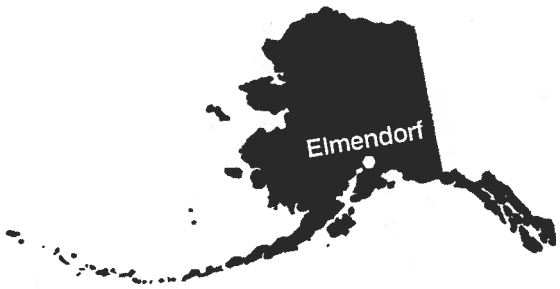
Elmendorf Air Force Base



Environmental Justice & Alaska Military Superfund Sites
Fact Sheet

Location:

Elmendorf Air Force Base is located within traditional Athabaskan lands and the Tanaina language region on the northern boundary of the Municipality of Anchorage on Cook Inlet.

Primary Contaminants:

- **Petroleum, Oils and Lubricants** (POLs): benzene, toluene, ethylbenzene, xylene (these four are also referred to BTEX, as a group), diesel fuels, gasoline
- **Volatile Organic Chemicals**: (VOCs): trichloroethane, (TCE), tetrachloroethene, benzene, vinyl chloride, carbon tetrachloride, ethylbenzene
- **Semi-Volatile Organic Chemicals:** (SVOCs): fluoranthene, pyrene
- **Persistent Organic Pollutants** (POPs): pesticides (including dieldrin, DDT and DDD), PCBs
- **Heavy Metals**: lead
- **Others:** chlorinated solvents (trans-1,2,-dichloroethylene, and chloromethane)

Note: The categories used here are those used by the Environmental Protection Agency for Superfund sites. Other methods of categorizing do exist. See www.epa.gov/reg3hwmd/bfs/regional/analytical. Chemicals listed as "Others" were those not found on the EPA's list.

History:

Elmendorf is located within the traditional lands of the Athabaskan peoples and within the Tanaina Alaska Native language region. It is upstream of a traditional fishing site for the Eklutna people and borders Cook Inlet, which has been traditionally hunted by local villages.

In a 1939 executive order, President Franklin Roosevelt designated public lands in Southcentral Alaska for military use. By 1940 168,000 acres were occupied by military personnel and Fort Richardson was established under the jurisdiction of the U.S. Army. In 1950, the Fort was divided between the Army and Air Force. The airfield at the fort was named Elmendorf Field, and in 1948, the airfield (encompassing about 13,000 acres) was renamed Elmendorf Air Force Base. In 1951, after the creation of the Department of the Air Force, jurisdiction of the base was officially transferred to the Air Force. Elmendorf now occupies 32,500 acres.

Although Elmendorf is within an urban area, it borders areas that continue to be important to Alaska Native peoples. Elmendorf's location is relevant regarding concerns about contamination of fishing and hunting areas that may be used to provide some portion of the yearly diet of affected Alaska Native communities. Several Alaska Native villages on both sides of the Cook Inlet, including Knik, Eklutna, Chickaloon, Alexander Creek, Tyonek, Pt. Possession, Kenai, Salamatof, and Ninilchik could potentially be affected by contamination migrating from the

* Words in **bold** signify terms used in the world of Superfund. For a comprehensive discussion of Sueprfund law and how it works, please see the accompanying document, *An Overview of Key Issues at Alaska Military Superfund Sites.*

site by air or water. In addition, the base abuts Anchorage residential neighborhoods, which could also be affected by migrating toxins.

Activities that caused contamination are described within each specific site further on in this document.

Geography & Geology:

Elmendorf Air Force Base is bounded by the Knik Arm of Cook Inlet to the west and portions of the north. Ship Creek forms a portion of the southern border and runs through the base before emptying into the waters of Knik.

