**Background for comments #1-3 in "MEJO Comments to City for F35 Listening Session"[1]**

**1. Environmental justice**

The placement of F-35s at Madison's Truax Air National Guard base raises significant environmental justice issues that should be fully evaluated in the EIS process. Low income people living at the Truax apartments (about ½ mile southeast of the base), including a large percentage of people of color, will be disproportionately exposed to the noise and other pollution emitted from F-35s during their ongoing operations at Truax ANG and during jet landings and takeoffs. Given their proximity to the site, Truax residents are more at risk from jet crashes during takeoff and landing than people living further from the site. Starkweather Creek, which flows right next to the neighborhood, receives all the runoff from the base and is contaminated with chemicals from stormwater runoff from it (see below). Anglers in the neighborhood eat fish from this creek downstream of the site. People living at the trailer park about 1/2 mile west of the ANG site, and low-income apartments just west of that, will also be disproportionately affected by the noise and other pollution from these jets. The Darbo Worthington neighborhood about a bit over a mile south of the base, with a high proportion of low income minorities, is right under a frequent landing path for the fighter jets. Starkweather Creek also flows through this neighborhood.

The Truax, Darbo Worthington, and the trailer park neighborhoods are already exposed to a number of environmental health risks and score very high on the EPA EJSCREEN (see attached documents for the three areas described above). Locating supersonic F-35s at Truax WANG will further add to these risks.

In assessing environmental justice issues impacts to these neighborhoods in the EIS process, Promising Practices for EJ Methodologies in NEPA Reviews should be followed.

**2. Vertical and horizontal groundwater and vapor contamination at WANG never completely assessed**

**History of existing WANG site contamination and remediation**

Following the implementation of the Resource Conservation and Recovery Act (RCRA) of 1976 , and Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA, or Superfund) the Department of Defense (DoD) Installation Restoration Program (IRP) was initiated in the late 1980s. This led to a series of investigations of soil and groundwater contamination the Truax Wisconsin Air National Guard (WANG) base, led by consultants hired by the National Guard Bureau.

The first comprehensive assessment of the WANG site in 1988 stated: "The major operations of the 128th TFW that have used and disposed of hazardous materials/hazardous wastes include aircraft maintenance, ground vehicle maintenance, aerospace ground equipment, and fire department training. The operations involve such activities as corrosion control, nondestructive inspection, fuel cell maintenance, and engine maintenance. Varying quantities of waste oils, recovered fuels, spent cleaners, strippers, and solvents were generated and disposed of by these activities." There were (and still are) many underground storage tanks at the site, many holding toxic chemicals, petroleum fuels, and/or waste soils.[2,3]

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[1] Disclaimer: Most of the information in this document comes from a review of thousands of pages of investigative reports compiled by the ANG, which we obtained from UW Memorial Library years ago. There is an overwhelming amount of complex and confusing information in these reports, and we may have incorrectly interpreted information and/or data in them. We apologize for any incorrect statements. Please contact Maria Powell (mariapowell@mejo.us) for references to specific information cited in this report, correct mistakes, clarify or contribute information.

[2] The August 1988 investigation was prepared for the National Guard Bureau by the HAZWRAP SUPPORT CONTRACTOR OFFICE, Oak Ridge. Tennessee 37831, Operated by MARTIN MARIETTA ENERGY SYSTEMS. INC., For the U.S. DEPARTMENT OF ENERGY under contract DE-AC05-840R21400

[3] Many of the toxic chemicals used at the site were dumped down storm drains and/or onto the ground. The 1987 "Initiation of Installation Restoration Program Preliminary Assessment" for Truax Field noted that "Past experience has indicated that units have not been totally open and in some cases may have restricted information about disposal practices. This could have occurred because people did not know how their superiors would react or what the impact might be on public affairs and legal issues."

The August 1988 investigative report includes a table with general categories (but few specific names) of some types of hazardous chemicals used and stored at the site up to that point:

