chemicals. The Center for Disease Control and Prevention (“CDC”) reports that PFAS  
18 exposures “can be linked to higher rates of certain cancers, higher cholesterol levels, suppressed  
19 immune systems, fertility issues in women, and weakened antibody responses to vaccinations  
20 among children.” Agency for Toxic Substances and Disease Registry, *Annual Report:*  
21 *ATSDR Leads Charge to Reduce PFAS Exposure* (2017), <https://www.atsdr.cdc.gov/2017dchian>  
22 [nualreport/assets/pdf/ATSDR\\_Annual\\_Report\\_PFAS\\_Success\\_Story-508.pdf](https://www.atsdr.cdc.gov/2017dchianualreport/assets/pdf/ATSDR_Annual_Report_PFAS_Success_Story-508.pdf).

23 44. Similarly, the U.S. Environmental Protection Agency (“EPA”) found that PFAS  
24 can result in “developmental effects to fetuses during pregnancy and infants (e.g., low birth  
25 weight, altered puberty, skeletal variations), cancer (e.g., testicular, kidney), liver effects (e.g.,  
26 tissue damage), immune effects (e.g., changes in antibody production and immunity), thyroid  
27 effects related to developmental outcomes, and other effects (e.g., cholesterol changes).” EPA,  
28 *Per- and Polyfluoroalkyl Substances (PFAS) Action Plan* at 13 (Feb. 2019), <https://www.epa.gov>



1 /sites/production/files/2019-02/documents/pfas\_action\_plan\_021319\_508compliant\_1.pdf. Last  
2 year, EPA released a PFAS Action Plan to “reduce the risks associated with PFAS in the  
3 environment.” *Id.* at 8.

4 45. These harms occur at very low exposure levels. The CDC’s Agency for Toxic  
5 Substances and Disease Registry has identified minimal risk levels of approximately 21 parts-  
6 per-trillion and 14 parts-per-trillion for PFOA and PFOS, respectively, in drinking water. For  
7 purpose of comparison, one part-per-trillion is approximately equal to a single grain of sand in an  
8 Olympic-sized swimming pool.

9 46. Over the last decade, 3M, DuPont, and several other chemicals manufacturers, at  
10 the urging of EPA, have phased out their production of PFOA and PFOS. As they have done so,  
11 however, they frequently replaced those substances with other PFAS chemicals, many of which  
12 present similar health hazards.

13 47. The Director of CDC’s Center for Environmental Health has described the  
14 management of PFAS chemicals as “one of the most seminal public health challenges for the  
15 next decades.” Pat Rizzuto, David Schultz, & Sylvia Carignan, *CDC Sounds Alarm on Chemical*  
16 *Contamination in Drinking Water*, Bloomberg Environment (Oct. 17, 2017), [https://news.bloom](https://news.bloombergenvironment.com/environment-and-energy/cdc-sounds-alarm-on-chemical-contamination-in-drinking-water)  
17 [bergenvironment.com/environment-and-energy/cdc-sounds-alarm-on-chemical-contamination-](https://news.bloombergenvironment.com/environment-and-energy/cdc-sounds-alarm-on-chemical-contamination-in-drinking-water)  
18 [in-drinking-water](https://news.bloombergenvironment.com/environment-and-energy/cdc-sounds-alarm-on-chemical-contamination-in-drinking-water).  
19

## 20

### 21 **II. The Defense Department Has Long Known of the Risks Associated with AFFF**

22 48. One of the primary uses of PFAS chemicals is in AFFF, which is used to fight  
23 fires caused by the ignition of fuel or other flammable liquids. When AFFF concentrate is mixed  
24 with water, it creates a foam that can be sprayed over open flames, leaving a film on the surface  
25 that blocks the fire’s supply of oxygen and prevents re-ignition.

26 49. The Defense Department accounts for approximately seventy-five percent of all  
27 AFFF used in the United States, with municipal airports, refineries, and other industrial facilities  
28

1 responsible for the remainder. AFFF has been widely used at military installations for  
2 firefighting training exercises and during emergency fire situations.

3 50. The Defense Department was instrumental in the initial development of AFFF,  
4 which was invented by the U.S. Naval Research Laboratory and 3M in the 1960s.

5 51. The initial formulations of AFFF contained PFOA and/or PFOS.

6 52. The United States Navy received a patent for AFFF containing “one or more  
7 fluorocarbon compounds,” *i.e.*, PFAS chemicals, in 1966. Three years later, the Navy issued  
8 rules requiring the use of PFAS-based AFFF for all firefighting activities. Those requirements,  
9 which were subsequently adopted by other branches of the military, remain in effect today.

10 53. It did not take long for the Defense Department to discover the environmental and  
11 public health risks associated with AFFF. In the mid-1970s, the Naval Research Laboratory  
12 began researching alternate firefighting products, explaining that while “present formulations [of  
13 AFFF] with respect to fire suppression are highly effective ... improvements are desired in the  
14 environmental area.” Memorandum from Commanding Officer, Naval Research Laboratory to  
15 Commander, Aeronautical Systems Division, Wright-Patterson Air Force Base, Re: R&D Final  
17 Report on DOD-AGFSRS-76-10: Improved Environmental Impact Properties for AFFF  
18 Materials at 8 (Oct. 21, 1976).