Approximately 1,592 acres within Elmendorf's boundaries are wetlands, important habitat for birds and other wildlife. Several other sensitive environments exist within, adjacent to, or down gradient from the areas of contamination at the base, such as moose habitat, beaver ponds, and several active fisheries (including salmon) in Ship Creek.[2]

There are two main groundwater aquifers on the Elmendorf moraine, including a deep confined aquifer, and a shallow unconfined aquifer, which appears to be separated from the deep aquifer by the Bootlegger Cove formation. This formation is made up of shallow marine deposits, silt and clay, which may be up to 250 feet thick at its maximum depth. It underlies the glacial moraine and outwash deposits that constitute the major geological feature of the contaminated areas of the base, and are below the surface cover.

The deep aquifer runs under the entire area of the base, generally flowing in a westerly direction from the Chugach Mountains toward the Knik Arm. The Municipality of Anchorage uses the deep aquifer extensively for industrial, commercial, domestic, and public supply uses. According to monitoring data from Elmendorf, this aquifer has not been affected by contamination from the base. The base itself relies on the public water supply for drinking water, using the deep aquifer only for backup purposes. According to the source documents for this report, the shallow aquifer is the immediate concern, because of historical contamination and its potential availability to humans, wildlife, and other organisms.

Most of the developed areas of Elmendorf are built on a glacial outwash plain alluvium, which is a relatively flat area of land made up of unconsolidated deposits of sand and silt left over after glacial melt. An alluvium is relatively porous, so contaminants that spill or are poured on the ground will migrate below the surface into the groundwater beneath.

Ship Creek is important to highlight because it runs through the Air Force base at its southern boundary. Although the *1998 Elmendorf Five-Year Review* reports that "There is no evidence of surface water contamination from sources on Elmendorf AFB,"[1] the deep aquifer and the upper basin of Ship Creek are interrelated. Ship Creek provides as much as one quarter of the total recharge to the deep aquifer system, which would have tremendous implications if the Creek were to be affected by contamination from nearby military installations.

Contamination Background:

Investigation of environmental contamination at Elmendorf was formally initiated in 1983. Since then 84 potential sources of contamination were identified, including five landfills classified as solid waste source areas. In August 1990, Elmendorf was placed on the **National Priorities List** (NPL) and became a **Superfund** site. In response, the Air Force, EPA, and Alaska Department of Environmental Conservation signed a **Federal Facility Agreement** for Elmendorf in November 1991.

The Air Force maintains primary responsibility for conducting **remedial** activities, with the State and EPA working jointly in planning and decision-making. The multilateral State-Elmendorf Environmental Restoration Agreement (SERA), between Elmendorf and the Alaska Department of Environmental Conservation was signed in October 1992. SERA addresses the cleanup and restoration of sites contaminated with petroleum, oils, and lubricants, not addressed under **Comprehensive Environmental Response Compensation and Liability Act**

(CERCLA). In the end, 37 source areas were addressed under **CERCLA** (the Superfund law) and 39 areas were addressed under the SERA; the remaining five sites were transferred to the base's Environmental Compliance Section as **RCRA (Resource Conservation and Recovery Act)**[1] sites.

In July 1998, the first five-year review of the remediation activities at Elmendorf was carried out. Remedial actions and long-term monitoring are ongoing at the site, with a second five-year review scheduled for late summer 2003.

Particularly notable in all these agreements is the lack of acknowledgement and inclusion of tribal governments none include tribal governments as equal partners in the process. This omission is discussed in more detail in the environmental justice section of this document.

Sources of Contamination:

The 37 CERCLA **source areas** were initially divided into seven **operable units** (OUs). Source areas in OU7 were subsequently redistributed among the other six OUs, so OU7 was removed from Superfund remediation and closed under the base's Environmental Remediation program.

After cleanup had begun, the Air Force initiated investigation of additional sites at Elmendorf thought to have been overlooked in the original effort to catalog all the contaminated sites. A number of new areas **of concern** (AOC) were revealed, which warranted further investigation. These sites ranged from oil barrel dumps to formerly used training sites. Studies of 22 sites were completed in 1997; three were identified as areas of potential environmental concern, 19 required no further action.

