

Health Consultation

Evaluation of Health Statistics and Public Health Data Gaps Related to
Exposure to Naturally Occurring Asbestos from Swift Creek

Swift Creek Sediment Asbestos Site Everson, Whatcom County, Washington

February 22, 2008

Prepared by

**The Washington State Department of Health
Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry**



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Foreword

The Washington State Department of Health (DOH) has prepared this health consultation in cooperation with the Agency for Toxic Substances and Disease Registry (ATSDR). ATSDR is part of the U.S. Department of Health and Human Services and is the principal federal public health agency responsible for health issues related to hazardous waste. This health consultation was prepared in accordance with methodologies and guidelines developed by ATSDR.

The purpose of this health consultation is to identify and prevent harmful human health effects resulting from exposure to hazardous substances in the environment. Health consultations focus on specific health issues so that DOH can respond to requests from concerned residents or agencies for health information on hazardous substances. DOH evaluates sampling data collected from a hazardous waste site, determines whether exposures have occurred or could occur, reports any potential harmful effects, and recommends actions to protect public health. The findings in this report are relevant to conditions at the site during the time of this health consultation, and should not necessarily be relied upon if site conditions or land use changes in the future.

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For more information about ATSDR, contact the ATSDR Information Center at 1-888-422-8737 or visit the agency's Web site: www.atsdr.cdc.gov/.

Glossary

Acute	Occurring over a short time [compare with chronic].
Agency for Toxic Substances and Disease Registry (ATSDR)	The principal federal public health agency involved with hazardous waste issues, responsible for preventing or reducing the harmful effects of exposure to hazardous substances on human health and quality of life. ATSDR is part of the U.S. Department of Health and Human Services.
Cancer Slope Factor	A number assigned to a cancer causing chemical that is used to estimate its ability to cause cancer in humans.
Carcinogen	Any substance that causes cancer.
Chronic	Occurring over a long time (more than 1 year) [compare with acute].
Comparison value	Calculated concentration of a substance in air, water, food, or soil that is unlikely to cause harmful (adverse) health effects in exposed people. The CV is used as a screening level during the public health assessment process. Substances found in amounts greater than their CVs might be selected for further evaluation in the public health assessment process.
Contaminant	A substance that is either present in an environment where it does not belong or is present at levels that might cause harmful (adverse) health effects.
Dose (for chemicals that are not radioactive)	The amount of a substance to which a person is exposed over some time period. Dose is a measurement of exposure. Dose is often expressed as milligram (amount) per kilogram (a measure of body weight) per day (a measure of time) when people eat or drink contaminated water, food, or soil. In general, the greater the dose, the greater the likelihood of an effect. An “exposure dose” is how much of a substance is encountered in the environment. An “absorbed dose” is the amount of a substance that actually got into the body through the eyes, skin, stomach, intestines, or lungs.
Environmental Protection Agency (EPA)	United States Environmental Protection Agency.
Epidemiology	The study of the occurrence and causes of health effects in human populations. An epidemiological study often compares two groups of people who are alike except for one factor, such as exposure to a chemical or the presence of a health effect. The investigators try to determine if any factor (i.e., age, sex, occupation, economic status) is associated with the health effect.

Health Consultation

Exposure	Contact with a substance by swallowing, breathing, or touching the skin or eyes. Exposure may be short-term [acute exposure], of intermediate duration, or long-term [chronic exposure].
Hazardous substance	Any material that poses a threat to public health and/or the environment. Typical hazardous substances are materials that are toxic, corrosive, ignitable, explosive, or chemically reactive.
Ingestion	The act of swallowing something through eating, drinking, or mouthing objects. A hazardous substance can enter the body this way [see route of exposure].
Inhalation	The act of breathing. A hazardous substance can enter the body this way [see route of exposure].
Inorganic	Compounds composed of mineral materials, including elemental salts and metals such as iron, aluminum, mercury, and zinc.
Media	Soil, water, air, plants, animals, or any other part of the environment that can contain contaminants.
Route of exposure	The way people come into contact with a hazardous substance. Three routes of exposure are breathing [inhalation], eating or drinking [ingestion], or contact with the skin [dermal contact].

Summary and Statement of Issues

This report is a follow-up to a March 2006 health consultation that is available at the following web-address:

<http://www.atsdr.cdc.gov/HAC/PHA/SwiftCreekSedimentAsbestos/SwiftCreekHC033006.pdf>.

The primary goal of this document is to present an epidemiological review of health outcome data in the area of Swift Creek, summarize activities conducted at the site since the previous health consultation was written, identify remaining data gaps, and prepare a public health action plan designed to fill data gaps. Filling data gaps will provide the basis for future public health actions and risk communications to citizens. DOH prepares health consultations under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR).

Background

Swift Creek drains an area of about three square miles (mi²) near the town of Everson in Whatcom County, Washington. The creek originates on the west flank of Sumas Mountain and flows west approximately four miles through agricultural land into the Sumas River. The Sumas River in turn meanders roughly 15 miles northeast to the Canadian border (about 7 mile straight line distance) where it eventually flows into British Columbia's Fraser River 10 miles north of the border.

A large landslide on Sumas Mountain that occurred in the 1930s is a recurring source of sediment deposited in Swift Creek during periods of rain and snowmelt. Much of this sediment is deposited in the lower reaches (approximately 2 miles) of Swift Creek where a large volume (tens of thousands cubic yards (yds³)) settles annually (Kerr Wood Leidal Associates 2005). Sediment deposition causes continuing flood control problems.

