Exposure Investigation

Final Report

June 28, 2007

Ambler Gravel Pit

Ambler, Alaska

Exposure Investigations and Site Assessment Branch
Agency for Toxic Substances and Disease Registry

DEPARTMENT OF HEALTH & HUMAN SERVICES · USA

ATSDR

AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

Executive summary

At the request of the Tribal Environmental Department of the Maniilaq Association ATSDR performed an exposure investigation in the City of Ambler, Alaska to determine if riding all terrain vehicles (ATV) on gravel roads lead to significant asbestos exposures for riders and pedestrians along the side of the road. Sampling design and methods included the use of personal air samplers attached to ATV riders while riding 2 ATVs in tandem on a designated section of the airport road. Sampling also included stationary monitors, reference stations, and respirable dust measurements.

The findings indicated:

- Dust levels of health concern
- Asbestos levels of health concern
- ATV riders trailing another ATV are most exposed
- Pedestrians are exposed to asbestos and dust levels of health concern
- Reference sampling indicated airborne asbestos in the community but at a level of risk not likely to be a public health concern
- Asbestos was found in the gravel supplying the roads in Ambler and is suspected of being the major source of road generated asbestos

ATSDR is recommending:

- All access to the gravel pit that supplies road gravel should be closed.
- No gravel from the pit should be used on roads.
- Short-term and long-term solutions to road generated dust and asbestos needs to be developed by appropriate federal, state, city, and tribal governments
- A barrier with clean fill should be put in place where children come into contact with contaminated soil
- Education efforts and material should be developed that target the community and health care workers.

Introduction

Ambler is a city in Northwest Alaska located on the Kobuk River. It is located approximately 40 miles north of the Arctic Circle and 120 miles east of Kotzebue Sound. The 2000 census lists the population as 309. Ambler is located at 67º5'6"N, 157º51'37"W and according to the United States Census Bureau the city has a total area of 10.8 mi^2 (see Figure 1).

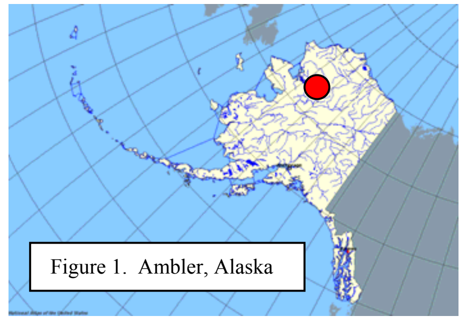


Figure 1. Ambler, Alaska

Francis Chin with the Tribal Environmental Department of the Maniilaq Association originally contacted Richard Kaufmann, Senior Regional Representative, ATSDR Region 10 about asbestos concerns in the City of Ambler, Alaska. Mr. Chin stated in a letter to Mr. Kaufmann that the Maniilaq Association, as the region's health provider, was concerned that the gravel pit that supplies the gravel for the city roads was recently found to contain asbestos. Mr. Chin was particularly concerned about the entrained airborne particulates, including asbestos, arising from roads that are heavily traveled on by "4 wheelers", or 4 wheel all terrain vehicles (ATVs). He was also concerned about funding and indicated that the tribe or City of Ambler had no means to fund a testing project. ATSDR proceeded to contact the Mayor of Ambler and discuss the situation with the city and city council. The city was also primarily concerned with the use of ATVs and the dust they generate in the summer months. Upon review of the data showing the gravel pit contaminated with chrysotile asbestos and review by ATSDR's exposure investigation group, ATSDR agreed to perform a limited exposure investigation of airborne asbestos generated by ATVs driving on contaminated gravel within the City of Ambler.

ATSDR, in collaboration with the EPA's Las Vegas Emergency Response Team designed an activity-based sampling protocol to examine the impact of driving ATVs on roads on the level of asbestos in air. It should be noted:

1) The sampling plan was not designed to examine the extent of contamination within the community or to determine if the soils of yards and public areas contained asbestos.
2) The sampling plan was not intended to determine the "safety" associated with digging and construction activities

for numerous projects within the city (including sewer and water upgrades, lagoon repair, and the building of laundry facilities).

Sampling was performed in a manner to best estimate exposures from air during ATV riding, walking beside the road as an ATV passed, and a one-time reference level in the community. Soil sampling was performed only to determine the presence or absence of asbestos and the extent of contamination and to examine the types and size of fibers that may become airborne.