The two sites needing more study were investigated in 1998. SS83, a former World War II anti-aircraft artillery site near Six-Mile Lake, was found to be contaminated with fuel products, fuel-related chemicals and lead. An engineering evaluation/cost analysis (EE/CA) was begun in FY00. During the EE/CA, a landfill was discovered, which, as of the date of this writing, is still being evaluated for cleanup remedies.

DP98, where fuel products and slightly elevated levels of chlorinated solvents were found, was discovered during an underground tank removal. During further investigation in 2000, higher than anticipated levels of chlorinated solvents were measured. The site is now undergoing a formal Remedial Investigation under CERCLA. Rather than amend the former **Record of Decision** (ROD) for Elmendorf, a new ROD will address DP98 on its own. The ROD will be available for a 30-day public review within the first six months of 2003.

Superfund Source Areas:

All of the information in this section is adapted directly from the *Record of Decision (ROD) Abstracts for Elmendorf Air Force Base* on the EPA Superfund website,[1] and the *Environmental Restoration Five-Year Review for Elmendorf Air Force Base.*[9] Institutional controls, natural attenuation (also called intrinsic attenuation), and long-term monitoring (LTM) are included in the remedies of all operable units at Elmendorf AFB, even if not specifically noted in the text.

Operable Unit 1

Operable Unit 1 (OU1) consists of five general waste disposal areas, including landfills and gravel pits, located next to the Davis Highway. These landfills and general disposal areas received a variety of materials over the years, including old pesticide containers, used chemicals, scrap metal, asphalt drums, used chemicals and construction debris. Contaminants of concern at OU1 were identified as arsenic, 1,2-dibromethane (EDB), polychlorinated biphenyls (PCBs), lead, manganese, vinyl chloride, and volatile organic chemicals (VOCs). Although not listed as a contaminant of concern, it is known that refuse-containing asbestos was dumped at one of the landfill source areas in OU1.

OU1 is located approximately three-quarters of a mile northeast of an Anchorage subdivisioin; it is separated

from that populated area by Ship Creek. The area is zoned as undeveloped outdoor recreational use and consists of grassy fields, gravel pits and wooded areas adjacent to Ship Creek. The only medium of concern noted in the available documents is the groundwater, and all remediation activities were geared toward preventing further contamination and the spread of contamination in the groundwater. The selected remedial actions for this site included establishing institutional controls to the site; monitoring groundwater for five years; and evaluating the monitoring results periodically to determine if there is need for further remedial action.

At the time of the 1998 five-year review it was reported that response actions were ongoing. EDB (a highly toxic fungicide also used as a petroleum additive) and vinyl chloride (a carcinogen) were reported as being below detection limits and cleanup goals. Two additional contaminants, manganese and the volatile organic chemical trichloroethylene (TCE), were found to be migrating downstream through the groundwater (downgradient). As there are no reported drinking water wells within or down gradient of OU1, and because the chemicals are diluted as they move down gradient, the *Five-Year Review* determined that there was no evidence of a current or future threat to human health or the environment. Based on current cleanup goals, the groundwater at OU1 is expected to reach cleanup goals through **natural attenuation** by 2004.

Operable Unit 2

This OU contained two areas where underground storage tanks (USTs) had been constructed. Storage tank 20 is located in the central portion of the base and ST41 is located in the western part. ST20 is the former site of a 338,000-gallon UST used to store bunker C fuel oil for the original base power plant. After the power plant was shut down, the tank stored waste oils, used solvents, and other wastes generated by industrial shops. The tank was cleaned and demolished in 1990. ST41 is the former site of four one-million gallon USTs. The primary contaminants of concern at this site were petroleum, oils, and lubricants as well as petroleum-related contaminants.

An interim Record of Decision (Air Force, 1992) for the groundwater contamination at ST41 was signed in September 1992. It mandated treatment efforts to address free product and dissolved phase contaminants (from petroleum spills) in the groundwater. A system was designed to remove product from the groundwater table and to decrease off-site migration of contaminants from groundwater seeps on the north and south sides of storage tank 41. During the operation of the groundwater treatment system at ST41, far less fuel product was recovered than predicted. When the underground storage tanks and associated pipelines were removed in 1996, it was discovered that the tanks and pipeline system had not leaked as assumed in the original conceptual site model. The fuel at the groundwater seeps were found to be coming from a woodstove pipe that drained the valve pits at each tank.