To prevent flooding, Whatcom County Public Works has dredged a one-mile reach of Swift Creek from Goodwin Road west beyond Oat Coales Road. Dredging normally occurs on an annual basis (or as needed) with dredged material piled on private property on either side of the creek forming high levees, which provide temporary storage. In the past, most dredged sediment was removed from the site by the public and contractors for use as fill in construction projects. This provided an inexpensive method for removing dredged sediments from the area. This practice was later halted due to renewed human health concerns related to naturally occurring asbestos in Swift Creek sediments (United States Environmental Protection Agency 2005).

Because dredged sediments are no longer removed from the stockpiles along the banks of Swift Creek, large piles are located on both sides of the creek year-round. Storage capacity within the existing bounds of the easements was reached in the summer of 2006 when an additional 30,000 – 50,000 cubic yards were added to the existing 150,000 + cubic yards. Land owners are reluctant to allow the easements to widen because this would further reduce the amount of productive land available for agriculture.

In June 2006, Whatcom County Health Department requested the assistance of DOH to provide guidance for dealing with health issues related to asbestos in Swift Creek sediments. At that

time, DOH could not make firm conclusions about health impacts from asbestos at the site; therefore additional site characterization was recommended (Washington State Department of Health 2006).

EPA actions at Swift Creek

In February 2006, the EPA was asked by the Whatcom County Health Department to characterize and determine the type and amount of asbestos contained in Swift Creek sediments. EPA’s involvement was limited to the dredged stockpiles along the one-mile reach between Oat Coles and Goodwin Roads. EPA conducted field reconnaissance in April 2006 to characterize the mineral composition of Swift Creek sediments and dredge piles and to verify the presence of chrysotile asbestos. A more thorough investigation began in May 2006 which consisted of characterization and bulk sampling of materials in the dredge piles, followed by activity based sampling in August 2006 to assess residents’ and workers’ potential exposure to asbestos in the dredged material. These efforts culminated in a summary report released in February 2007 (United States Environmental Protection Agency Region 10, 2007).

Bulk Asbestos Sampling

EPA characterized dredge piles along Swift Creek in spring 2006. Fifty-one bulk samples were taken from the dredge piles along Swift Creek. Each sample was split into four size fractions; <250 micrometers (um), 250 um-2 millimeter (mm), 2 mm-4.75 mm, and > 4.75 mm. The most common size fraction was >250 um - < 2mm. Each size fraction was analyzed for asbestos using polarized light microscopy (PLM).

Asbestos content in bulk materials ranged from 0.1 to 4.4 % and averaged 1.7% (United States Environmental Protection Agency Region 10, 2007). Average asbestos content in fine grained sediments was nearly twice that of the coarse fraction asbestos content (Table 1). Chrysotile asbestos was the primary asbestos type detected in Swift Creek sediments.

Table 1. Percent asbestos in Swift Creek sediments (by size fraction)

Size Fraction	Range of size fraction making up bulk sediment %	Average size fraction present in bulk sediment %	Range Asbestos %	Average Asbestos %
< 250 um	2.1-67.6	15.3	0.1 – 5.0	1.9
250 um-2 mm	14.0-79.1	61.5	0.1 – 5.0	1.9
2 mm-4.75 mm	7.1-45.1	18.2	0 – 5.0	1.0
> 4.75 mm	0-52.7	5.0	0 – 4.0	0.9
All Fractions	NA	100	0.1- 4.4	1.7

Although asbestos in sediments is of concern because there is potential for human exposure, there is currently no health-based standard or comparison value for asbestos in soil or sediments. That is to say, there is not a level of asbestos in soil that is considered or known to be safe. Most health-based standards or comparison values for contaminants in soil are based on soil ingestion estimates. Since the main concern with asbestos is inhalation, EPA conducted activity based

Health Consultation

sampling to approximate how much asbestos in soil/sediment is suspended in air to be inhaled by humans.

Activity Based Sampling

Activity based sampling (ABS) consists of air samples being taken while soil is disturbed by human activity. EPA conducted ABS along Swift Creek in August 2006 to determine how much asbestos is suspended in air during human contact with sediment. Realistic activities were performed because the purpose of ABS is to determine if activities involving Swift Creek sediments pose a health risk.

Three different activities were simulated at the site: 1) loading dredged materials onto a dump truck with a front-end loader, 2) shoveling and spreading dredged materials, and 3) recreational activities along the creek. Each activity was chosen because it either occurred on the site in the past or is ongoing.

Asbestos fibers were detected in personal breathing zones during all activities ranging from 0.009 to 0.2 fibers per cubic centimeter (f/cc) (Table 2). EPA Region 10's Office of Environmental Assessments concluded in a risk evaluation that some activities (e.g., dredging and hauling, farm-related soil work, and gardening) conducted over long periods of time at Swift Creek can lead to lifetime increased cancer risks in excess of 1×10^{-4} (0.0001 increase in risk of getting cancer over a lifetime) (United States Environmental Protection Agency Region 10, 2007). These risks exceed what is typically considered acceptable under State and Federal regulatory guidelines.

Table 2. Levels of asbestos in air resulting from simulated activities at Swift Creek. August 2006

Activity	Repetition **	Sample type	Concentration PCMe (f/cc)
Loading Dredged Materials onto Dump Truck with a Front-end Loader	1a	Personal	0.0441
	1b		0.0324
	2a		0.0637
	2b		0.0325
	3a		0.2073
	3b		0.0858
	AVERAGE	0.0776	
	North	Stationary	0.028
	South		0.0005
	West		0.0008
	East		0.002
Downwind Hi-volume	0.0011		
Shoveling and Spreading Materials with a Rake *	1a	Personal	0.00028
	1b		0.03015
	2a		0.0052
	2b		0.00864
	3a		0.04035
	3b		0.02688
	AVERAGE	0.0186	
	North 1	Stationary	0.00178
	North 3		0.00122
	South 1		0.00277
	South 2		0.00045
	South 3		0.00106
	West 1		0.00052
	West 3		0.00192
	East 1		0.0003
East 2	0.00345		
East 3	0.00124		
Recreational Activities Along the Creek Walk/Bike/Jog	1a	Personal	0.0933
	1b		ND
	2a		ND
	2b		0.01604
	3a		0.05672
	3b		0.00897
	AVERAGE		0.0292

Note: wind direction during activities was primarily from southwest

* Moisture content of material at beginning of shoveling and raking averaged 7%. Once spread out and allowed to dry, the moisture content average 3.6%.