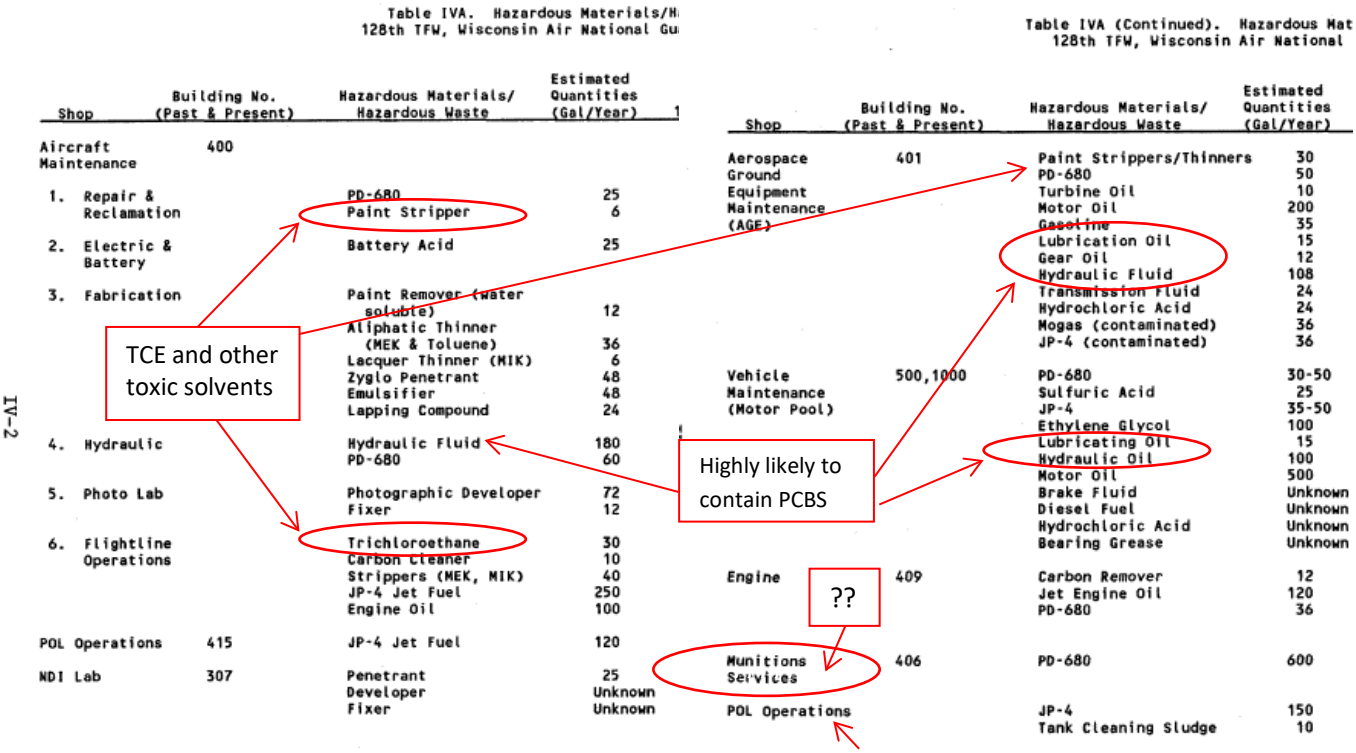

Table IVA. Hazardous Materials/H
128th TFW, Wisconsin Air National Gu

| Shop | Building No. (Past & Present) | Hazardous Materials/ Hazardous Waste | Estimated Quantities (Gal/Year) |
|---|---|---|---|
| Aircraft Maintenance | 400 | | |
| 1. Repair & Reclamation | | PD-680 | 25 |
| | | Paint Stripper | 6 |
| 2. Electric & Battery | | Battery Acid | 25 |
| 3. Fabrication | | Paint Remover (water soluble) | 12 |
| | | Aliphatic Thinner (MEK & Toluene) | 36 |
| | | Lacquer Thinner (MIK) | 6 |
| | | Zyglo Penetrant | 48 |
| | | Emulsifier | 48 |
| | | Lapping Compound | 24 |
| 4. Hydraulic | | Hydraulic Fluid | 180 |
| | | PD-680 | 60 |
| 5. Photo Lab | | Photographic Developer | 72 |
| | | Fixer | 12 |
| 6. Flightline Operations | | Trichloroethane | 30 |
| | | Carbon Cleaner | 10 |
| | | Strippers (MEK, MIK) | 40 |
| | | JP-4 Jet Fuel | 250 |
| | | Engine Oil | 100 |
| POL Operations | 415 | JP-4 Jet Fuel | 120 |
| NDI Lab | 307 | Penetrant | 25 |
| | | Developer | Unknown |
| | | Fixer | Unknown |

Table IVA (Continued). Hazardous Mat
128th TFW, Wisconsin Air National

| Shop | Building No. (Past & Present) | Hazardous Materials/ Hazardous Waste | Estimated Quantities (Gal/Year) |
|---|---|---|---|
| Aerospace Ground Equipment Maintenance (AGE) | 401 | Paint Strippers/Thinners | 30 |
| | | PD-680 | 50 |
| | | Turbine Oil | 10 |
| | | Motor Oil | 200 |
| | | Gasoline | 35 |
| | | Lubrication Oil | 15 |
| | | Gear Oil | 12 |
| | | Hydraulic Fluid | 108 |
| | | Transmission Fluid | 24 |
| | | Hydrochloric Acid | 24 |
| | | Mogas (contaminated) | 36 |
| | | JP-4 (contaminated) | 36 |
| Vehicle Maintenance (Motor Pool) | 500,1000 | PD-680 | 30-50 |
| | | Sulfuric Acid | 25 |
| | | JP-4 | 35-50 |
| | | Ethylene Glycol | 100 |
| | | Lubricating Oil | 15 |
| | | Hydraulic Oil | 100 |
| | | Motor Oil | 500 |
| | | Brake Fluid | Unknown |
| | | Diesel Fuel | Unknown |
| | | Hydrochloric Acid | Unknown |
| | | Bearing Grease | Unknown |
| Engine | 409 | Carbon Remover | 12 |
| | | Jet Engine Oil | 120 |
| | | PD-680 | 36 |
| Munitions Services | 406 | PD-680 | 600 |
| POL Operations | | JP-4 | 150 |
| | | Tank Cleaning Sludge | 10 |



**POL is the "petroleum, oils and lubricants" facility (later dubbed "site 4")**

Not surprisingly, given the types of operations at the site, numerous petroleum hydrocarbon compounds and chlorinated solvents (perchloroethylene (PCE), trichloroethylene (TCE), cis-dichloroethylene (DCE) and vinyl chloride) were found in groundwater and/or soils, in several areas exceeding preventative action and/or enforcement standards. Some groundwater well tests found free-floating petroleum compounds in shallow groundwater (free product was found through the last testing in 2010, indicating recent petroleum spills or other sources). In all, eight contaminated areas on the base (some overlapping) were identified and investigated. The "petroleum, oils, and lubricants (POL)" facility (Site 4), which included four old 50,000 gallon underground storage tanks from 1952-1999, was found to be highly contaminated with petroleum hydrocarbon compounds. An abandoned buried oil pipeline near this was also associated with significant petroleum compound contamination (it was later removed). See attached 2012 Proposed Final Proposed Plan for Installation Restoration Program Sites I through 8 for a description and maps of the eight sites.

Site investigations began in 1990 and 1991, but remediation moved along slowly. In 1994, after Wisconsin NR700 environmental regulations were promulgated, DNR wrote to ANG: "During the years of operation at the Truax facility, there have been many releases of petroleum and solvent related volatile organic chemicals to the soil and groundwater. These releases have caused soil and groundwater contaminant concentrations in excess of health-based standards. Chapter NR 140, Wis. Adm. Code establishes health-based groundwater standards. At a number of groundwater monitoring points around the base these standards are exceeded. Requirements in NR 140 Wis . Adm. Code and ss . 144.76 Wis. Stats. demand that you remediate this contamination to restore the environment to the condition it was before the contaminant releases occurred. To date there has been only limited site remediation work…."

Eventually, with DNR's approval, a variety of active and/or passive remediation strategies were utilized at the identified contaminated areas. Contaminated soils excavated from some areas were treated onsite by passive

volatilization or "thermal desorption" (incineration). Some soils were treated and then re-used for fill elsewhere on the site. Soil vapor extraction (SVE) was done in a few areas, with unclear effectiveness, and in a few areas contamination was left to "natural attenuation" (described by an ANG consultant as "natural processes will ultimately remove the compounds from the soil over some indeterminate amount of time" (in other words, the "do nothing" approach). Underground pipes, gas, electric and other utilities made it hard or impossible to excavate some areas. It isn't clear how effective these remediations were, since we found little post-remediation data. Although some excavated contaminated soils were landfilled, according to ANG documents, in some areas it was explicitly avoided due to "liability concerns" (probably to avoid contaminant testing required at landfills, which would likely have identified problematic compounds not tested, like PCBs, see below).

For years through the 1990s, DNR and ANG negotiated how to remediate highly contaminated Site 4, the "petroleum, oils, and lubricants" facility. The ANG repeatedly argued for using natural attenuation to remediate this area, but the DNR denied this request several times, asking for active remediation. In 1997, the DNR wrote the ANG that "The POL facility is more than 40 years old and does not meet current state or federal safety regulations or environmental laws. Investigations conducted at the facility indicate the presence of soil and groundwater contamination at concentrations exceeding Wisconsin Department of Natural Resources (WDNR) cleanup standards."

In 1999, the old POL facility was demolished and a new one was built, at which time they excavated some contaminated soils. However, additional soil sampling conducted in March 1999 indicated the extent of soil contamination was "greater than anticipated" so "soil excavation was no longer considered a viable remedial alternative because of the significantly greater cost and the presence of multiple utilities within the area that would need to be excavated." Eventually, soil vapor extraction (SVE) was done in the POLs area for four years, until it was deemed to be no longer effective, at which point natural attenuation became the only remedial approach for the site. In the last round of testing at the site in 2010, significant levels of petroleum hydrocarbon contamination (mostly benzenes), at levels well over enforcement standards, remained in groundwater and soils. The POLS site was closed by DNR in 2012.