During the evaluation of the ST41 treatment system (Air Force, 1997a), a complete review of historical spills was completed which revealed that the Remedial Investigative/ Feasibility Study and ROD had erroneously reported two catastrophic spills (since the mid 1970's) that could not be confirmed through a complete search of base records. One spill was reported to be several million gallons and the other several hundred thousand gallons. It is now believed, by the agencies, that these two catastrophic spills never occurred. With this information, a new conceptual site model was developed that illustrates there is less fuel to recover than what was originally anticipated and explains why large quantities of fuel have not been recovered.

The final ROD for OU2 (Air Force, 1995b) was signed in May 1995. It focused on removal of contaminant sources and continued groundwater cleanup at storage tank 41. Due to minimal soil contamination at ST20, this site was designated as needing **no further action**. This final ROD incorporates the interim remedial action, and includes additional remedies for source control and groundwater remediation. The selected remedy for ST41 groundwater included monitoring the groundwater beneath and adjacent to the site to evaluate contaminant migration and waiting for the reduction of contaminant concentrations by **natural attenuation** within 21 years. The first five-year review in 1998 assessed the protectiveness of the remedial action and determined that all site activities were adequately protective of human health and the environment, and that a major reduction of risk had been achieved. Surface water monitoring and groundwater data confirmed that dissolved contamination is not

migrating and that natural attenuation is occurring, meaning that the expectation continues to be that cleanup goals – all contaminants below maximum contaminant levels – will be achieved by 2016.

Institutional controls that restrict access to groundwater will be implemented at the site as long as hazardous substances remain at levels that preclude unrestricted use. The specific institutional controls include: development of a site map that shows the areas currently and potentially impacted by groundwater contaminants to be included in the Base Comprehensive Plan; zoning the affected area for undeveloped outdoor/recreational use only; continued enforcement of base policy that prohibits installation of groundwater wells (other than for monitoring purposes) into the shallow aquifer underlying OU2; and prohibition of unauthorized access to existing water supply and groundwater monitoring wells.

To ensure long-term integrity of the above land use controls, the Air Force will ensure that deed restrictions or equivalent safeguards will be implemented in the event that property containing groundwater contamination is transferred from Air Force ownership.

It should be noted that the ROD assumes groundwater is the only **pathway** for contaminants and that use of the site for recreational purposes is acceptable. It is unclear whether or not children will be allowed to use the site, or whether recreational activities include hunting and fishing.

Operable Unit 3

OU3 is located in the southwest quarter of Elmendorf, on relatively flat terrain at an approximate elevation of 150 feet above sea level. As part of the ongoing mission at Elmendorf Air Force Base, shop facilities, storage buildings, and hangars located within OU3 are used to support base operations. These facilities have been in operation for over 30 years.OU3 consists of three source areas and one **receptor** area called Cherry Hill Ditch. Cherry Hill Ditch is an artificial drainage channel that flows westward from the east-west runaway toward Knik Arm. The source areas include: a former shop waste disposal site (SD16), a former PCB transformer storage area (SS21), and a dry well at an aircraft maintenance hangar (SD31). Site SD52 (Cherry Hill Ditch) is not considered a source of contamination but did receive water runoff from the eastern portion of the base, and was considered a contaminated receptor of PCB contamination. Presently, the eastern portion of the area is occupied by heavy equipment and the northern portion is used to stockpile snow during the winter.