** Each activity was repeated three times with two people conducting each activity simultaneously. Stationary air samplers were set up around the perimeter of each activity except the recreational activity.

Stationary – samples were taken from a stationary sampler

Personal – samples were taken from samplers worn by people participating in the activity

EPA's recommendations

Because ongoing exposures may occur near the site and the demonstration that asbestos fibers are released into the breathing zone upon disturbance, EPA recommends that dredged materials no longer be removed from the site without personal protection and that it not be taken to other sites where further exposure is possible, as has been done in the past. Further actions recommended by EPA include using a multi-agency approach to address management of current and future dredged sediments from Swift Creek (United States Environmental Protection Agency Region 10, 2007).

Uncertainty

There are many uncertainties associated with the risk assessment process EPA used to derive risk estimates described above. Uncertainty refers to incomplete understanding of factors such as asbestos fiber toxicity, human variability, human behavior patterns, and asbestos fiber concentrations in the environment. Uncertainties can be significant and can only be reduced through further study. In the face of this uncertainty, environmental and public health agencies must make decisions that are protective of human health and the environment.

Exposure uncertainty

The level of asbestos in air generated by activities at Swift Creek over a long period of time is a point of uncertainty. Measurements were made during activities in August 2006, but whether this is representative of the whole year is not clear. Risks may be overestimated because air samples were taken in the summer when sediments were more likely to be dry. On the other hand, the sediment contained some moisture at the time activity based sampling occurred which may have suppressed some fibers from being released into the air.

The exposure scenarios evaluated in assessing human exposure to pollutants are another source of uncertainty. In the case of EPA's risk evaluation, some exposure scenarios were based on anecdotal information from the community, and other scenarios were based on what EPA considered a reasonable activity. The exposure scenarios may not represent all activities that may occur near the creek. EPA's risk evaluation was focused solely on activities that might be conducted in direct contact with asbestos-laden sediments dredged from Swift Creek. It is possible that asbestos is distributed more widely in the community and exposures to other sources of asbestos could result in risks higher than those estimated in EPA's report.

Toxicological uncertainty

In risk assessments, uncertainty about chemical toxicity and how it varies among individuals can be significant. Although we know that asbestos can cause disease in humans from epidemiological and clinical evidence, it is not certain at what point a person's exposure can or will lead to disease. For this reason, risk assessment is used to estimate a person's increased cancer risk from asbestos exposure. Factors such as exposure duration, fiber concentration and are important for determining the risk.

Health Consultation

The risk estimates used to derive the current asbestos slope factor were based on a synthesis of available epidemiologic studies at the time the slope factor was derived (EPA IRIS, 1988). The slope factor calculated for the additive combined risk of lung cancer and mesothelioma, and is calculated as a composite value for males and females with no consideration for smoking habits. The epidemiological data show that cigarette smoking and asbestos exposure interact synergistically for production of lung cancer and do not interact with regard to mesothelioma. Exposure characterization in these studies was originally conducted according to airborne fibers seen using phase contrast microscopy (PCM), in which fiber type was not distinguished and smaller fibers were not seen. Because Swift Creek air samples were analyzed using transmission electron microscopy (TEM), a more sensitive analytical method, numerous fibers were detected in Swift Creek air samples that were not included in the evaluation because they did not match the existing definition of a PCM equivalent (PCMe) fiber. It is not known to what degree, if any, these fibers contribute to asbestos toxicity. If they do contribute to risk, then risk estimates derived in EPA's risk evaluation described above may be underestimates.

Finally, current quantification of risk from asbestos exposure can only be accomplished for the cancer endpoint (i.e., lung cancer and mesothelioma), but non-cancer hazards (e.g., asbestosis and pleural changes) cannot be quantified. It is not currently known which endpoint, cancer or non-cancer, is more likely to be of concern with regard to low-level asbestos exposure.

Community Concerns

US EPA held public meetings on October 24, 2006, and February 12, 2007, at St. Innocent Church near Swift Creek. Residents who attended the meeting voiced concerns about property values, flooding, and long-term solutions for dealing with sedimentation. To date, there have been only a few health concerns voiced since the release of EPA's report. Specific community concerns are presented below.

- At public meetings, residents asked whether or not there was any evidence of asbestos related disease in the community. DOH conducted a review of cancer statistics. This information is presented in the following section of this document and Appendix A.
- Some local residents reported that during times of high wind, dust is visibly blown in the area. Some of this dust may contain Swift Creek sediment and naturally occurring asbestos. Though these storms are intermittent, they represent a pathway by which asbestos can be blown from the site to residences.
- A resident of Sumas, Washington that lives on a property adjacent to the Sumas River contacted DOH to ask if she was possibly exposed to asbestos that was deposited during flooding. Her greatest concern was that she was causing asbestos to become airborne while cutting the grass at areas near the river.
- A Bellingham resident contacted EPA to tell them of fill that she bought about ten years ago to use in her yard (personal communication, Denise Baker, United States Environmental Protection Agency Region 10). She claimed that it took awhile for

Health Consultation

anything to grow in it, and thus suspected it might be material from Swift Creek. She also noted that her child had asthma and was wondering if there was a link.