19 54. A 1979 study by the Air Force’s Aerospace Medical Research Laboratory found  
20 that PFAS damaged the “thymus, bone marrow, stomach, mesentery, liver, and testes in the male  
21 rats.” Additional Air Force studies in the 1980s confirmed reproductive damage and impaired  
22 cell growth in animals exposed to PFAS chemicals. *See* Aerospace Medical Research  
23 Laboratory, *Teratologic Evaluation of a Model Perfluorinated Acid*, NDFDA at 1 (Jan. 1981).

24 55. By 1991, the U.S. Army Corps of Engineers recommended that AFFF “be  
25 replaced with nonhazardous substitutes” at the Fort Carson military base. U.S. Army Corps of  
26 Engineers, *Hazardous Waste Minimization Assessment: Fort Carson, CO* (Report No. N-91/02)  
27 at 141 (Jan. 1991).

28

1           56.     In 2000, 3M announced that it would voluntarily phase out the use of PFOS in  
2 AFFF. However, 3M and other companies continue to manufacture AFFF from other PFAS.

3           57.     In 2011, the Defense Department issued a Chemical & Material Emerging Risk  
4 Alert for AFFF, warning that PFOA and PFOS “are found widespread at low levels in humans  
5 and the environment, bioaccumulate in the food chain, resist degradation, show evidence of  
6 toxicity in laboratory studies, and are the subject of increasing regulation worldwide.”

7           58.     After AFFF is used, the PFAS from the foam can leach into soil and groundwater  
8 or flow into surface water, resulting in the contamination of military facilities and surrounding  
9 communities. More than 200 military facilities have unsafe PFAS levels in drinking water or  
10 groundwater, and many others have yet to be tested.

11          59.     In 2016, the Defense Department issued a policy requiring PFOS-based AFFF to  
12 be removed from ships and local supplies and stored in drums and cans. However, the  
13 Department continues to use AFFF containing other PFAS chemicals.

14          60.     Following the issuance of that policy, military installations were left with millions  
15 of gallons of stockpiled “legacy” AFFF containing PFOA and PFOS. Without any review of the  
16 environmental consequences, the Defense Department decided to incinerate it.  
17

18  
19 **III.    The Defense Department Acknowledges That AFFF Incineration Presents Serious**  
20 **Health Risks**

21          61.     The same properties that make AFFF an effective fire suppressant make it a  
22 dangerous substance to incinerate. As stated by EPA, “PFAS compounds are difficult to break  
23 down [via incineration] due to ... the chemical stability of fluorinated compounds.” EPA,  
24 *Technical Brief: Per- and Polyfluoroalkyl Substances (PFAS): Incineration to Manage PFAS*  
25 *Waste Streams* (“EPA Technical Brief”) (Aug. 2019), [https://www.epa.gov/sites/production/files](https://www.epa.gov/sites/production/files/2019-09/documents/technical_brief_pfas_incineration_ioaa_approved_final_july_2019.pdf)  
26 [/2019-09/documents/technical\\_brief\\_pfas\\_incineration\\_ioaa\\_approved\\_final\\_july\\_2019.pdf](https://www.epa.gov/sites/production/files/2019-09/documents/technical_brief_pfas_incineration_ioaa_approved_final_july_2019.pdf).

27          62.     Because PFAS do not break down under typical incineration conditions and  
28 temperatures, the fact that an incinerator has been permitted to dispose of other hazardous wastes

1 does not mean that it is capable of destroying PFAS. PFAS that do not break down are emitted  
2 into the air by the incinerator, along with other hazardous byproducts of incomplete combustion.  
3 *Id.*

4 63. When asked about AFFF incineration at a March 2019 Senate hearing, EPA’s  
5 Assistant Administrator for Water expressed concerns about the potential air emissions of PFAS  
6 and questioned whether, instead of eliminating PFAS, incineration was “just transferring the  
7 media [with] which we have a problem.” *Examining the Federal Response to the Risks*  
8 *Associated with Per- and Polyfluoroalkyl Substances (PFAS): Hearing Before the S. Comm. on*  
9 *Env’t & Pub. Works*, 116th Cong., 53 (Mar. 28, 2019), [https://www.epw.senate.gov/public/\\_cache](https://www.epw.senate.gov/public/_cache/files/9/0/90f8dc4c-e7e8-4699-83f5-051b557f9560/A9509915AA3E829D3EC9C2DA5B0754F4.spw-032819.pdf)  
10 [files/9/0/90f8dc4c- e7e8- 4699- 83f5- 051b557f9560/A9509915AA3E829D3EC9C2DA5B075](https://www.epw.senate.gov/public/_cache/files/9/0/90f8dc4c-e7e8-4699-83f5-051b557f9560/A9509915AA3E829D3EC9C2DA5B0754F4.spw-032819.pdf)  
11 [4F4.spw-032819.pdf](https://www.epw.senate.gov/public/_cache/files/9/0/90f8dc4c-e7e8-4699-83f5-051b557f9560/A9509915AA3E829D3EC9C2DA5B0754F4.spw-032819.pdf).