Contaminants of concern at this site included polychlorinated biphenyls (PCBs), waste solvents, shop wastes, and pesticides. Remedial action focused on cleaning up the PCBs and contaminated sediments. The remedies selected were the excavation of PCB-contaminated soil and transfer to the Lower-48 states for disposal, backfilling and grading of the site to its original elevation, and landscaping. In 1994, low levels of PCBs were capped in the bottom of Cherry Hill Ditch and a storm water diversion project was completed. By 1998, some 980 tons of PCB-contaminated soil had been removed from the site. Subsequent soil samples demonstrated that there were below 0.6 ppm of PCBs remaining in the soil (which is probably below background levels), and the site was reopened for unlimited and unrestricted use. The only restriction remaining (as required by other RODs) are institutional controls that prohibit the use of the shallow aquifer in the outwash plain for groundwater in this operable unit.

Operable Unit 4

OU4 consists of ten source areas, including floor drains in eight maintenance facilities (SD24 through SD30 and SS18), a fire training area (FT23), and an asphalt drum storage and processing area (SS10). Eight of the ten source areas in OU4 are located north of the east-west runway. The remaining two source areas (SD30 and SS18) are located south of the east-west runway, near Second Street between operable units 3 and 5. Due to minimal soil contamination at SD26, SD27, SD30, and SS18; these have been designated as no-further-action sites, and decision documents were signed in May 1993.

Operable Unit 4 is divided into two sections: OU4 West and OU4 East. Land use for both includes light industrial, aircraft operations and maintenance, and an airfield. Light industrial use includes maintenance, storage,

and supply functions directly related to aircraft. Primary land use within OU4 is for airfields, which includes active and inactive runways, taxiways, and parking aprons for aircraft. Other land uses include designated outdoor recreation and open areas. The right-of-way for the Alaska Railroad is located in OU4 East. The Base Master Comprehensive Plan has designated this area for airfield, and aircraft operations and maintenance in the future, which affects the acceptable levels of risk for human health and the environment in decision documents.

Contaminants of concern at OU4 included benzene, 1,1-dichloroethene, 1,2-dichloroethane, trichloroethene, dieldrin, chloroform, chloromethane, carbon tetrachloride, vinyl chloride, toluene, ethylbenzene, cis-1,2-dichloroethene, tetrachloroethene, 1,1,1-trichlor benzo(a)anthracene, PCB-1260, benzo(k)fluorsnthene, indeno(1,2,3-cd)pyrene, benzene, BTEX, diesel, gasoline, jet fuel, and kerosene. All of these chemicals are petroleum or fuel-gas constituents, also called diesel-range organics and gas-range organics and are related to the land uses of the source area for maintenance, fueling, and other petroleum-related activities.

Selected remedies included **intrinsic remediation**[2] for the groundwater, and *in situ* bioventing for soils that were contaminated at levels greater than five feet in depth (which could potentially contribute to contamination of the groundwater). No detailed information about the bioventing was available in agency documents used for this report, but in the administrative record for Fort Richardson (where bioventing was also used) it is clearly stated that the air emissions for the bioventing were monitored and were required to meet regulatory limits. At the time of the 1998 five-year review, sufficient intrinsic attenuation had occurred. Cleanup goals for the soil had been reached for two source areas. As a result, no further monitoring is being conducted at these sites, but institutional controls have been established and will continue until all of OU4 meets cleanup goals.

Reviews in 1997 and 1998 continued to find contamination in deep soils that exceeded cleanup levels for fuel-related constituents such jet fuel, diesel-range organics and gas-range organics. The groundwater in the shallow aquifer also exceeded cleanup levels of benzene, ethylbenzene, toluene, and other solvents. Monitoring and bioventing will continue until cleanup goals are achieved, and institutional controls will continue to be relied upon to protect human health and the environment from exposures. It should be noted that flight operations continue in the area of the remediation activities, which assures that some level of contamination will inevitably continue as long as those activities continue.