Also in 2012, ANG and DNR officially approved "no further action" for the eight sites, all of which had received official DNR closure in previous years.

**Vertical and horizontal extent of chlorinated VOC groundwater contamination never delineated**

In 1993, DNR sent an official "Spill Law" letter to WANG, stating that that: "the Wisconsin Air National Guard is required to determine the horizontal and vertical extent of contamination and clean-up/properly dispose of the contaminants." … "The longer contamination is left in the environment, the farther it can spread and the more difficult it becomes to cleanup."

Similarly, Wisconsin law NR 716 says that at contaminated sites, "The purposes of the field investigation shall be to: "Determine the nature, degree and extent, both areal and vertical, of the hazardous substances or environmental pollution in all affected media." NR 716 also stipulates that field investigations should evaluate "The extent of contamination in the source area, in soil and saturated materials, and in groundwater" and "the extent, both vertically and horizontally, of groundwater contamination."

Unfortunately, the vertical and horizontal extents of the groundwater contamination have never been fully investigated or defined at the contaminated areas or the WANG site as a whole.[4]

This is especially problematic in the case of the chlorinated and other halogenated compounds, which are more persistent than petroleum hydrocarbons. Trichloroethyelene (TCE), perchloroethylene (PCE) were definitely used

[4] We couldn't find isoconcentration plume maps for any of the sites except Site 4; the closure document includes horizontal isoconcentration maps.

at the site for decades as solvents, and other types of unidentified solvents were as well. Solvents were likely used in large quantities at the base, given the operations and maintenance requirements of military jets and other planes and equipment. Before environmental laws were developed in the 1970s and 80s, disposal practices for these chemicals often involved dumping them on the ground and/or down storm drains.

Many chlorinated solvents were found in groundwater testing at the site above standards at the time, but the testing was not at all adequate to delineate the extent of the plumes. In several of the investigations, detection limits were too high (higher than the standard levels) so non-detects could have been false negatives. In some areas where there were significant hits of chlorinated solvents, after one or two shallow groundwater tests showed low levels or non-detect, testing was stopped, no further tests were done, and wells were abandoned. Since levels of these compound can vary significantly over time, especially as water table levels rise and fall, longer term (and deeper) monitoring is necessary to fully assess the extent and levels of the contamination.

**Groundwater testing too shallow to fully delineate contaminant plumes**

Further, though several groundwater wells were installed throughout the site, the wells were nearly all very shallow.[5] The 1998 Remedial Action Plan for the POLS site admitted this, stating that "although the depth of groundwater contamination is unknown, it is assumed that the contamination is confined to the upper portion of the aquifer." Further, this report argued—also incorrectly-- that the contamination wouldn't go very deep: "The depth to the bedrock aquifer in the vicinity of the site is approximately 200 to 300 ft. The bedrock aquifer is covered by undifferentiated glacial deposits (primarily ground moraine) and marsh deposits. lnterbedded silts and clays within these deposits will prevent vertical migration of contaminants in groundwater" (pg. 54-55).

Chlorinated solvents were barely tested at the POLs site, but if they had been thoroughly and adequately tested (with appropriate detection limits) it is likely they would have been found, especially if tested in deeper groundwater. Chlorinated solvents, especially in pure form, are "dense nonaqueous phase liquids" (DNAPLs), which means that they are heavier than water and sink downward, deep into the groundwater very quickly after release.[6] Also, pumping of Madison Water Utility wells draws groundwater downward in the area. The shallow groundwater wells at WANG would not have assessed the likely higher levels of chlorinated compound deeper in the groundwater.

The hundreds or thousands of gallons of solvents used at the site over decades—especially the less biodegradable halogenated solvents-- didn't just magically go away. They likely went down into the groundwater very fast, and are still there.

Also, groundwater contamination in many areas of the site was not been tested at all. If more groundwater testing was done vertically and horizontally, more contamination would likely be found—especially if all the contaminants that were used at the site were tested (see next section). No offsite groundwater was tested, though it is highly likely that groundwater plumes traveled off the site.[7,8]

In sum, the sparse, shallow, and limited testing of chlorinated solvents that done at this site did not, as the law requires, delineate the horizontal and lateral extents of the contamination.

**Potential risks to Well 15 not assessed**

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[5] It is extremely difficult to ascertain the depths of all the wells, since they aren't listed on tables. Looking at the well logs we could find, nearly all the groundwater wells were less than 30 feet, many were less than 20 feet. The one deeper well was about 35 feet.

[6] At Madison-Kipp Corporation, for instance, the levels of chlorinated compounds in shallower groundwater are not that high, but the amounts rise dramatically as deeper levels are tested. Over time, this groundwater contamination has spread out far and wide, reaching thousands of feet (probably well over a mile if not miles) in all directions.

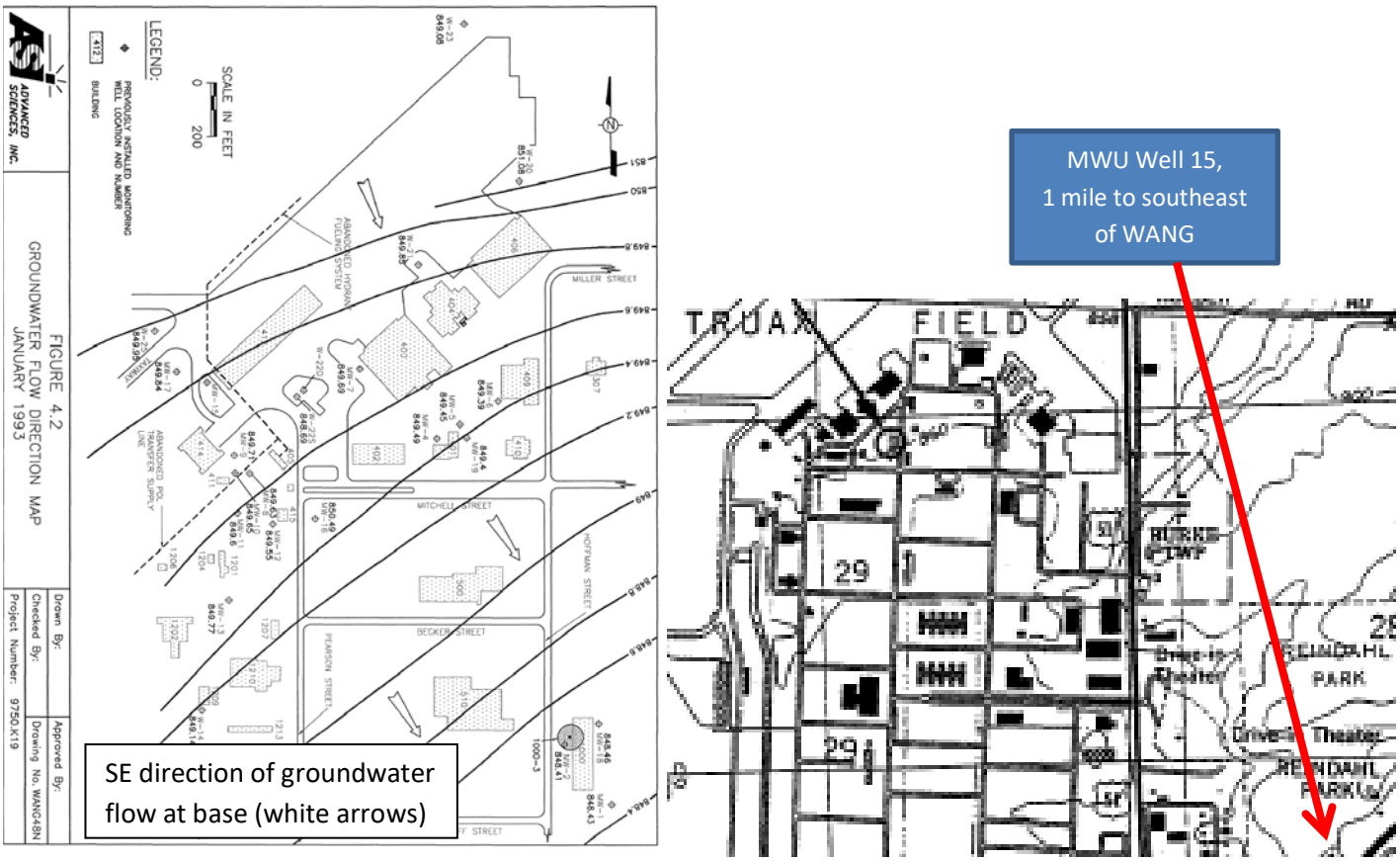
[7] NR 716.11(4) says: "Responsible parties shall extend the field investigation beyond the property boundaries of the source area as necessary to fully define the extent of the contamination."