12 64. The Defense Department has been aware of the risks associated with the  
13 incineration of PFAS for years. In April 2017, the Department solicited proposals for “novel”  
14 AFFF disposal technologies because “no satisfactory disposal method has been identified.”  
15 Department of Defense, *AFFF Disposal Solicitation*, Topic No. AF17B- T001 (Apr. 21, 2017), [h](https://www.sbir.gov/sbirsearch/detail/1254657)  
16 [t](https://www.sbir.gov/sbirsearch/detail/1254657)[tps://www.sbir.gov/sbirsearch/detail/1254657](https://www.sbir.gov/sbirsearch/detail/1254657). That solicitation acknowledged that AFFF  
17 incineration faced “several significant challenges,” including the absence of information about  
18 “products of pyrolysis or combustion, temperatures at which these will occur, or the extent of  
19 [PFAS] destruction that will be realized.” *Id.*

20 65. The Defense Department also warned that “many likely byproducts” of PFAS  
21 incineration “will also be environmentally unsatisfactory ... or toxic, e.g., [hydrogen fluoride],  
22 fluoroacetates, or perfluoroisobutylene.” *Id.*

23 66. These “likely byproducts” present serious health risks to fence-line and downwind  
24 communities. Hydrogen fluoride can cause severe respiratory damage and skin burns following  
25 inhalation or dermal contact. Fluoroacetates are poisons that are often used as rodenticides.  
26 Perfluoroisobutylene is a deadly chemical that has been used as a chemical warfare agent.  
27  
28

1           67.     Reiterating the need for additional research into PFAS disposal, the Defense  
2 Department’s environmental science and technology program recently issued a “statement of  
3 need” for “improved understanding of thermal destruction technologies for materials laden with  
4 per- and polyfluoroalkyl substances.” Strategic Environmental Research and Development  
5 Program (SERDP), *FY 2021 Statement of Need: Improved Understanding of Thermal  
6 Destruction Technologies for Materials Laden with Per- and Polyfluoroalkyl Substances* (Oct.  
7 24, 2019), [https://www.serdp-estcp.org/index.php//content/download/50016/492599/file/ERSON-  
8 21-C1%20Thermal%20PFAS.pdf](https://www.serdp-estcp.org/index.php//content/download/50016/492599/file/ERSON-21-C1%20Thermal%20PFAS.pdf).

9           68.     EPA has echoed the Defense Department’s concerns about PFAS incineration.  
10 EPA is currently soliciting research into PFAS disposal technologies, noting that PFAS are  
11 “extremely difficult to combust” and that PFAS incineration “may promote the formation of  
12 complex products of incomplete combustion that may themselves be toxic and/or contribute to  
13 ozone depletion as well as other potential physical effects to the atmospheric environment.”  
14 EPA, *Per- and Polyfluoroalkyl Substances (PFAS) Air Emissions: Characterization, Mitigation  
15 and Disposal/Destruction of PFAS Residuals* (Apr. 2019), [https://cfpub.epa.gov/ordpd/PostDoc  
16 Position.cfm?pos\\_id=1115](https://cfpub.epa.gov/ordpd/PostDocPosition.cfm?pos_id=1115).

17           69.     EPA has also acknowledged the harms associated with incineration when  
18 approving new PFAS chemicals under the Toxic Substances Control Act. In multiple rules and  
19 orders restricting the manufacturing, use, and disposal of new PFAS chemicals, EPA found that  
20 the chemicals presented unreasonable risk in part due to “concern[s] that ... perfluorinated  
21 products may be released to the environment from incomplete incineration.” *See, e.g.*,  
22 *Significant New Use Rules on Certain Chemical Substances*, 77 Fed. Reg. 48,858 (Aug. 15,  
23 2012).

24           70.     Another problem posed by PFAS incineration is the inability to adequately  
25 monitor the PFAS emissions from incinerators. According to EPA, “[e]mission studies” of PFAS  
26 incineration “have been incomplete due to lack of necessary measurement methods ...” EPA  
27 Technical Brief at 2.  
28

1           71. In June 2019, an EPA official presented on “EPA PFAS Air Emission  
2 Measurements: Activities and Research.” His presentation noted that “[a]ccepted source and  
3 ambient air methods for PFAS do NOT exist” and “[c]urrent emissions tests often target only a  
4 small number of PFAS compounds for analysis while significantly more may be present.”  
5 Presentation by Jeff Ryan, EPA Office of Research and Development, EPA Region 4 Spring  
6 Grants/Planning Meeting at Slide 13 (May 23, 2019), [https://cfpub.epa.gov/si/si\\_public\\_file\\_down  
7 load.cfm?p\\_download\\_id=538634&Lab=NRMRL](https://cfpub.epa.gov/si/si_public_file_download.cfm?p_download_id=538634&Lab=NRMRL).