Operable Unit 5

OU5 is located along the southern boundary of the base. It is a geographically diverse area that covers an area over 7,000 feet long and 1,200 feet wide. OU5 is known to capture approximately 90% of the groundwater flowing from Elmendorf. In the western part of OU5, a steep bluff gives way to a broad flat area that ends in Ship Creek. In the eastern area, a more gently sloping bluff leads to a wetland identified as the Beaver Pond area, where there are several shallow connected water bodies and marsh areas. The central part of the operable unit is a transitional area with a bluff and some surface water features, including a snowmelt pond and a fish hatchery. The snowmelt pond is an elongated shallow water body measuring approximately 50 x 300 feet formed by beavers backing up natural drainages. It is called the snowmelt pond because snow is often piled on top of the bluff near the pond.

Land uses in OU5 vary. An Army Corps of Engineers building is located near the western side of the operable unit above the bluff. Some military residential units are located back from the bluff on the eastern and western sides of the operable unit. Ship Creek flows from east to west along the southern edge of the base. The primary land use is light industrial, including the presence of diesel, jet, and multi product fuel and distribution lines. These fuel lines have leaked fuel into the soil and groundwater surrounding the pipelines. Before the leaks could be detected, fuel product and fuel constituents, such as benzene, migrated from the leak to the water table. This migration from source areas is the primary cause of contamination at OU5.

Major contaminants of concern are identified as primarily solvents and volatile organic chemicals related to fuel constituents. PCBs are also identified, with the implication that they migrated from other operable units upgradient from OU5. The risk assessment considered the current and future transport of contaminants to potential receptors, which at this site include soil, sediment, groundwater, and surface water. Solvent constituents, primarily

Trichloroethylene (TCE), were detected in the upper aquifer groundwater in OU5. Upgradient sources from Operable Unit 5 (Operable Units 1, 2, 3, 4 and several SERA sites) are the source of some of the groundwater contamination in Operable Unit 5. Regardless of the source of contamination, groundwater contamination is being treated through Operable Unit 5 remedial actions.

The ROD for OU5 (Air Force, 1995d) was signed in February 1995. Remedies rely heavily on natural attenuation and other passive approaches. Source area ST37, which included both TCE and PCB contamination, is the one exception. In this area, approximately 3,000 cubic yards of soil contaminated with fuel were excavated and treated at an on-base treatment facility, and contaminated seep water in the western and middle portions of OU5 from this area was passively drained using horizontally inserted extraction wells in the bluff. A wetland was constructed to receive the contaminated seep water at the location of the snowmelt pond. A layer of gravel was placed over sediments in the snowmelt pond to isolate low levels of PCB contamination. Monitoring is ongoing and will be fully reviewed in the upcoming five-year review, late summer, 2003.

Although the *1998 Five-Year Review* maintains that the OU5 remedies (which are functioning as designed) remain protective of human health and the environment, serious questions remain about the efficacy of institutional controls in protecting wildlife from the contaminated areas. Land use restrictions, including fencing and signs, may be adequate to prevent human access to the site, but given that response actions at OU5 are expected to continue for over twenty years into the future, it is doubtful that this approach is adequately protective of the environment. Relying on the transfer of contamination from one medium to another through evaporation and volatilization as a means of remediation, and attempting to maintain and monitor large tracts of contaminated soils and groundwater are clean up strategies that should be examined. These practices do not constitute progressive environmental health policy. This is an issue which ought to be brought into the 2003 five-year review discussion. Thousands of residents and non-residents eat salmon from Ship Creek annually. The State DEC and Elmendorf should conduct a joint study of contaminant levels in Ship Creek salmon populations to give the public adequate information about inherent risks associated with food consumption, and to more holistically address cleanup goals for the Creek.

Operable Unit 6

OU6 consists of six source areas: three former landfills, two sludge disposal pits, and a surface disposal area around a rock-testing laboratory. Past landfill and general waste management practices are the principal reason for the contamination present at these sites. In addition, several fuel lines and the associated valves and storage tanks associated with the base fueling facilities are located within OU6 source areas. These fuel systems have leaked fuel into the soil and groundwater surrounding these facilities. Three of the sources are in the northern part of the base, and three are in the southern part of the base.