[8] The Covance site, surrounded on two sides by the Air National Guard base, has significant vinyl chloride contamination in groundwater. This site was formerly Hazelton labs. It is possible that the vinyl chloride came from operations at Hazelton, but it could also be from the breakdown of PCE, TCE, and DCE from the ANG site.

One key reason it is important to know the lateral and vertical extents of contaminant plumes from the ANG site is to assess the risks of groundwater contamination reach public drinking water supplies. The Air National Guard repeatedly dismissed this concern in investigative reports, and as far as we can tell, DNR never asked them to address it.

Several WANG consultant reports stated (incorrectly) that the nearest groundwater use was at Oscar Mayer. The 1998 Remedial Action Plan for Site 4, said "the direction of groundwater flow is toward the southeast" but "there are no known downgradient users of groundwater" because "the nearest potable supply wells arc high-capacity wells located at the Oscar Mayer processing plant, approximately 1.5 miles southwest of the site." (1998 RAP, p. 54-55)

These consultants apparently overlooked the fact that there was (and still is) a Madison Water Utility public water supply well (Well 15) just one mile southeast of the site in Reindahl Park—in the direction of groundwater flow from the site. Well 15 is already contaminated with PCE, and several years ago a filter was installed there. See below maps from previous ANG site reports:




In a recent Water Utility-funded investigation of the potential sources of PCE to Well 15, the WANG site was not considered (presumably because it was deemed to be outside of the zone of contribution?). Whether or not it is a source of the existing PCE contamination at Well 15, it would be prudent to have more information about the vertical and horizontal extents of any/all VOC plumes at WANG to know if this contamination could reach the well in the future.

Maintenance and operations of the F-35s will require the ongoing use of halogenated and other types of solvents that may be spilled, leaked, or otherwise released into soils and groundwater at the site and contribute to this plume, increasing the future risks to the well. A full assessment of solvents and chemicals required for F-35 operations and maintenance should be compiled as part of the EIS process.

**Vapor intrusion at site never assessed**

Another reason it is critical to have thorough assessments of the vertical and horizontal extents of groundwater contamination, and of contamination migration pathways is to assess the potential for vapor intrusion into buildings at the WANG site. Given the known and repeated releases of volatile chemicals at base, vapor intrusion should have been assessed at the site to protect military staff working and/or living there. Further, DNR should have required vapor testing as part of the site investigations, especially in the mid and later 2000s when there was increasing scientific and technical knowledge about vapor intrusion.

Oddly, the only mention of the potential for vapor intrusion related to the WANG site is in a 2011 letter to ANG after an F16 crashed in 2011; the crash released hydrazine and petroleum chemicals into the soils at the crash site in a rural area north of Madison. The letter states:

> "Chapter NR 716, Wisconsin Administrative Code outlines the requirements for investigation of contamination in the environment. Specifically, s. NR 716.11(3)(a) requires that the field investigation determine the "nature, degree and extent, both areal and vertical, of the hazardous substances or environmental pollution in **all** affected media". In addition, section 716.11(5) specifies that the field investigation include an evaluation of the "pathways for migration of the contamination, including drainage improvements, utility corridors, bedrock and permeable material or soil along which **vapors**, free product or contaminated water may flow."
>
> While many RP's and their consultants have been assessing the vapor intrusion pathway, there have been a number of situations where this pathway had not been evaluated at the time a case closure request was submitted. In some cases this resulted in the need for additional field work which ultimately delayed case closure. In order to ensure the vapor intrusion pathway was evaluated, you need to include documentation with the Site Investigation Report that explains how the assessment was done and why the pathway was ruled out. **If the pathway cannot be ruled out, then investigation and, if appropriate, remedial action must be taken to address the risk presented prior to submitting the site for closure."** (highlighting in original letter)

We found no DNR letters about vapor intrusion to the WANG officials as volatile chemicals were found all over the base from 1990 through the 2010. The site was closed without any vapor intrusion testing whatsoever as far as we know. Before F-35s are based there, thorough assessment of the potential for vapor intrusion should be done to protect the health of that military jet pilots and other staff.

**Several toxic chemicals and solvents not adequately assessed/not assessed at all (partial list below):**

**Trichloroethylene (TCE), perchloroethylene (PCE) and other solvents:**

TCE and PCE are highly toxic solvents associated with numerous health problems and cancer.[9] These solvents were used widely at military sites, and the U.S. Department of Veterans Affairs lists exposures to these solvents as one of the main health risks to military personnel. At numerous military sites, TCE contamination in particular has been associated health problems among military personnel and their families. Yet even though TCE was listed in the 1988 investigation as one of the solvents used at WANG, and the site used PCE as well, as described above the groundwater testing at WANG for both solvents was too limited to ascertain their extents. Vinyl chloride, a breakdown product of PCE and TCE (and more toxic than both), was detected sporadically in WANG wells also, but like the others, not enough testing with appropriate detection limits was done fully ascertain its presence in groundwater beneath the site (it was found at significant levels in groundwater at the Covance site, formerly Hazelton Labs, directly adjacent to the WANG base).

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**Metals:** The WANG site operations involved equipment, materials, and activities that could have released toxic metals. Although a lead and/or cadmium were sporadically tested at the site, the testing was extremely sparse and incomplete and the full range of metals was not tested in any media. Interestingly, however, when POLs/Site 4 was being evaluated for its potential to facilitate natural attenuation, iron and manganese levels in some wells were monitored and found to be high.[10] However, these metals were not assessed in the ongoing testing at the site, and the final closure documents for Site 4 do not include any metals data at all.