8           72. Without reliable measurement methods, there is no way to verify that incinerators  
9 have successfully destroyed or captured the PFAS chemicals, as opposed to releasing them into  
10 surrounding communities. *Id.*

11  
12 **IV. DLA Entered into Three Contracts for the Incineration of Millions of Gallons of**  
13 **PFAS-Based AFFF**

14           73. Despite knowing the dangers associated with incinerating PFAS, on or around  
15 July 6, 2018 DLA issued a solicitation for three regional contracts governing the removal,  
17 transportation, and incineration of unused AFFF from the military and Department of Homeland  
18 Security facilities across the country. Each Contract was to last for 30 months, with an option for  
19 a 30-month extension, for a total contract life of five years.

20  
21                   *a. The Eastern Regional Contract*

22           74. On or around November 13, 2018, DLA awarded the contract for the removal,  
23 transportation, and incineration of AFFF from military installations in the Eastern Region to  
24 Tradebe Treatment and Recycling, LLC (“Tradebe”). The Eastern Region covers Alabama,  
25 Connecticut, Delaware, Florida, Georgia, Illinois, Indiana, Kentucky, Maine, Maryland,  
26 Massachusetts, Michigan, Mississippi, New Hampshire, New Jersey, New York, North Carolina,  
27 Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Vermont, Virginia, West  
28

1 Virginia, and Wisconsin. A copy of the Eastern Regional Contract is attached hereto as **Exhibit**  
2 **A.**

3 75. Through the Eastern Regional Contract, DLA contracted for the incineration of  
4 approximately 843,000 gallons of stockpiled AFFF concentrate and rinsate.

5 76. Approximately one month after the award of that contract, a Tradebe affiliate  
6 within the region—Tradebe Treatment and Recycling Northeast, LLC—entered a consent decree  
7 with the United States Environmental Protection Agency to resolve a series of violations of the  
8 Clean Air Act and Resources Conservation Recovery Act, including “failure to report hazardous  
9 waste releases,” failure to “minimize threats from hazardous waste releases,” “failure to comply  
10 with ... tank and emission control standards,” and “failure to conduct adequate inspections for  
11 malfunctions or deteriorating conditions.”

12 77. Tradebe owns Norlite, LLC, which owns and operate a lightweight aggregate kiln  
13 in Cohoes, New York where the Department of Defense has sent PFAS-containing firefighting  
14 foam for incineration. The Norlite kiln also has a long history of environmental violations,  
15 resulting in fines and enforcement actions by the New York State Department of Environmental  
16 Conservation. The kiln is also located next to a public housing complex, whose residents are  
17 exposed to emissions from the kiln. However, Tradebe continued to send PFAS to that kiln under  
18 the Eastern Regional Contract.  
19

20  
21 *b. The Mid-America Regional Contract*

22 78. Also on or around November 13, 2018, DLA awarded the contract for the  
23 removal, transportation, and incineration of AFFF from military installations in the Mid-America  
24 Region to Tradebe Treatment and Recycling, LLC. The Mid-America Region covers Arkansas,  
25 Iowa, Kansas, Louisiana, Minnesota, Missouri, Nebraska, North Dakota, Oklahoma, South  
26 Dakota, and Texas. A copy of the Mid-America Regional Contract is attached hereto as **Exhibit**

27 **B.**  
28

1           79. Through the Mid-America Regional Contract, DLA contracted for the  
2 incineration of more than 310,000 gallons of stockpiled AFFF concentrate and rinsate.

3  
4                           *c. The Western Regional Contract*

5           80. On or around May 29, 2019, DLA awarded and entered a contract with Heritage  
6 Environmental Services (“Heritage”) for the removal, transportation, and incineration of AFFF  
7 from the Western Region. The Western Region covers Arizona, California, Colorado, Idaho,  
8 Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. A copy of the  
9 Western Regional Contract is attached hereto as **Exhibit C**.

10           81. Through the Western Regional Contract, DLA contracted for the incineration of  
11 more than 888,000 gallons of stockpiled AFFF concentrate and rinsate.

12           82. Heritage and its affiliates operate incinerators with a long history of  
13 environmental violations. In October 2018, the Environmental Protection Agency entered a  
14 settlement with Heritage Thermal Services Inc., a Heritage subsidiary, arising from several years  
15 of Clean Air Act violations at an East Liverpool, Ohio hazardous waste incinerator that is one of  
17 the facilities authorized to incinerate AFFF under the Contracts.

18           83. Critically, the Heritage incinerator failed to maintain minimum temperatures  
19 specified in its Clean Air Act permit “on numerous days,” according to EPA. The maintenance  
20 of adequate temperatures is particularly critical for the incineration of AFFF, since PFAS  
21 chemicals do not break down even at normal incineration temperatures, much less at  
22 temperatures below permitted levels.

23           84. In November 2018, the Vermont Department of Environmental Conservation  
24 cancelled plans to send PFAS-containing AFFF to Heritage’s East Liverpool incinerator, citing  
25 concerns about the facility’s environmental violations and poor operating conditions.

26           85. Less than a year later, EPA awarded Heritage the Western Region Contract.

27           86. On December 18, 2019, an EPA official wrote to the East Liverpool City Council  
28 to express “concern over the incineration of PFAS waste” at Heritage’s East Liverpool



1 incinerator and informed the Council that EPA was “evaluating whether the incineration of  
2 PFAS is a violation of the Facility’s permit.”