Major contaminants of concern include benzene, ethylbenzene, toluene, 1,2-dichloroethane, methylene chloride, 1,1,2,2-tetrachloroethane, 1,1,2-trichloroethane, trichloro-ethane, and lead; all of which are fuel-related chemicals. Pesticides were also found to be contaminating soil at one of the source areas, SS19. As a result, an expedited response action was conducted at the site to remove the soil, which was accomplished in 1995. Following this, it was determined that the residual risk was at an acceptable level (primary data regarding levels was not available for this report), which can be assumed to mean that the remaining pesticide levels in the soil were below **maximum contaminant levels** (MCLs), and the source area was designated as requiring no further action.

The Knik Bluff Landfill (LF04) was used for disposal of construction rubble, debris and other solid waste from 1945 to 1957. It parallels the Knik Arm with a steep bluff that drops about 200 feet down to the shoreline. Daily tidal action erodes the base of the bluff causing it to subside into the ocean, leaving approximately 20 acres of solid wastes exposed. Although the primary contaminant found is benzene, unexploded ordinance (UXO) was discovered in 1999. Institutional controls include fencing and "no trespassing area" signs, groundwater testing is ongoing and debris on the beach is removed annually to prevent human exposure to the wastes. The Air Force has agreed to maintain these land/groundwater use controls indefinitely.[11]

Remediation at OU6 included several cleanup activities in addition to monitoring and institutional controls. At two sites, recoverable quantities of free product found on top of the water table were removed during groundwater monitoring events. Annual debris removal on the beach was proposed, which was done in 1997 as reported in the 1998 five-year review. Debris removal at other source areas was accomplished as of 1996, and soil covers were constructed over three areas to minimize potential human exposure to lead contaminated soils in these areas. Groundwater in one source area was treated by a high-vacuum-extraction process to remove contaminants including removable free product. Groundwater in all other source areas was included in the base wide monitoring program and sampled twice yearly. Institutional controls are also listed as remedial actions to prohibit the use of the shallow aquifer and/or designate the areas as "restrictive use area" to prohibit the construction of any sort of manned facility, such as an office building or residence.

As of the *1998 Five-Year Review*, all of these activities were operational and considered to be protective of human health and the environment.

Risk Assessment:

Two risk assessments are done for each operable unit. One assesses the effects of contaminant exposure to human health and the other to wildlife and the environment. An initial risk assessment establishes baseline conditions at the time of the remedial investigation. At this time, if contaminant levels measured at the site are below what the EPA considers to be a risk to human health or the environment, they rule that action is not warranted. This is called "acceptable risk." With regard to the site, it means the EPA has determined that the expense of cleanup is greater than the risks to human health presented by not cleaning up. Due to this concept of acceptable risk, many contaminants will remain present in the environment at some level.

Two main problems arise out of this traditional model of assuming there is some level of exposure that is "safe." One: there is no way of knowing what is safe. For example, very little information is known about how different chemicals at the same site will interact with one another, or react in a person's body that already has another chemical present (this is a process called synergistic affects). Two: the old toxicological approach that "the dose determines the poison" is being proven unsound. Recent research shows a key factor to human health is not dosage as much as it is timing of exposure, such as during pregnancy, puberty, or menopause. Certain persistent pollutants, such as dioxin, PCBs, and pesticides, can interfere with cellular and molecular processes that may manifest only years later as cancer or show up only in offspring.

These issues represent what is called *uncertainty.* Under the current paradigm of risk assessment, the burden of uncertainty falls entirely on those who are exposed to the contaminants.

The *uncertainty* discussed in the EPA risk assessments is related, but is expressed somewhat differently. Records of decision always include a section that states, "Health risk assessment methodology has inherent uncertainty associated with how accurately the calculated risk estimates represent the actual risk,"[3] and it is acknowledged that risk in the laboratory is not the same as risk in the field. Uncertainties may overestimate- or under-estimate the calculated risks. Some of the kinds of uncertainty the EPA recognizes include the possibility of underestimating risk because groundwater detection limits for some contaminants are higher than risk-based screening concentrations, in other words, uncertainty due to the time of year samples were drawn, the possibility that two few surface soil composite samples may have been taken, or that standardized calculations may not accurately reflect Arctic conditions.