- A Whatcom County resident that lives about one mile from Swift Creek contacted EPA to tell them that he suspected Swift Creek sediment was used as bed material for a private road near his property (personal communication, Monica Tonel, United States Environmental Protection Agency Region 10). Maintenance of the road was on-going and he was concerned that dust from the project could impact his home and family.
- A project manager from the Whatcom Conservation District working on a restoration project along the Sumas River was concerned that employees could be exposed to asbestos deposited along the banks of the river. Restoration activities include
 - Mowing of grasses and weeds with weed whackers, brush hogs, or tractor and deck mowers.
 - Cutting and clearing of blackberry canes by hand or heavy equipment.
 - Herbicide treatment of planting spots and invasive weeds using backpack sprayers and/or tractor.
 - Fencing installation.
 - Tillage.
 - Digging holes for planting.

Health Statistics Review

Residents asked whether there was any evidence of asbestos related disease in the community near Swift Creek. The potential asbestos-related diseases and health effects are lung cancer, pleural mesothelioma, asbestosis, pleural plaques, and pleural changes. DOH has focused on the two cancer outcomes, lung cancer and mesothelioma, because they are the only two notifiable asbestos related diseases that must be reported by health care providers to the Washington State Department of Health. This information is compiled in the Washington State Cancer Registry.

DOH compared the number of cancer cases seen in the community near Swift Creek with the number of cancer cases seen in two reference populations. In this way, the number of cases observed in the Swift Creek community was compared to the number of cases DOH expects to find based on numbers seen in other populations.

For this analysis, the area of interest consists of four block groups near Swift Creek (Figure 2), and the reference populations are Whatcom County and the population of the State of Washington as a whole. The ratio of the observed cases in the area of interest to the expected number of cancer cases (based on county or statewide rates) was examined.

In the area of interest, no mesothelioma cases were identified from 1992-2004. Lung and bronchus cancer rates were in the area of interest, were similar to Washington State rates, and were not significantly different from Whatcom County as a whole. A more detailed description of the methodology and results is included in Appendix A.

Discussion

DOH and ATSDR reviewed EPA's report of activities at the Swift Creek site and concur with the methodology used to estimate exposure to asbestos and the resulting evaluation of human health risks at the site. However, EPA's assessment at Swift Creek was limited to a small area, and scenarios covered by activity based sampling may underestimate total exposure. The movement of asbestos from the site by wind, water, and humans may present opportunities for additional exposure to asbestos originating from Swift Creek. The following discussion focuses on health implications away from the area EPA focused their investigation.

Data Gaps

EPA's sampling and analysis at Swift Creek provided much needed information about the levels of asbestos contained in dredged material deposited along the banks of Swift Creek and associated health risk with interacting with that material. Unfortunately, it is difficult to extrapolate results of activity based sampling to other scenarios, including indoor exposure. Consequently, it is difficult to determine what public health actions are appropriate without a more complete picture of potential exposures.

There are three primary areas where questions remain about non-occupational exposure:

- Properties adjacent to Swift Creek - Based on comments from residents at public meetings, there is potential that asbestos from Swift Creek was either blown into homes through open doors and windows, or tracked into homes from residents' shoes.
- Properties where Swift Creek sediment was used as fill - The full extent to which asbestos-containing sediments have been used off-site is uncertain, and will likely never be completely known, but an estimated 2 million cubic yards were moved off-site. Anecdotal information suggests that Swift Creek sediments have been used as fill for a variety of private (e.g., driveways, parking lots, log yards, and horse arenas) and public projects (e.g., transportation projects). A potential pathway of significant concern is the in home exposure pathway. If asbestos containing fill was used at or near residential properties, there is potential that asbestos may have been tracked into the home over time. Since people spend the majority of time indoors, this potentially presents a frequent and prolonged exposure pathway.
- Properties downstream where asbestos may be deposited during floods - Swift Creek flows into the Sumas River which flows north to Canada. Flooding on Sumas River has the potential to deposit asbestos in the floodplain. Anecdotes from area geologists tell of vegetation being covered with white silty material after flooding. If this material is indeed asbestos, it too can be windblown or disturbed by activities conducted adjacent to the river. Flooding of homes and basements in the past may have deposited unknown quantities of asbestos indoor environment contributing to longer-term exposures.

Occupational exposure to asbestos originating from Swift Creek may occur. The following workplace scenarios warrant further consideration:

Health Consultation

- Great Western Lumber – Great Western Lumber operates a sawmill near Swift Creek. Anecdotal information suggests that sediment from Swift Creek may have been used as fill at the log sorting yard.
- Future dredging and removal actions – although it is not yet clear what strategies will be used to manage Swift Creek sedimentation and flooding, dredging and/or movement of the sediments will likely occur in the future. These activities will likely be taken on by contractors who may not be aware that sediments contain asbestos.
- Restoration projects along Sumas River – habitat restoration along the Sumas River was planned, but concerns about asbestos deposition along the banks have temporarily halted the project.
- Road repair – Some roads in the area may have been built using Swift Creek materials as fill or as bed material. Resurfacing and repair work might expose road bed materials.

Children's Health Concerns

DOH and ATSDR recognize that infants and children are often more vulnerable to exposures than adults in communities faced with environmental contamination. Because children depend completely on adults for risk identification and management decisions, DOH and ATSDR are committed to evaluating children's special interests at the site.

The effects of asbestos on children are thought to be similar to the effects on adults. However, children could be especially vulnerable to asbestos exposures because they are more likely to disturb fiber-laden soils or indoor dust while playing. Children also breathe air that is closer to the ground and may thus be more likely to inhale airborne fibers from contaminated soils or dust.