3 87. All of the Contracts contain largely identical terms. They require DLA to submit a  
4 Task Order to Tradebe or Heritage when it has a shipment of AFFF that is ready for incineration.

5 88. The Contracts also all state that “[a]ll wastes turned in under this contract are  
6 believed by the Government to contain or potentially contain unknown concentrations of per- or  
7 polyfluoroalkyl substances (PFASs) such as perfluorooctane sulfonate (PFOS) and/or  
8 perfluorooctanoic acid (PFOA).”

9 89. The Contracts further state that all AFFF-related wastes will be “thermally  
10 destroyed at a fully permitted [Resource Conservation and Recovery Act, or RCRA] incineration  
11 facility on the DLA Disposition Services [Qualified Facilities List].”

12 90. On information and belief, there are at least eight RCRA incinerators on the  
13 DLA’s Qualified Facility List where the AFFF may be sent under the Contracts. Tradebe and  
14 Heritage can send AFFF to any of these incinerators.

15 91. Many of these incinerators have a long history of Clean Air Act and RCRA  
16 violations, and are located in communities that suffer disproportionate environmental burdens.

17 For instance:

18 a. The Veolia ES Technical Solutions incinerator in Sauget, Illinois has had at least  
19 twelve consecutive quarters with “high priority” Clean Air Act violations. Sixty-one percent of  
20 the residents living within a three mile radius of the incinerator are African American, and forty-  
21 four percent have a household income of \$25,000 or less, according to 2010 Census data. The  
22 respiratory hazard index for the surrounding area, measuring the likelihood of harm from  
23 inhalation of air pollution, and the air toxics cancer risk, measuring the likelihood of developing  
24 cancer from the inhalation of air toxics, is in the 79th percentile for the nation and 93rd  
25 percentile for the state.  
26

27 b. The Clean Harbors incinerator in El Dorado, Arkansas is classified by EPA as a  
28 “significant non-complier” with RCRA, and has had RCRA or Clean Air Act violations in nine

1 of the last twelve quarters, resulting in multiple enforcement actions and compliance orders.  
2 Sixty-one percent of the residents living within a three mile radius of the incinerator are African  
3 American or Latino, and approximately fifty percent have a household income of \$25,000 or  
4 less, according to 2010 Census data. The respiratory hazard index and air toxics cancer risk for  
5 the surrounding area is in the 75th percentile for the nation and the 82nd percentile for the state.

6 92. The Heritage-WTI incinerator in East Liverpool, Ohio has violated its Clean Air  
7 Act permit in eleven of the previous twelve quarters and has violated its RCRA permit in three of  
8 the previous twelve quarters. The incinerator has repeatedly failed to meet its operational limits  
9 for temperature and pressure, and has released unsafe levels of dioxins, furans, and other  
10 hazardous substances into the surrounding community. The incinerator is less than 400 feet from  
11 the nearest home, in a neighborhood where the majority of the African Americans in East  
12 Liverpool reside, and approximately 1,100 feet from the nearest school. The respiratory hazard  
13 index and air toxics cancer risk for the surrounding area is in the 61st percentile for the state. In a  
14 letter to Plaintiff Save Our County, the Ohio Department of Health wrote that East Liverpool has  
15 a “strikingly high incidence rate of overall cancer, but also for bladder, colon & rectum,  
16 esophagus, lung & bronchus, multiple myeloma, and prostate cancer when compared to Ohio and  
17 the U.S.” *See* Letter from Ohio Dep’t of Health to Alonzo Spencer, Save Our County, Re:  
18 Cancer Among Residents of East Liverpool (Aug. 19, 2010).

19  
20 c. The Veolia incinerator in Port Arthur, Texas is located in a minority community  
21 that is already overburdened by pollution from chemical plants, refineries, and other industrial  
22 facilities. More than seventy percent of Port Arthur residents are African American or Latino,  
23 and the cancer risk among African Americans in Jefferson County—where Port Arthur is  
24 located—is fifteen percent higher than the state-wide average. The mortality rate from cancer  
25 among African Americans in Jefferson County is forty percent above the state-wide average, and  
26 residents of Port Arthur are four times more likely than people 100 miles upwind to report  
27 suffering from heart and respiratory conditions; nervous system and skin disorders; headaches  
28 and muscle aches; and ear, nose, and throat ailments.

1 93. The Contracts do not impose any minimum temperature requirements for AFFF  
2 incineration, despite the fact that PFAS are resistant to combustion and are not fully destroyed at  
3 the temperatures that are sufficient to destroy other hazardous waste.

4 94. The Contracts also do not require the authorized AFFF incinerators to  
5 demonstrate that they have successfully incinerated or can successfully incinerate AFFF.

6  
7 **V. DLA Failed to Evaluate the Environmental Impacts of the Contracts**

8 95. Despite the acknowledged risks and unanswered questions about the effects of  
9 AFFF incineration, DLA conducted no review of the Contracts' environmental impacts under  
10 NEPA.

11 96. DLA did not prepare an EIS to evaluate the Contracts' significant adverse  
12 environmental impacts.