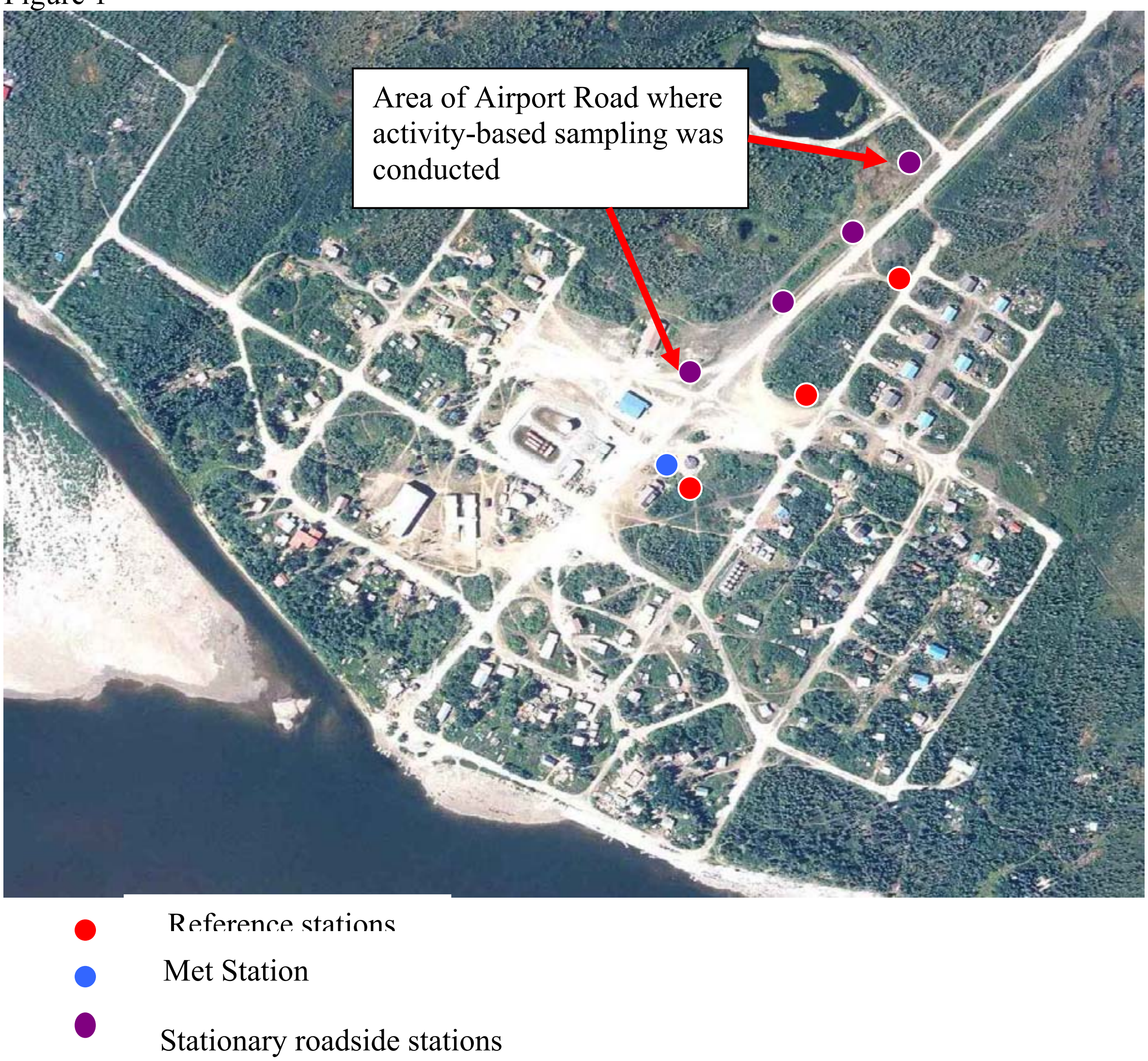
How ATSDR investigated asbestos in Ambler

We designed an investigation that required both air sampling and soil sampling. Air samples are needed to determine the amount of asbestos present in air that can be breathed in by residents of Ambler, and soil samples are needed to determine the extent of asbestos contamination and fiber morphology (size and mineralogy) present for suspension in air.