A third issue with risk assessment is particular to Alaska and is relevant in terms of environmental justice. In order to accurately assess risk to human health, the assessment must take into consideration the dietary intake of the population being evaluated.

In the risk assessment paradigm, the question asked is: how much damage is safe? Instead, the question should be: how little damage is possible? This can be accomplished by shifting the paradigm to the Precautionary Principle in which the burden of uncertainty bore by the public is replaced by the burden of proof of lack of harm,

which is bore by the proponents of an activity (in this case, the Army, the EPA and the State Department of Environmental Conservation).

A more in-depth discussion of risk assessment, including exposure pathways and routes of exposure, is available in the *Overview of Key Issues at Alaska Military Superfund Sites*, which accompanies this report.

Conclusions:

Elmendorf Air Force personnel did not adequately address environmental justice in the process, however, with DP98 undergoing a formal CERCLA Remedial Investigation, the opportunity exists to do otherwise. The EPA and Elmendorf should include local tribes in all investigative and decision-making steps, so as to fulfill government-to-government obligations under federal statute.

With the upcoming Five Year Review, due in late summer of 2003, areas that the public may want to pay particular attention to: SS83 – a landfill discovered in 2001, the extent of contamination is unknown at this time, however, significant levels of lead are already known to be present; OU5 - because 90 percent of the shallow aquifer flowing through Elmendorf flows through this area, and much of the waters end up in Ship Creek, this site is of particular importance. The Air Force ought to participate in more holistic approaches given that fish hatcheries and salmon habitat play an important role in public consumption of the fish; and Knik Bluff Landfill (LF04) - tidal erosion continues to expose contaminated waste on the shoreline. The Air Force is researching other methods of cleanup other than annual removal of the debris.

In general, the Air Force and Navy have chosen natural attenuation for most groundwater contamination at their Superfund sites in Alaska, while the Army has been more willing to install active cleanup systems. The Air Force should follow this example and apply more active systems, especially in areas, such as OU5, where the migration of groundwater contamination could pose serious consequences. The Air Force should also pay particular attention to cleanup of areas contaminated with POPs.

Finally, the authors had this space reserved to commend the Air Force for making some of the their Elmendorf Superfund documentation available on the Internet. Up until early March 2003, one could easily access this information through their website. Now, however, the website has changed, with absolutely no reference to environmental issues, nor the ability to do a search. Unfortunately, the Air Force has taken a step backward instead of forward. The Air Force and the Army should follow the example of Adak and provide the public with a webpage devoted to their contaminated sites. Adak can be viewed at www.adakupdate.com.

A glossary of terms and laws, commonly found contaminants, and a comprehensive discussion of environmental justice issues can be found in the accompanying document, *Overview of Key Issues at Alaska Military Superfund Sites.*

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Limited information is available online at:
http://www.state.ak.us/dec/dspar/csites/dod/rabs.htm

Sites where Elmendorf Superfund documents are located:
Alaska Resources Library (Administrative Records)
3150 C Street
Magnum Electronics Building
Anchorage, AK 99513

University of Alaska at Anchorage Consortium Library (Selected Documents)
Reserve Desk
3211 Providence Road
Anchorage, AK 99508

Footnotes:

[1] U.S. EPA Superfund, Record of Decision (ROD) Abstracts, Elmendorf Air Force Base, http://www.epa.gov/superfund/topics.htm.

[2] "Intrinsic remediation" is the same thing as natural attenuation, which refers to the process of eventual natural elimination of contaminants from media either by virtue of biodegradation, volatilization, or simple transfer to another medium due to weather, animals, etc. The EPA referred to the same process by different terms in RODs signed before 1998. The term now in use is "monitored natural attenuation". Environmentalists ironically refer to this so-called remedy as, "Dilution is the solution to pollution."

[3] Site Summary Update November 1999

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