13 97. DLA did not prepare an EA to evaluate whether the Contracts may present  
14 significant adverse environmental impacts warranting an EIS.

15 98. On May 17, 2019, Petitioner Sierra Club and Petitioners' counsel Earthjustice  
17 submitted a Freedom of Information Act ("FOIA") request seeking "[a]ny records documenting  
18 the review of the [Tradebe Contracts] under the National Environmental Policy Act, including,  
19 but not limited to, documentation of a categorical exclusion, Environmental Assessment, or  
20 Environmental Impact Statement and any supporting studies or analyses."

21 99. On July 9, 2019, DLA responded, "we have conducted a search on your behalf.  
22 Our agency's subject matter expert's searches found no records responsive to your request."

23 100. Not only did DLA conduct no NEPA review, but it admits that it has no records  
24 concerning the environmental impacts of the Contracts or the consequences of AFFF  
25 incineration. In response to a separate FOIA request from Sierra Club and Earthjustice seeking  
26 "[a]ny studies or other records concerning the environmental impact of incineration of AFFF and  
27 AFFF-related wastes," DLA responded, "[t]he Defense Logistics Agency (DLA) has determined  
28 it possesses no records responsive to this request."

1 101. Incineration of AFFF is currently ongoing under the Contracts.

2 **FIRST CLAIM FOR RELIEF**

3 **Violation of the National Environmental Policy Act**

4 **(Against DLA, the Defense Department, and Sec. Esper and Director Williams in their**  
5 **official capacities)**

6 102. Plaintiffs incorporate all preceding paragraphs by reference.

7 103. Each of the Contracts for the large-scale incineration of toxic AFFF is a major  
8 federal action subject to NEPA.

9 104. NEPA requires federal agencies to prepare an EIS for all “major Federal actions  
10 significantly affecting the quality of the human environment.” 42 U.S.C. § 4332(2)(C).

11 105. Defendants did not prepare an EIS for the Contracts.

12 106. If there are questions about whether a proposed action may have significant  
13 environmental effects, an agency may prepare an EA to determine whether an EIS is needed.  
14 40 C.F.R. § 1508.09.

15 107. Defendants did not prepare an EA for the Contracts.

16 108. By failing to prepare an EIS or an EA, Defendants failed to take a “hard look at  
17 the environmental consequences of their proposed actions,” as required by NEPA. *Tillamook*  
18 *Cty.*, 288 F.3d at 1143.

19 109. An agency may avoid the preparation of an EA or an EIS only if an action has  
20 been categorically excluded from NEPA review.

21 110. Defendants have not identified any categorical exclusion applicable to the  
22 Contracts.

23 111. Moreover, even in circumstances where a categorical exclusion would otherwise  
24 apply, NEPA review of a proposed action is still required if the action involves “extraordinary  
25 circumstances.” 40 C.F.R. § 1508.4.

26 112. If a proposed action might involve extraordinary circumstances, an agency must  
27 document its consideration of such circumstances and state the basis for its decision.  
28

1 113. DLA has not documented its consideration of the extraordinary circumstances  
2 presented by the Contracts.

3 114. DLA's NEPA Regulations identify eight extraordinary circumstances, any one of  
4 which precludes the use of a categorical exclusion. At least four of those extraordinary  
5 circumstances apply here.

6 115. First, the Contracts present a "[r]easonable likelihood of significant effects on  
7 public health, safety or the environment." DLA NEPA Regulations at 18. As acknowledged by  
8 the Defense Department, AFFF incineration is "likely" to result in the emission of  
9 "environmentally unsatisfactory ... or toxic" chemicals, including PFAS. *See supra* ¶ 65. Once  
10 emitted, PFAS chemicals can remain in the environment for hundreds or thousands of years, bio-  
11 accumulate in people and other living organisms, and cause severe health effects even at very  
12 low exposure levels.

13 116. Second, even if the Contracts were not reasonably likely to result in significant  
14 health effects, they would still have "[e]ffects on the environment which are likely to be highly  
15 controversial, uncertain or involve unique or unknown risks." DLA NEPA Regulations at 18.  
16 The Defense Department has acknowledged that "there is no precedent to predict products of  
17 [AFFF] combustion," and EPA recently warned that "[e]mission studies" of PFAS incineration  
18 "have been incomplete due to lack of necessary measurement methods." AFFF Disposal  
19 Solicitation (2017); EPA Technical Brief at 2. As EPA concluded in August 2019, following the  
20 award of all three Contracts, "[t]he effectiveness of incineration to destroy PFAS compounds and  
21 the tendency for formation of fluorinated or mixed halogenated organic byproducts is not well  
22 understood." EPA Technical Brief at 2.

23 117. Third, the Contracts present a "[r]easonable likelihood of violating any federal ...  
24 requirement imposed for the protection of the environment." DLA NEPA Regulations at 18.  
25 Under the NDAA, DLA may not incinerate AFFF unless the Defense Department has ensured  
26 that the temperature conditions at the incinerator are sufficient to break down PFAS and to attain  
27 the maximum achievable reduction in PFAS emissions. The Contracts do not impose any  
28

1 temperature requirements or minimum standards for PFAS emissions reduction, and thus are  
2 likely to result in violations of those statutory requirements.