Air samples	To determine asbestos air levels air samples were collected in three different areas during three different testing periods. The three areas included: 1) ATV riders. Air samples were collected using personal pumps on 2 ATV riders. One rider trailed the other rider during the sampling to be exposed to dust kicked up from the front ATV. Sampling began at the intersection of Redstone Ave and Zane St. and proceeded NW and back for a 2 hour period (see Figure 1). Riders wore personal pumps and air sampling filters; in addition a Data Ram for detecting total particulates was attached to the trailing ATV (see Figure 2); 2) Areas beside the road during ATV riding. Four stationary air monitors were placed at 0, 333, 666, and 1000 meters along the downwind side of the road. These monitors simulated someone walking down the road as ATVs passed by; and 3) Monitors were placed at 4 locations in the community not directly affected by the ATVs on the road. These monitors provided an estimate of exposures in the community and indirect (blowing dust, tracking dust, etc.) exposures from the road. For greater detail on sampling see Appendix F. To determine total respirable dust levels a Data Ram was

	mounted to the trailing ATV and collected continuous readings of PM10 levels during all activity-based sampling.
Soil samples	Soil samples were collected along the route of activity based sampling (ATV riding) and at the school yard. To prevent biasing the sample locations a computer program randomly selected soil samples along the activity-based sampling route. Samples from the school yard play area were selected to cover all major areas of the play area.

Figure 1



How were the samples analyzed?

Soil samples. Soil samples were analyzed using a method being developed at EPA and MVA Scientific Consultants. This method was employed because the method is more sensitive than other methods and because this method leaves longer fibers intact, as opposed to methods like the California's Air Resources Board method 435 that requires grinding the sample. The method, referred to as the "Comprehensive Soil Method" is described in Appendix A.

Air samples - asbestos. Air samples were analyzed using the International Standards Organization method 10312. The method modification to count fibers with aspect ratios ≥ 3:1 was used. This method employs transmission electron microscopy that allows counting of short and thin fibers and captures information about mineralogy and fiber size for each fiber. This is the most sensitive method available and allows ATSDR to examine those fibers that are the most toxic in its analysis.

Air samples – dust. Air samples were collected to measure PM_{10} (particulate matter that has a diameter of 10 µm and less). Testing was performed with a Data-Ram particulate sampler and calibrated to report PM_{10} particulates. The Data Ram was mounted on the trailing ATV in all activity-based sampling events.

Figure 2.
Activity-based sampling on ATVs. Personal monitors are worn by both riders to collect air samples. Data Ram is attached to the rack on the trailing (green) ATV.

Findings

Soil

Eleven composite soil samples were collected. Seven composite samples were collected along the road (21 discrete samples) and 4 composite samples from within the play area at the local school. Soil samples collected on the road were randomly spaced using sampling software to pick the locations (10). Sets of three collection areas were combined to provide a composite sample. A total of 7 composite samples from the road were analyzed and 4 composite samples from the school yard playground. Samples were analyzed using the Comprehensive Soil Method described in Appendix A. All samples showed chrysotile asbestos with aspect ratios indicating the presence of numerous short fibers and very long fibers (see Table 1). Fibers > 5 um in length are the fibers that are counted for risk purposes while even longer fibers are suggested to be the most toxic. Soil samples demonstrate the presence of long fibers in Ambler but do not show their ability to become airborne.

Sample		% asbestos (weight basis)	Aspect ratio	
			Low	High
Road	1	1.3	3:1	750:1
	2	0.5	2.5:1	100:1
	3	0.5	2:1	90:1
	4	0.6	2:1	53:1
	5	0.6	3:1	800:1
	6	0.5	3:1	37.5:1
	7	0.6	2:1	250:1
Play area	1	0.009	2:1	90:1
	2	0.7	9:1	130:1
	3	0.5	2:1	250:1
	4	0.7	4:1	150:1

Table 1 – The 7 sampling locations on the road were randomly generated (see Appendix A). Samples locations in the play area were selected by accessibility and areas where children played. Asbestos in soil was determined by the procedure reported in Appendix A. All values are reported as a percent weight of the total (all fractions combined). Aspect ratios are a measure of a fibers length to width. Very high aspect ratios indicates long thin fibers. Fibers found in Ambler soils ranged from very short to very long.

Soil samples cannot be used to estimate the risk of contracting an asbestos related disease. They are, however, useful in showing the extent of contamination, the type of asbestos present (mineralogy), and with the Comprehensive Soil Method some understanding of the morphology of the asbestos that can become airborne.

Ambler soil data indicate widespread asbestos contamination of chrysotile asbestos containing many long thin fibers.

Air -asbestos

Background measurements – True background measurements would require months of sampling under various meteorological conditions at several locations throughout the city. That was not performed here due to time and cost restraints. We collected samples approximately 100 meters from where activity-based sampling was being performed at three separate locations during each of the three sampling events. ATSDR also collected high volume samples at 5 locations throughout town during one morning when no activity-based sampling was being performed. These samples, from all 4 events, are used here as a surrogate for long-term background studies.

Activity-based sampling – Activity based sampling comprised riding ATVs along a 1000 foot section of road on the edge of town. Air monitoring for asbestos was conducted at stationary monitors along the road and with personal pumps on the riders of the lead and trailing ATV. In addition to asbestos measurements dust measurements (PM_{10}) were made on the trailing ATV.