**Polycyclic aromatic hydrocarbons (PAHs):** Petroleum compounds such as jet fuel contain a high proportion of PAHs, which are associated with many health problems and are therefore regulated in air, water, soil, and groundwater. Problematically, the PAH testing at the WANG site (like other compounds above) was sporadic and limited. In early tests, DNR noted that the consultants that did the PAH analyses were not approved by DNR. At the heavily petroleum contaminated Site 4, BTEX (benzene, toluene, ethylbenzene, xylene) compounds were assessed but only a few PAHs (e.g., naphthalene) were tested in the 90s and not again. Napthalene, of particular concern for stormwater runoff, was tested at Site 4 a few years in the 2000s (and levels were high in some tests) but testing stopped after a high level was found in 2007.

**Polychlorinated biphenyls (PCBs):** The U.S. Department of Veterans Affairs lists PCBs on its main page as one of the types of chemicals military staff are likely to be exposed to during their service. PCB exposures are associated with neurological, developmental, immune system problems, cancer, and other health problems. It is highly likely that PCBs would be found at the WANG site if soils were tested for them—especially around the POLs facility. The oils, lubricants, and hydraulic fluids used and stored in this facility (and elsewhere on the site) very likely included PCBs. Though PCBs were banned in the late 70s, they remained at many military and industrial sites well through the 1980s (sometimes longer).

PCBs were identified at one of the WANG sites in 1983—Site 3. These PCBs were released from an electrical transformer that reportedly had 1800 ppm of PCBs in it. The contaminated soils were purportedly removed and post-testing showed low residual PCB levels. In 1988 ANG concluded that "a potential for migration does not exist" and this site "posed no significant hazards to human health or the environment." However, no investigation of whether the PCBs migrated from the spill area was done as far as we can tell. This transformer was undoubtedly one of many PCB-containing transformers on the WANG site. According to documents, PCB transformers were removed from the site, but there is no evidence that any testing was done to determine if any others leaked PCBs.[11]

**Perfluorinated chemicals, including PFOA/PFOS:** Truax WANG uses "aqueous film forming foams" (AFFF) for fire-fighting purposes (see table below in section on Starkweather Creek); they are very effective at extinguishing petroleum-based fires. Most AFFFs in the past contained toxic perfluorinated compounds such as PFOA (perfluorooctanoic acid) and PFOS (perfluorooctane sulfonate). According to the October 2017 DoD *Aqueous Film Forming Report to Congress* (attached) releases of PFOS and PFOA on DoD installations are primarily associated with firefighting training areas, hangars, fire suppression systems, and aircraft crash sites. Though PFOS/PFOA AFFFs were phased out by manufacturers beginning in 2000, in response to proposed U.S. Environmental Protection Agency (EPA) regulations, some DoD bases still have PFOS-PFOA-based AFFF in their inventories. In 2011, DoD issued a human health and environmental risk alert with guidelines to control future AFFF releases and

[10] Because iron and manganese were highest in the wells most highly contaminated with petroleum compounds, consultants attributed this to the reduction of insoluble forms of manganese/iron to soluble forms during the biodegradation of petroleum compounds. Manganese and iron have contaminated several Madison drinking water wells, including Well 7 about 1.5 southwest of Truax WANG, which now has a manganese and iron filter.

[11] The ANG was probably very careful to avoid testing PCBs on the site in the late 1980s when site investigations began. If identified, the site might have been deemed a Superfund site Landfilling of contaminated soils was also avoided as much as possible because these soils would have to be tested at the landfill, and this might identify PCBs. This is how PCBs were originally "discovered" at Madison Kipp in 2012 (just a month after the DNR told us there were no PCBs there and there was no reason to test for them).

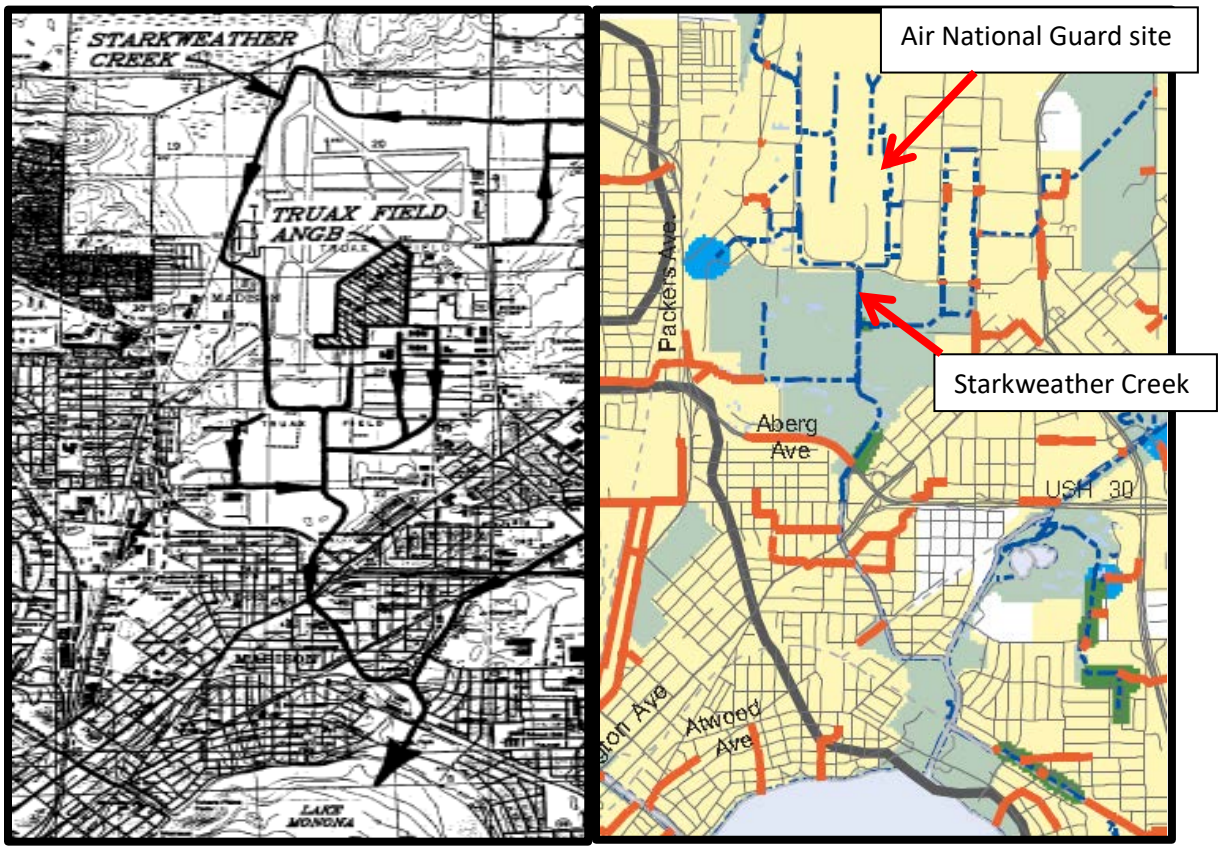
advising the "DoD Components" to determine site-specific characterization, assessment, and risk management procedures if records indicate that a facility may have a release of AFFF into the environment.