Furthermore, children who are exposed could be more at risk of actually developing asbestos-related disease than people exposed later in life because of the long latency period between exposure and onset of asbestos-related respiratory disease.

Conclusions

1. A *public health hazard* exists for people conducting activities regularly on dredge piles.
 - EPA conducted a risk evaluation of exposure to asbestos through various activities at Swift Creek. An unacceptable cancer risk (exceeding 1×10^{-4} or 1 excess cancer in 10,000 exposed people) results from some activities while other exposures were not quantified because of data gaps. Risk estimates may in fact be underestimated because exposures may occur at other locations such as indoor environments of residences near Swift Creek.
2. There is no evidence of elevated asbestos related disease rates (i.e., mesothelioma and lung cancer) in the community near Swift Creek compared to Whatcom County or the state of Washington as a whole.
 - It is important to note that although no elevated disease rates were found in this community, minimizing exposure to asbestos is still important due to the level of uncertainty regarding asbestos exposure and toxicity.
3. An *indeterminate public health hazard* exists for people who might be exposed to Swift Creek asbestos at off-site locations such as indoors, or areas where dredged material was used as fill.
 - Data gaps exist especially with regard to:
 - Whether or not asbestos is present in homes.
 - Off-site locations and uses of material.
 - Off-site activities might result in additional exposures for nearby residents and exposures for people in other areas of the county.
 - Filling data gaps is important for identifying people that are exposed so that they can be provided with information that will help them reduce their exposure. Filling data gaps can also help to prioritize future public health actions.

Recommendations

1. DOH concurs with EPA's recommendations to:
 - Avoid contact with material dredged from Swift Creek.
 - Not take Swift Creek sediments off-site where further exposure is possible.
2. DOH and Whatcom County Health Department should communicate risks and personal risk reduction measures to community directly adjacent to Swift Creek.
 - Risk communication for the broader community should be undertaken if off-site exposure to asbestos is confirmed.
3. Data gaps should be filled to better understand other exposure pathways. The utility of filling these gaps is that exposures may be less or more than assumed. Appropriate messages can be formed that will aid in protecting health and easing anxiety. DOH understands that these data gaps will take time and additional funding.
 - Conduct indoor sampling at homes where sediments were transported by natural or human means (pending voluntary authorization from property owners).
 - Determine extent of potential asbestos deposition in flood plains of Sumas River and Swift Creek.
 - Determine locations and off-site areas where Swift Creek sediments have been used.
4. Businesses, workers or project managers should seek consultative service from Washington State Department of Labor and Industries (L & I) to aid in determining workplace hazards from exposure to Swift Creek asbestos.

Public Health Action Plan

Actions completed

1. EPA has characterized dredge spoils at Swift Creek to determine bulk asbestos content.
2. EPA has conducted activity based sampling at Swift Creek to determine health risks related to exposure to naturally occurring asbestos in dredge piles.
3. EPA, ATSDR, DOH, and Whatcom County Department of Health met with the community on February 12, 2007, to relate the results of ABS and their health implications.

Actions planned

1. DOH and ATSDR will determine the community's interest for indoor dust sampling at homes near Swift Creek to determine if windblown or tracked-in dust has accumulated in homes and poses additional exposure pathways to residents living along the creek.
2. Ecology will provide funding to Whatcom County Health Department to conduct

Health Consultation

additional characterization and outreach.

- Whatcom County has received a Site Hazard Assessment grant from the Washington State Department of Ecology. A portion of that grant has been earmarked to use on Swift Creek projects. Specific projects have not been determined, but money will go toward complementing indoor dust sampling by ATSDR and DOH, additional characterization efforts and community outreach.
3. Pending evaluation of community interest, EPA, Ecology, Whatcom County Health Department and DOH will seek funding and staff to characterize outdoor soils at the following locations:
 - Community locations - playgrounds, schools, daycares, and parks where dredged materials appear to be or have been reported to be present.
 - Outdoor areas of residences where Swift Creek sediments may have been deposited or placed (pending voluntary authorization from property owners/ residents) - homes closest to the dredged materials are preferred.
 - Roadways - roads and driveways may contain dredged materials in the bed material.
 - Other locations as determined through public interaction such as horse arenas.
 4. DOH will consult with representatives from L & I Consultative Services to address potential current and future occupational exposures to Swift Creek asbestos. Some possible candidate occupations are:
 - Restoration along the Sumas River
 - Great Western Lumber
 - Future dredging and hauling of Swift Creek materials
 - Road work
 5. DOH will work with Whatcom County Health Department, Ecology, and EPA to develop and distribute communications to the community based on the results of indoor and outdoor asbestos sampling in the area.
 - Information notifying and warning people that Swift Creek contains naturally occurring asbestos will be made available to the public through signs and kiosks near Swift Creek.
 - A broader outreach plan will be developed to determine what communications are necessary and appropriate to disseminate over a wider geographical area.
 - Existing facts sheets from ATSDR and EPA that deal with naturally occurring asbestos may be modified to fit the conditions at the Swift Creek site.
 6. DOH and ATSDR will evaluate any new data that provides information on off-site exposure to Swift Creek asbestos.

References

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Figure 1. Swift Creek site location, Whatcom County, Washington.