3 118. Finally, the Contracts present the potential for “degradation of already existing  
4 poor environmental conditions.” *Id.* at 19. The communities surrounding the incinerators  
5 authorized by the contracts already suffer from elevated rates of cancer, respiratory disease, and  
6 other harms caused by toxic air pollution. PFOA and PFOS are associated with many of these  
7 same health effects. The incineration of AFFF thus threatens to exacerbate the already dangerous  
8 levels of air pollution where Petitioners’ members live, work, and play.

9 119. DLA did not consider any of these extraordinary circumstances before it approved  
10 and awarded the Contracts.

11 120. On information and belief, DLA applied a categorical exclusion to the Contracts  
12 notwithstanding the existence of extraordinary circumstances.

13 121. DLA’s failure to consider and account for extraordinary circumstances violated  
14 NEPA, *id.* at 18, and the APA’s requirement for rational and lawful decision-making.  
15 5 U.S.C. § 706(2).

## 17 SECOND CLAIM FOR RELIEF

### 18 Violation of the National Defense Authorization Act

#### 19 (Against DLA, the Defense Department, and Sec. Esper and Director Williams in their 20 official capacities)

21 122. Plaintiffs incorporate all preceding paragraphs by reference.

22 123. In December 2019, Congress enacted new restrictions on the Defense  
23 Department’s incineration of AFFF and other PFAS-containing material through the NDAA.

24 124. The NDAA states that “[t]he Secretary of Defense shall ensure that when  
25 materials containing [PFAS] or [AFFF] are disposed—(1) all incineration is conducted at a  
26 temperature range adequate to break down PFAS chemicals while also ensuring the maximum  
27 degree of reduction in emission of PFAS, including elimination of such emissions where  
28 achievable.” NDAA § 330, 133 Stat. at 258–259.







**Smith, Sean D. (ECY)**

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**From:** Mari Anderson <itisimari@gmail.com>  
**Sent:** Saturday, September 19, 2020 1:59 PM  
**To:** Smith, Sean D. (ECY)  
**Subject:** comment on firefighting foam collection and disposal plan?

**THIS EMAIL ORIGINATED FROM OUTSIDE THE WASHINGTON STATE EMAIL SYSTEM - Take caution not to open attachments or links unless you know the sender AND were expecting the attachment or the link**

Mr. Smith,

Could not find a means to submit my comment on the WA Department of Ecology as suggested in the article "Public invited to comment on firefighting foam collection and disposal plan." posted by My Edmonds News on September 12, 2020. Please accept my apology if this is not the acceptable means to contact or my miss-understanding of the post. Would appreciate having the proper link for comments if available.

This is my comment:

Three of my wells have been contaminated with PFAS. I am angry this contamination was NOT revealed much earlier. I think of many who have suffered from the toxins in PFAS causing horrible deaths. It is imperative to safely dispose of PFAS in a manner that will not spread contamination. It is also critical to conduct research for possible removal of PFAS from the public drinking water, private wells and storm water runoff. It is devastating to learn storm water runoff from NAS Whidbey contaminated with PFAS is migrating to bodies of water with harm to marine, wildlife and the public. NAS Whidbey has contaminated the ground and water with toxic jet fuel runoff since 1942 when the wetlands were paved for runways. Decades ago a dairy farmer near the runway torched the slough to burn off the fuel. The farmer had lost income due to Dairy Gold refusing to accept milk contaminated with jet fuel. The farmer received NO compensation from the navy. What is currently the policy of containing contaminates from the navy? High temperature

incineration with least risk leaves no choice but to agree to accept this method, therefore I agree.

WA Department of Ecology is performing an outstanding service to the public we are fortunate to live in the State of Washington. Governor Inslee is a hero for the environment. My family has lived on Whidbey Island since 1911.

Have a PEACEFUL day,

Mari Deen Anderson  
4 West Frostad Road  
Oak Harbor, WA 98277-9562  
EARTH

360-675-2354

**From:** Michael Maier [<mailto:MAIERM@pasco-wa.gov>]  
**Sent:** Wednesday, September 16, 2020 7:55 PM  
**To:** Terpening, Dustin (ECY) <[DTER461@ECY.WA.GOV](mailto:DTER461@ECY.WA.GOV)>  
**Subject:** SEPA #202004521

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the attachment or the link**

Dustin,

I am contacting you with regard to the public comment period for SEPA #202004521 review.