Madison Truax WANG base was identified in the 2017 DoD report to Congress as one of the sites that had a "known or suspected" release of PFOS or PFOA. The report states that $115,700 has been spent to investigate this. What were the results of this investigation? They should be disclosed to the public and considered in the EIS process.

**Radioactive materials:** The WANG base (and presumably the nearby Armory) has stored munitions, including nuclear munitions since the 1940s. The base also probably used/stored other radioactive materials. Given this, it is possible that radioactive materials have leaked or spilled in different forms in various contexts on the base. None of the investigations to date have assessed radioactive materials in soils, groundwater, or other media.

**Other unidentified/unknown chemicals and solvents used at base:**
There are many chemicals and solvents used (or formerly used) at the base that have never been identified or tested. Without a full list of chemicals, solvents, and fuels used at the base, amount used, where they are stored and used, etc.—information that is required as part of NR 716 investigations--it is hard to know the types and amounts of chemicals that could be in soils and groundwater there. In 1990, DNR wrote to WANG: "The information on tanks labeled used oil/solvent should be more detailed. At a minimum the following information needs to be provided. a. Type of solvents that were put into the tanks. b. Records that would provide information as to the amount and disposal of waste solvents from 1981 to the present. c. The dates of the use of each of the used oil/solvent underground tanks for material that would be classified as hazardous waste. d. Information concerning the possible mixing of waste oil and waste solvent in the underground tanks labeled 'used oil/solvents'." In our thorough review of the files, we saw no such information.

**3. Comprehensive assessment of effects of WANG stormwater runoff on Starkweather Creek**
Starkweather Creek, a highly impaired 303(d) listed waterway, surrounds the Air National Guard site on three sides. All stormwater runoff from the site discharges to the creek, which then flows to Lake Monona (also highly impaired) about 2.5 miles south. The airport and ANG base were built on drained wetlands, and many ditches and culverts were built to drain the base's stormwater runoff to the west branch of the creek to prevent flooding. Air National Guard investigative reports explicitly state this and include maps showing it—see map on the left:




**Left:** Map from 1988 Air National Guard report **Right:** 2005 City of Madison drainage system

**Starkweather Creek is negatively affected by Airport/Air National Guard sites**

Not surprisingly, sparse data available from Starkweather Creek indicate that stormwater runoff from the airport/WANG site has significantly and negatively affected it. Below is a summary of data from a "Microtox" test done on Starkweather Creek water in a 2005 University of Wisconsin Water Resources Management Study:

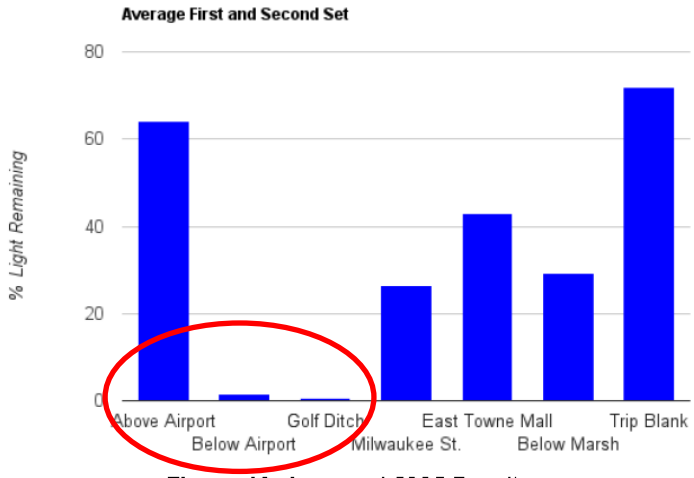



**Figure 10:** Averaged 2005 Results

The blue bars, referring to the % "light remaining," reflect the toxicity of the water—the more light remaining (the higher the blue bar), the less toxic the water. Based on this study, something is entering the stormwater at the Airport/Air National Guard sites that is increasing the toxicity of the water. Water quality was the worst in the area

further south of the airport near the "golf ditch"; this ditch drains the former city sewage disposal site/landfill area and Truax landfill,[12] which took hazardous wastes from the Truax DoD military operations.[13]

In 2016 sampling done by a local consulting firm (Freshwater Engineering), which replicated the 2005 study), the water quality at the site just below the airport was improved (but so was the upstream sample), but further south at the golf ditch site, the water quality was as bad as it was in 2005:

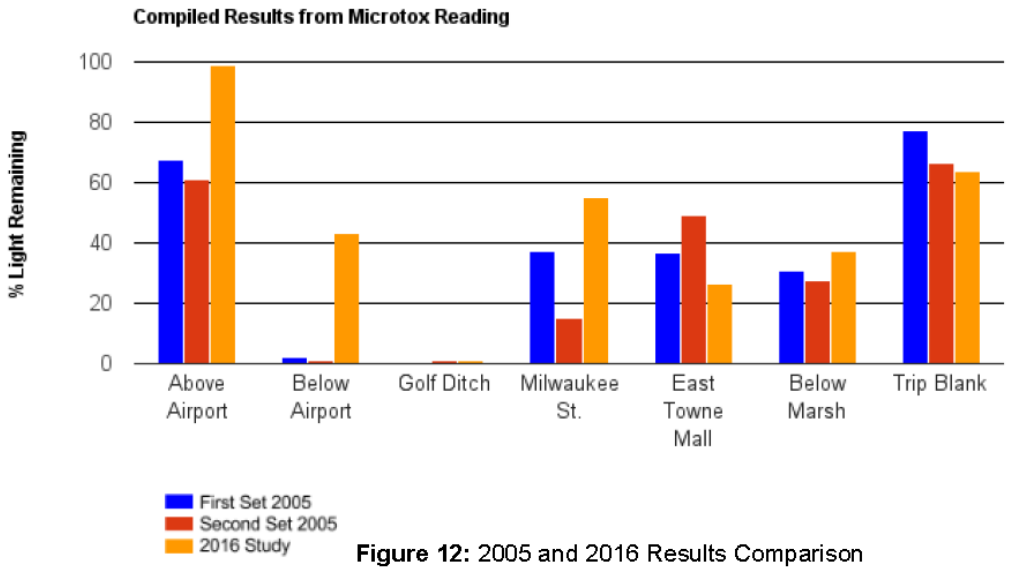



**Figure 12:** 2005 and 2016 Results Comparison

The 2005 UW study included an assessment of some of the chemicals in the creek compared to the control sample:

Table B-2. *Chemicals that were found in Starkweather Creek in higher concentrations relative to the concentrations found in the control sample.*

| | |
|---|---|
| 9-Methylanthracene | Methyl Fluorene + |
| Phenanthrene | Octylcyclohexane |
| Fluorene | Decylcyclohexane |
| Fluoranthene | cyclopenta(cd)pyrene |
| Pyrene | Dibenzo(ae)pyrene |
| Benz(a)anthracene | Dehydroabietic acid |
| chrysene/triphenylene | Benzo (a)pyrene |
| Benzo (b)fluoranthene | 1-methylchrysene + |
| benzo(k)fluoranthene | benzo(GHI)fluoranthene |
| benzo(a)pyrene | retene |
| benzo(e)pyrene | 9,10 Anthraquinone |
| Stigmasterol | Benz(a)anthracene-7,12-dione |
| Perylene | Phthalic acid(M) |
| indeno(cd)pyrene | Dodecanoic acid(M) |
| benzo(ghi)perylene | Tetradecanoic acid(M) |
| 1-phenyl-naphthalene | |

These compounds are mostly polycyclic aromatic hydrocarbons (PAHs) that are typically associated with petroleum hydrocarbons; there are many sources of PAHs, but the petroleum contamination at the WANG base and military landfill are among the likely sources to the creek.