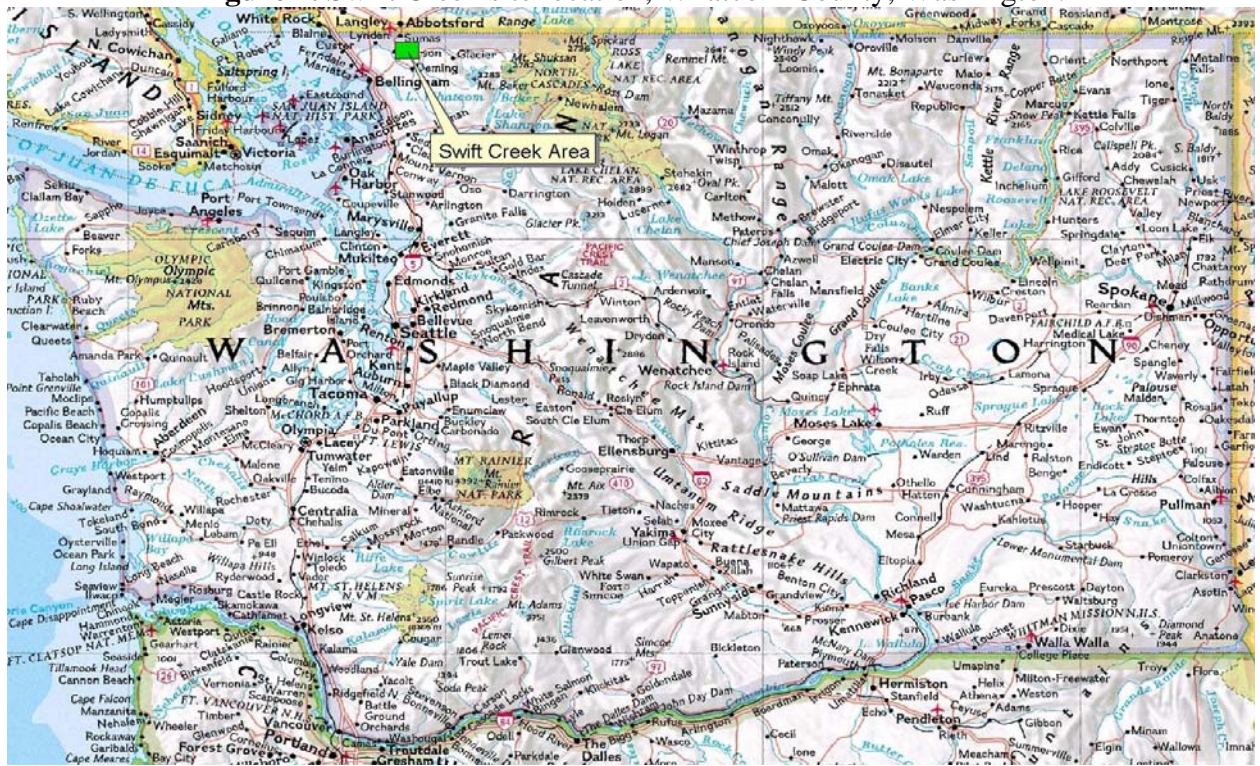
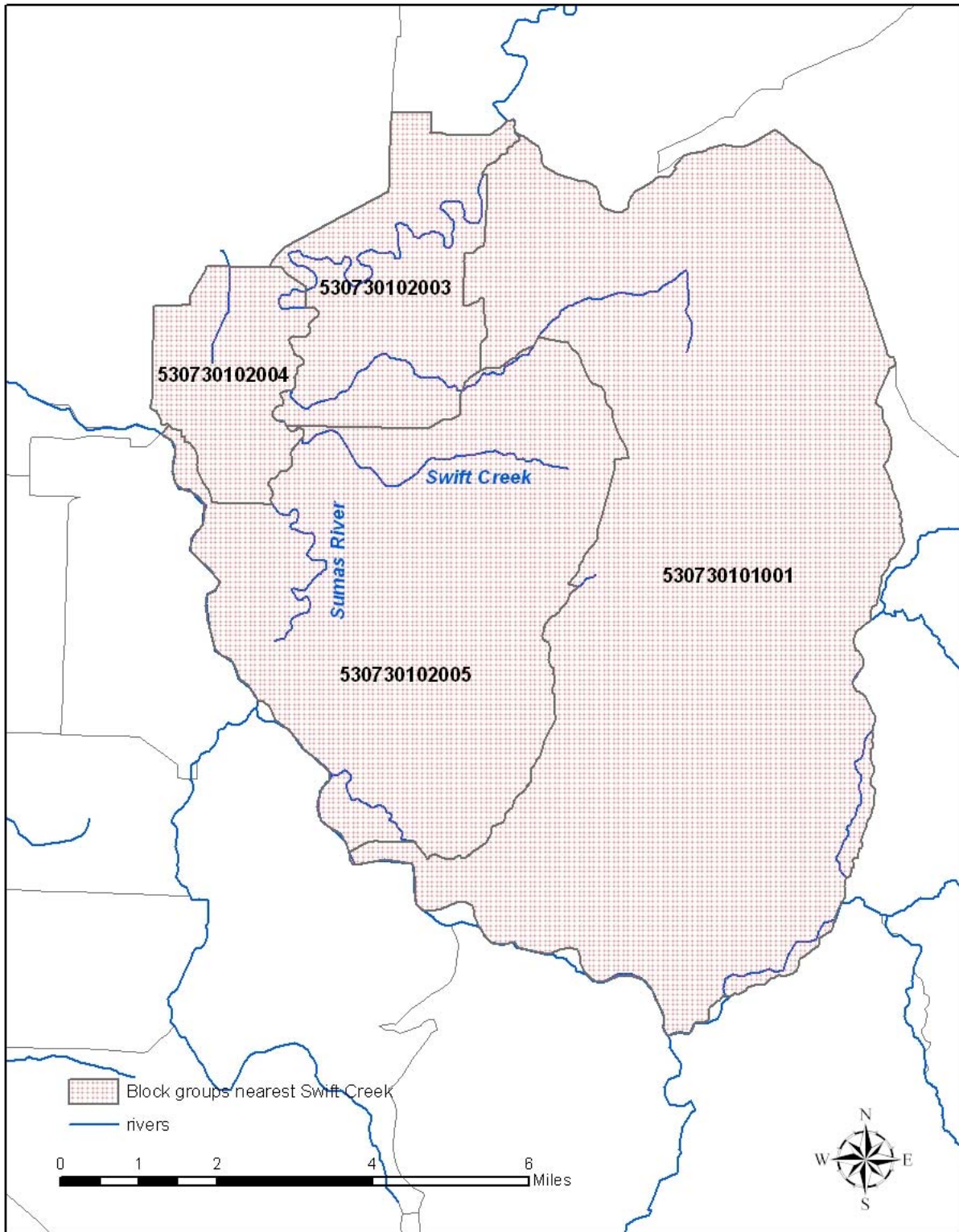