As a resident of Washington State and employee of Pasco Fire Department who uses firefighting foams for a variety of fire types, I applaud the state for being proactive and funding the safe disposal of PFAS-containing foams. The pervasive nature of these chemicals and their longterm health affects make the safe disposal of these foams important to all Washingtonians. The program is well conceived the communications from DOE, specifically Sean Smith has been informative and timely. One concern that I have relates to the program expiration and tight timeline for foam pickup conflicting for fire departments that serve FAA indexed airports with Aircraft Rescue and Firefighting (ARFF) responsibilities. There are 10 commercial service primary airports in Washington State. Title 14 Code of Federal Regulations (CFR) Part 139 requires that these airports carry foams that meet military specifications (MIL-PRF-24385). Currently, all foams that meet MIL-PRF-24385 are PFAS-containing. Included in the FAA Reauthorization Act of 2018 is a mandate directing the FAA to stop requiring the use of fluorinated foam no later than October 4, 2021. This means that departments with ARFF responsibilities may be legally bound to keep these PFAS-containing foams past the collection dates provided by the program causing thousands of gallons to slip through the cracks of the program. Providing a foam collection after October 2021 should allow these departments to participate and ensure that these pervasive chemicals do not further contaminate our soil and groundwater. Thank you for your consideration.

Mike Maier  
Captain 81A  
1011 E Ainsworth St  
Pasco, WA 99301  
Office: (509) 545-3439  
Cell: (509) 539-3433



## Smith, Sean D. (ECY)

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**From:** Stephen Colby Brown <browns6887@att.net>  
**Sent:** Tuesday, September 8, 2020 6:18 AM  
**To:** Smith, Sean D. (ECY)  
**Cc:** Sonya Lunder; darlenes@olympus.net; Eric Uram  
**Subject:** Washington State SEPA #202004521-AFFF collection and disposal

**THIS EMAIL ORIGINATED FROM OUTSIDE THE WASHINGTON STATE EMAIL SYSTEM - Take caution not to open attachments or links unless you know the sender AND were expecting the attachment or the link**

Mr. Smith,

As a PhD Chemist, I understand that high temperature incineration (> 1200 °C) in a reducing atmosphere *can* reduce most PFAS to Hydrogen Fluoride, CO<sub>2</sub>, and H<sub>2</sub>O. However, flue emissions are not normally monitored or controlled to ensure that these requirements are **actually met** in the high-capacity industrial facilities you are contracting with in Utah. As you know, the Cohoes, NY facility was a typical contractor for these services, and it took a [class exercise at Bennington College](#) to show that the EPA, etc. had NOT done their jobs to ensure that PFAS were destroyed. What controls will be put in place to ensure that these AFFF stocks are properly destroyed? Who will be responsible, and will they actually be liable for dereliction of duty?

Best Regards,

Stephen C Brown, PhD  
(734) 604-4582 (m)  
[browns6887@att.net](mailto:browns6887@att.net)

"If everyone is thinking alike, then somebody isn't thinking." *George S. Patton*



September 30, 2020

Sean Smith  
Washington State Department of Ecology  
300 Desmond Dr. SE  
Lacey, WA 98503

Dear Mr. Smith:

SEPA Checklist Comments Regarding Disposal of AFFF Containing PFAS Molecules

Comment #1:

Given;

- a) Ecology's Document 2020.9.1 Ecology DNS template KZ indicates that "Ecology is requiring Clean Harbors to expose the PFAS foam to temperatures in excess of 1000 C withhold time of two seconds or more (pg. 2)."
- b) Ecology's Document 2020.9.1 Ecology SEPA Check List indicates that "Ecology's Chosen disposal method is to incinerate the foam at a Resource Conservation and Recovery Act (RCRA)-permitted commercial hazardous waste incinerator capable of exposing the PFAS foam to temperatures in excess of 1300 C (2372 F), with hold times great than two seconds (pg. 2)."
- c) EPA Technical Brief Per- and Polyfluoroalkyl Substances (PFS): Incineration to Manage PFAS Waste Streams indicate that 1400 C is required to decompose CF4 compounds (pg. 1).
- d) Ecology's Document 2020.9.1 Ecology SEPA Checklist states that product of incomplete combustion are not well studied and "may settle out in residue ash, be captured in secondary pollution devices or escape as emissions (pg. 7)."
- e) Ecology's Document 2020.9.1 Ecology SEPA Check List states that "the fact that PFAS molecules are expected to outlast the lifespan of Subtitle C landfills, is a major concern to Ecology (pg. 8)"

Question #1: With temperature discrepancies and the uncertainty of incineration as a successful treatment option for PFAS molecules, although the best option currently available, will stakeholders who submit product for disposal through Washington Department of Ecology, Aqueous Film Forming Foam (AFFF) Collection Program be responsible and held accountable for RCRA's "cradle to grave" aspect if future PFAS/PFOA sampling at the Aragonite facility, Grassy Mountain landfill, the Greater Salt Lake water body or the surrounding area indicate PFAS molecule contamination and the need for site remediation? Once the product is relinquished to DOE will DOE be considered the waste generator?

Question #2: Will the 2019/2021 PFAS disposal timeframe be extended given the 2020/2021 Covid-19 pandemic disruptions? WSDOT may not be able to meet the 2021 deadline. Extending the timeframe to 2024 would allow enough time to retrofit the fire suppression system for the I-90 tunnel network. Are stakeholders listed in the Department of Ecology SEPA Checklist document, pages 14-16, grandfathered in or will there be no more funding available for AFFF disposal?

Sincerely,

Matthew R. Cox

Matthew Cox  
Hazardous Materials Specialist

cc: Sean Smith  
Norm Payton