**Air National Guard never assessed effects of its contamination on Starkweather Creek**

[12] The Truax Landfill and former sewage treatment plant just south of the airport/ANG site are now owned by Dane County.
[13] Petroleum hydrocarbons, PAHs, metals, PCBs, and chlorinated solvents have been found at these landfills; it is likely these contaminants are leaching to the creek via groundwater and/or the "golf ditch" that drains from them to the creek.

In 1993, following from the 1990-1991 investigative reports revealing extensive contamination on the site, the DNR sent the Air National Guard a letter about their responsibilities under the Wisconsin "Spill law:" "A person who possesses or controls a hazardous substance which is discharged or who causes the discharge of a hazardous substance shall take the actions necessary to restore the environment to the extent practicable and minimize the harmful effects from the discharge to the air, lands or waters of this state." NR 716 says the work plan should include: "Potential hazardous substance migration pathways," which at the base would include ways the contaminants at the site could migrate to Starkweather Creek via ditches, storm drains, and other utilities.

NR 716 also says that the field investigation shall include an evaluation of "The impacts of the contamination upon receptors" and "The known or potential impacts of the contamination on any of the resources listed in s. NR 716.07 (8) that were identified during the scoping process as having the potential to be affected by the contamination." Starkweather Creek is repeatedly described in WANG investigative reports as the receptor of all the stormwater runoff from the base. Yet during the 70+ years of the site's operation, other than very limited testing required in its DNR stormwater permit (see below), there is no evidence that the Air National Guard has ever tested stormwater runoff for the identified toxic contaminants found all over its site, or investigated how the site's runoff has affected the creek's water quality, sediments, fish and/or wildlife. The DNR has also not asked them to do so.

There is no doubt that petroleum compounds, solvents, and other toxic chemicals used at the base have made their way to the creek via storm drains since the base began operations in 1942. The table in the 1988 report (above) says the disposal method for many of these chemicals over the decades was "unknown." Before environmental regulations were developed in the 1970s and 80s (and possibly longer), they probably were dumped down storm drains or onto the ground—eventually running off into the creek. Groundwater at the site is also very shallow (usually 9-13 feet, sometimes only 4-5 feet down); when the water table is high, contaminated groundwater can seep into the shallow ditches and drainage ways that flow into the creek.

Further, some previous environmental investigative documents for the site clearly state that base storm drains on the base received drainage from areas where aircraft maintenance was performed, and contamination investigations connect soil and groundwater contamination to these drainage routes. For instance, a 1994 investigative report noted that "During the course of the pre drilling visual inspection for the January 1993 field effort, ASI noted that Hangar 414 was used for aircraft maintenance. The proposed expansion area is located over a topographic low which diverts runoff to a storm drain located at the center of the area. Hangar 412, located to the northeast of Hangar 414, utilizes a surface drainage system that diverts wastewater generated during periodic flushing of the hangar facility floors to the storm drain located in the proposed expansion area. Hangar 412 is also used for general aircraft maintenance operations. Monitoring well (MW) MW-15 is located between Hangars 412 and 414, along the surface drainage route. MW-15 is known to have elevated levels of petroleum hydrocarbon constituents in the groundwater (ASI 1991)." (July 1994)

**WANG risk assessments concluded that Starkweather Creek sampling was not necessary**

In 1994, Air National Guard did "Relative Risk Evaluations" for all of the sites to assess human and ecological risks and inform decisions about remedial actions at the site. In the section on contaminant pathways, it said: "Drainage on the base is channeled by excavated ditches and culverts which are routed into Starkweather Creek, the outfall is located just south of the base. Starkweather Creek discharges into Lake Monona south of the facility."[14]

However, on subsequent pages when rating risks, the ANG consultants concluded that surface water and sediments were "not proximate to the site" and therefore did not need to be sampled or otherwise evaluated—see table below.

[14] The September 1994 risk evaluation report was prepared for the Air National Guard Readiness Center at Andrews Air Force Base, Maryland by Radian Corporation in Virginia.

| Site Number | Potential Risks | Detected Contaminants | | | |
|---|---|---|---|---|---|
| | | In Groundwater | In Soil | In Surface Water | In Sediment |
| 1 | No significant risk to human health due to removal of contaminant source | No sampling required--contaminant source removed | No sampling required--contaminant source removed | No sampling required--surface water not proximate to site | No sampling required--sediment not proximate to site |
| 2 | No significant risk to human health due to removal of contaminant source | No sampling required--contaminant source removed | No sampling required--contaminant source removed | No sampling required--surface water not proximate to site | No sampling required--sediment not proximate to site |
| 3 | No significant risk to human health due to low levels of contaminants detected | No sampling required--contaminant source removed | PCB levels less than 0.1 parts per million | No sampling required--surface water not proximate to site | No sampling required--sediment not proximate to site |
| 4 | Ingestion of and dermal contact with contaminated groundwater; dermal contact, incidental ingestion, and inhalation of contaminated soil or groundwater during potential future construction activities | VOCs; SVOCs | TPH | No sampling required--surface water not proximate to site | No sampling required--sediment not proximate to site |
| 5 | Ingestion of and dermal contact with contaminated groundwater; contact with contaminated groundwater during potential future construction activities | VOCs | None detected | No sampling required--surface water not proximate to site | No sampling required--sediment not proximate to site |
| 6 | Ingestion of and dermal contact with contaminated groundwater; contact with contaminated groundwater during potential future construction activities | VOCs | None detected | No sampling required--surface water not proximate to site | No sampling required--sediment not proximate to site |
| 7 | Ingestion of and dermal contact with contaminated groundwater; contact with contaminated groundwater during potential future construction activities | VOCs | None detected | No sampling required--surface water not proximate to site | No sampling required--sediment not proximate to site |
| 8 | Dermal contact, incidental ingestion, and inhalation of contaminated soil during potential future construction activities | No sampling required--contaminant source removed | VOCs; TPH | No sampling required--contaminant source removed | No sampling required--contaminant source removed |

Consequently, the "Relative Risk Evaluations" did not consider human or ecological risks related to surface water or sediments because there was "no contaminant data." With no contaminant data from the creek water or sediments, the consultants scored the highly contaminated Site 4 (POLs facility) as a "medium risk" and argued for natural attenuation.