Figure 2. Census block groups where disease rates in the Swift Creek area were analyzed.



Appendix A – Epidemiological cluster investigation

Swift Creek Epidemiologic
Disease Investigation Summary

June 12, 2007

Office of Environmental Health Assessments
Environmental Epidemiology Section

Background

Extensive landslide activity at the headwaters of Swift Creek in the eastern-central part of Whatcom County has exposed a naturally occurring serpentine geologic formation that contains high concentrations of chrysotile asbestos. Weathering of this formation has contributed to the distribution of these chrysotile asbestos particles and other sediments along the banks and flood areas of Swift Creek.

Human exposure to asbestos particles via inhalation has been causally linked to a specific health condition known as mesothelioma, a cancer of the membrane that covers the lungs and chest cavity. Mesothelioma rarely occurs in people who have not been exposed to asbestos.

To address concerns over exposure to asbestos particles by people living near Swift Creek, and as a result, the possibility of increased disease among this population; an epidemiologic analysis was conducted to augment the Health Consultation prepared by the Washington Department of Health.

Goals

The primary goal of this project was to assess whether the number of cases of mesothelioma and lung and bronchial cancer among people living in the vicinity of Swift Creek, where sediment concentrations of naturally occurring asbestos are elevated, is significantly different from what would be expected, based on the incidence of cancer in the overall state population. Additionally, we assessed if there was any spatial clustering of cancer around Swift Creek compared to the rest of Whatcom County. Underlying these goals is the assumption that individuals living close to Swift Creek are likely to have a higher than typical exposure to asbestos particles and therefore have a greater likelihood of developing an asbestos related disease.

Methods

To address the above goals, mesothelioma and lung and bronchial cancer case data from diagnoses between 1992 and 2004 were abstracted from the Washington State Cancer Registry (WSCR) and analyzed. This duration reflects the years with the most reliable data. Aggregation of data across years was necessary due to the very small number of mesothelioma cases each year in Whatcom County. We evaluated the number of cases from Whatcom County as a whole, but focused on cases among individuals who lived within the upper Swift Creek region, as defined by four census block groups that most specifically encompassed this area (Figure A1). Human exposure in this region was assumed to be the greatest due to streambed asbestos concentrations, the extent of exposed depositional streambed area, and off-site movement of dredged streambed material for local use as fill.

Analyses included calculation of crude rates (e.g., age and gender combined) for mesothelioma and lung and bronchial cancer, the expected number for cases based on the county rate and the local population, the incidence ratio (observed number of cases/expected number of cases X 100), and 95% confidence intervals for rates and ratios.