**SURFACE WATER - ECOLOGICAL**

| CONTAMINANT HAZARD FACTOR (CHF) | Contaminant | Maximum Concentration (µg/L) | Standard (µg/L) |
|---|---|---|---|
| | (No contaminant data) | | |

DNR declined their request at that time, but in 1998 Air National Guard again argued that natural attenuation was an appropriate remedial strategy for the area, stating that "There is no surface water discharge at the site or directly downgradient from the site" and "the exposure pathways; direct contact (e.g., inhalation and ingestion), surface water discharge, and local pumping wells have been addressed" (June 1998).

In 1999, when the new POL facility was being constructed, trenches were dug to connect to the storm sewer. Sanitary sewer connections were also built because "collected groundwater is expected to have benzene contamination greater than WDNR storm sewer discharge limits as noted by past measured contamination levels within existing area monitoring wells." The report noted that a Wisconsin Pollution Discharge Elimination System (WPDES) permit would be obtained "prior to the uncapping and use of this discharge route" and a new storm sewer was built to direct surface runoff away from this area (September 1999). This was the first stormwater permit issued for the site.

**Current permit testing at WANG base is inadequate to assess stormwater effects on Starkweather Creek**
Currently, the Air National Guard is a tenant of the Dane County Airport and co-permittee with the airport on its WPDES stormwater permit. The permit documents include a table showing general categories of the types of chemicals used at the site—but no specific names:

Table 4-1 Potential Pollutant Sources by Industrial Activity Area

| Potential Pollutant Sources | Bldg No./Facility | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Bldg 400 | Bldg 401 | Bldg 409 | Bldg 412 | Bldg 430 | Bldg 510 | Bldg 511 | Bldg 700 | Bldg 705 | Bldg 710 & 711 | Bldg 1000 | Bldgs 1201, 1206, 1209, 1210 | Hush House | POL Facility | Flight Line |
| Petroleum Products | √ | √ | √ | √ | | √ | √ | | | | √ | √ | √ | √ | √ |
| Paints | √ | √ | | | | √ | √ | | √ | √ | √ | | | | |
| Solvents | √ | √ | √ | | | √ | √ | √ | | | √ | √ | | | |
| AFFF*/HEF | √ | | | √ | √ | √ | | | | | | | | | |
| Battery Acid | √ | | | | | | √ | | | | | √ | | | |
| Deicing Fluids | | | | | | | | | | | | | | | √ |
| Antifreeze | √ | | | √ | | | | | | | √ | √ | | | √ |
| Detergents/ Cleaners | √ | | √ | | | √ | | | | | √ | | | | √ |
| Pesticides/ Herbicides | | | | | | | | | | | | | | | |
| Aircraft/Vehicle Operations | √ | √ | √ | √ | | | | | | | √ | | √ | √ | √ |
| Used Oils | √ | √ | √ | √ | | | √ | | | | √ | √ | √ | | √ |

AFFF = Aqueous Film Forming Foam, HEF = High Expansion Foam.

Discharges from 6 of the 8 "oil-water separators" at WANG go into the sanitary sewer (where they are treated before discharge to Badfish Creek/Rock River), but discharges from two others go to storm drains to the creek. The WPDES permit only requires testing of discharges from these separators. The required testing includes "oil and grease," total suspended solids, BETX (benzene, ethylbenzene, toluene, xylenes), PAHs, benzo(a)pyrene and naphthalene.[15,16]

Monitoring data from these two outfalls, however, is very limited. For ANG Outfall 101, benzo(a)pyrene and naphthalene were tested once in 2015 but not tested again, PAHs and BETX were tested once a year from 2008 to 2015 but not after that. The testing of the other separator discharge is similarly limited.[17,18,19]

Unfortunately, these two outfalls do not represent all the stormwater runoff from the WANG site. Many other un-monitored storm drains and ditches all over the site discharge site runoff into Starkweather Creek. There is no sampling required in the permit from the main ditch that gathers water from the site's system of ditches/drains and relays it to the West branch of Starkweather Creek before it travels under Anderson St.

There are two "in-stream" sampling points that compare Starkweather water quality upstream of the airport/ANG site to downstream of the site (which reflects contaminants coming from both the airport and the WANG sites). Testing includes TSS (total suspended solids), phosphorus, and propylene glycol, but not benzo(a)pyrene, PAHs, or BETX. On average, the downstream TSS and phosphorus levels are higher than the upstream levels, but there are

[15] Testing is done by Dane Co. Airport staff.

[16] A part of the base's stormwater drainage (which is not covered by the permit) appears to discharge through city stormwater pipes down Wright Street and eventually into the East Branch of Starkweather Creek. There is no monitoring of this discharge and it is not covered by the permit.

[17] The sampling is limited because of this clause in the permit: "A representative discharge is monitored once during the first year after coverage under the permit is granted, for oil and grease, total BETX, PAH, benzo(a)pyrene, and naphthalene…If the concentrations are less than the effluent limits in table 5.2.1, the discharge of secondary containment water is allowed and additional chemical monitoring is unnecessary for the term of the permit."

[18] The permit effluent limit for PAHs and benzo(s)pyrene is 0.1 ug/L (monthly average). Benzo(a)pyrene was found at 4 ug/L in the one test in 2015 but not tested again. Six of the nine PAH tests were well over 0.1 ug/L (one was over 13) but testing stopped in 2015.

[19] We obtained this data from DNR in February 2018

no effluent limits in the permit for these sampling points.[20, 21] Other contaminants known to be in soils and groundwater at the Air National Guard base aren't assessed (TCE, chlorinated solvents, etc.).

In sum, there is almost no contaminant data needed to understand what effects WANG site stormwater runoff is having on Starkweather Creek water quality, sediments, fish and other wildlife in the creek.

**Thorough testing of current and future WANG stormwater discharges needed!**

F-35s will require solvents, fuels, fire-fighting materials, etc. for their operations and maintenance. They will require the construction of new facilities, which will disrupt and release contaminated soils and groundwater. These chemicals and activities could have effects on Starkweather Creek, and they should be thoroughly addressed in the EIS.

Also, before F-35s are approved at WANG, thorough and appropriate contaminant data should be gathered from stormwater outfalls at the site, especially the main ditch that flows into the Creek and from Starkweather Creek downstream of the base. Based on this testing, state-of-the-art strategies should be developed to prevent site contaminants from discharging to the Creek whether or not F-35s are located at the site in the future.

[20] At the downstream sampling point, in once or twice yearly testing from 2008-2017, TSS levels reported ranged from 9 to 540 mg/L and phosphorus from 25 to 250 ug/L. On average the levels of TSS and phosphorus (especially TSS) downstream from the airport were higher than the upstream levels.

[21] The permit has no effluent limit for phosphorus for any outfall at the site (as far as we could tell); the effluent limit for TSS for the WANG separator outfalls is 40 mg/L, but there is no limit for TSS for the Starkweather creek samples.