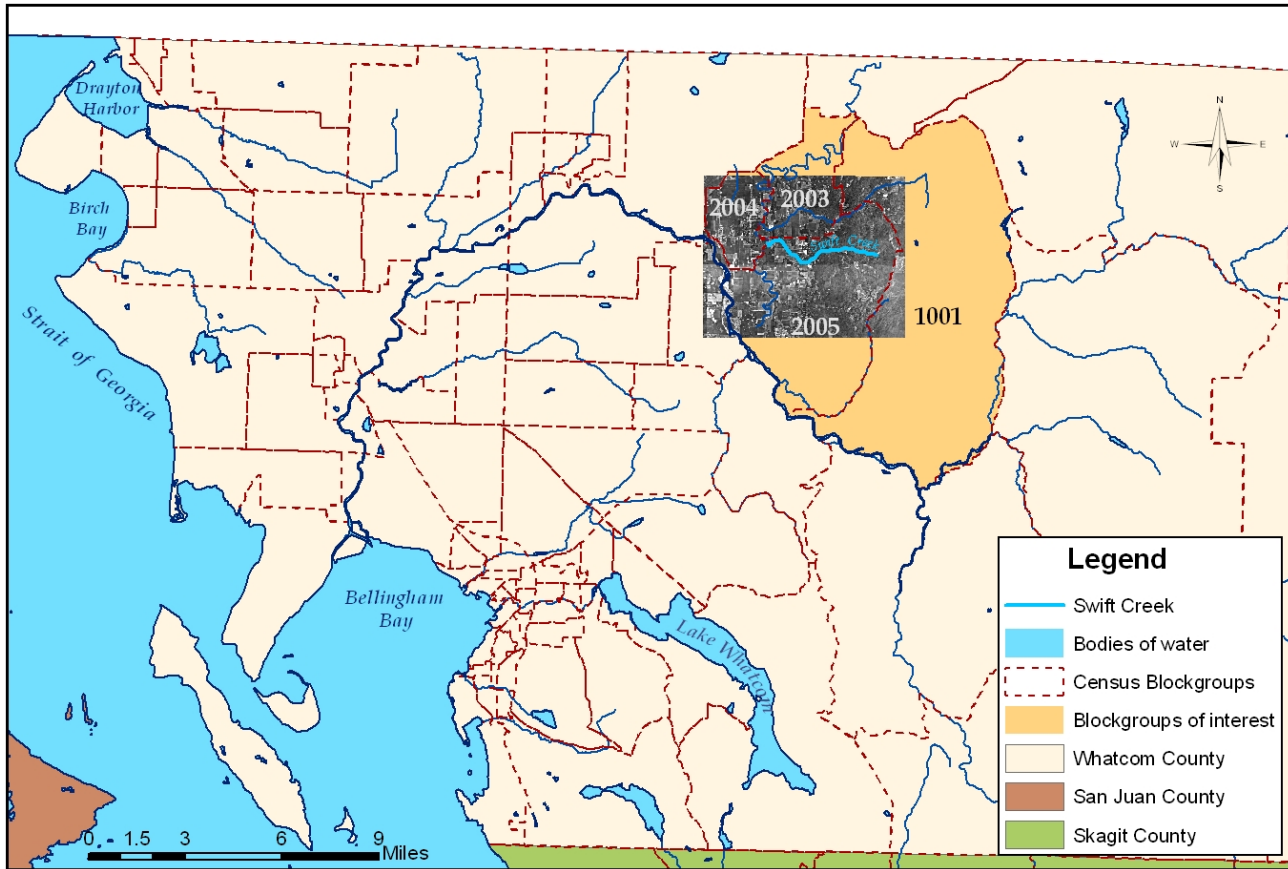


Figure A1. Swift Creek Epidemiologic Investigation Region, Whatcom County, Washington.

SatScan® software was used to evaluate whether cases were spatially clustered within Whatcom County, and in particular, in the vicinity of Swift Creek. Only cases geocoded to a street address were included in the spatial analysis due to artificial clustering when post office addresses were listed. Population data from the Washington State Office of Financial Management (OFM) were used as the denominator for these analyses.

Findings

Lung and Bronchial Cancer: Between 1992 and 2004, 1201 cases of lung and bronchial cancer were reported to the WSCR for Whatcom County, resulting in a crude rate of 720 cases per 100,000 population and an incidence ratio (IR) of 87.1 (95% CI = 82 – 92) (Table 1). This rate was significantly lower than the rate for Washington State overall, and is one of the lowest rates among Washington counties (36th out of 39 counties for lung and bronchial cancers).

Within the Swift Creek region, the rate of lung and bronchial cancer cases was lower than the overall state rate and not statistically different from the county rate. The small number of cases within the Swift Creek region resulted in an imprecise estimate of the crude disease rate, which is reflected in the wide confidence intervals. No significant spatial clustering of cases was detected (p=0.05).

Health Consultation

Mesothelioma: A total of 33 mesothelioma cases were reported to the WSCR for Whatcom County between 1992 and 2004 resulting in a crude rate of 19.8 per 100,000 compared to the state rate of 18.5 per 100,000 (Table 2). The county rate reflects two cases more than what was expected based on the county population. The county rate, being only slightly higher than the overall state rate, is not significantly different and is likely due to random variation in the number of cases that occur between years. Among people living in the Swift Creek region, no mesothelioma cases were reported, while one case was expected based on the state rate and the population in this region.

Table 1. Whatcom County Lung and Bronchial Cancer Data (1992 – 2004)

Geographic Area	Observed Cases	Population (2000)	Rate Per 100,000 (95% CI)	Expected	IR (95% CI)
Washington State	48698	5894143	826 (819-834)	Referent	Referent
Whatcom County‡	1201	166826	720 (680-762)	1378	87.1 (82-92)
Swift Creek Region	38	5423	701 (497-962)	39.0	97.3 (69-134)

Table 2. Whatcom County Mesothelioma Cancer Data (1992 – 2004)

Geographic Area	Observed Cases	Population (2000)	Rate per 100,000 (95% CI)	Expected	IR
Washington State	1093	5894143	18.5 (17.5, 19.7)	Referent	Referent
Whatcom County‡	33	166826	19.8 (13.6, 27.8)	30.9	107 (74, 150)
Swift Creek Region	0	5423	0.0 (0.0, 68.0)	1.1	0.0 (0., 335)

Notes:

1. The Swift Creek Region 4 Census block groups: 530730101001, 530730102003, 530730102004, and 530730102005.
 2. Washington State and Whatcom County population figures are taken from OFM revised on Feb 9, 2004.
 3. Population figures for the 4 block groups were from the small area estimates file prepared on Sep. 25, 2006 by OFM.
- ‡ Whatcom County IR is used as a reference for the sub regions in the County.

Summary

The crude rates of lung and bronchial cancer in Whatcom County and the Swift Creek region were found to be significantly lower than the overall state rate, while the rate for mesothelioma was similar to the state rate. Our analysis of these data provide no indication that lung and bronchial cancer or mesothelioma has occurred more frequently among residents of Whatcom County, or among residents living within the four block groups comprising the region around Swift Creek, than would be expected.

Although no significant differences in the rates of lung and bronchial cancer or mesothelioma were identified, it's important to note that the small number of cases results in wide confidence intervals around calculated values. However, given the lack of an observed significant increase in the number of cancer cases among the population living in the vicinity of Swift Creek, no further epidemiologic analyses are recommended at this time.

Certification

This Swift Creek sediment_Public Health Consultation_was prepared by the Washington State Department of Health under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). It was completed in accordance with approved methodology and procedures existing at the time the health consultation_was initiated. Editorial review was completed by the Cooperative Agreement partner.

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The Division of Health Assessment and Consultation (DHAC) ATSDR, has reviewed this health consultation and concurs with the findings.

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