Stationary monitoring.

These samples were collected along side the road while activity-based sampling on ATVs was being conducted. All samples were collected on the downwind side of the road. These samples would simulate exposures to someone walking along side the road as ATVs passed by. Samplers were stationed at 4 points along the 1000 ft of road; 0, 333, 666, and 1000 ft. The 0 and 1000 ft samplers were at the ATV turn around points.

Stationary samples were largely overloaded with dust preventing asbestos measurements on many of the samples. The average asbestos concentration during ATV riding beside the road was 0.212 f/cc.
This is a conservative estimates (exposure levels may actually be lower) because the value reflects both direct and indirect analysis. It is well documented that indirect analysis can lead to analytical errors (1). Quite often an indirect analysis breaks up asbestos structures and results in reporting higher numbers of fibers than would be seen with the direct analysis. The indirect method is required when filters are overloaded to dilute the material on the fiber so counting can be performed.

Lead ATV sampling – ATV riding proved to be extremely dusty (see discussion on dust). Dust overloaded the majority of samples to the degree that even the indirect method was not possible. Two samples were able to be analyzed. The average of the two samples was 0.051 f/cc for the lead ATV. This seems to be a reasonable value in that the lead rider, and sampling pump, was usually clear of the major plume of dust being generated by the 2 ATVs. One would expect the exposures on the lead ATV to be less than those beside the road (0.212 f/cc) or that of the trailing ATV (too overloaded to count).

Trailing ATV sampling – No samples were able to be evaluated in the trailing ATVs due to severe dust overloading. Based upon personnel observation and the dispersion characteristics of road dust (4) one would expect exposures on a trailing ATV to be much higher than those collected statically along side the same road. Since the stationary samples showed an average asbestos concentration of 0.212 f/cc one would expect the trailing ATV rider to be exposed to >0.212 f/cc

Air – Dust sampling during ATV riding

Dust - Dust levels were tested in Ambler during activity-based sampling and the following day for comparison purposes. [Note: this document refers to the data collected during no activity as either a surrogate background value or a background value. It should not be considered a true background value because determining such would require testing over several months. However, in this case the surrogate value is believed to be a reasonable estimate of background.] Testing was performed with a Data-Ram particulate sampler and calibrated to report PM_{10} particulates (particles that are 10 µm in diameter or less). Results indicated an average particle diameter of 3.8 µm and an average dust level of 5248 $\mu g/m^3$. Testing results are shown in Table 2 below.

Table 2

Date/time	Type of sampling	Average diameter µm	Average air Concentration ($\mu g/m^3$)
Aug 16, 05 / 14:47	Activity-based	3.7	4260
*Aug 17, 05 / 9:07	Activity-based	3.3	43
Aug 17, 05 /12:48	Activity-based	3.9	6235
Aug 18, 05 / 9:32	Background	0.5	376

* The instrument failed 12 minutes into the sampling event. This data point was not used in calculating averages.

Discussion and Conclusions

Dust	Dust from roadways is a major concern in Ambler. Dust is prevalent during most hours of the day as ATVs continuously travel back and forth across the town. Dust is found on surfaces of all public areas and is a major complaint of residents. This investigation includes dust because dust can both cause adverse health effects and exacerbate the health effects caused by other inhaled substances such as asbestos. Exposure to high dust levels can result in a number of complex lung reactions as well as increase the adverse health consequences of exposure to toxic fibrous particulates such as asbestos. High levels of dust can result in "dust overloading" of the lungs leading to a number of lung reactions. Alveolar macrophages play a key role in the clearance of particulates (including fibers) from the lung. Under high dust loads alveolar clearance rates are reduced causing particulates to reach the interstitium. The particulates interact with macrophages releasing factors that can stimulate fibrosis. Particles sequestered by macrophages may also remain in the lungs because of increased half-life of macrophages in the lungs (2,3). Overloading also leads to pulmonary alveolar proteinosis, a disorder of lung surfactant that can be life threatening. Because of the compromised function of the lungs from dust overloading asbestos fibers cannot be cleared as readily and any asbestos exposure is likely to have an increased likelihood of causing disease. The extent of this possible increase in disease is unknown. Average dust exposure while operating ATVs in this investigation showed an average dust concentration of 5,248 $\mu g/m^3$. Estimates by citizens of Ambler (Robinson, personnel communication) indicate that during the long light hours of summer months individuals will ride ATVs up to 8 – 10 hours per day. The National Institute for Occupational Safety and Health (NIOSH) and the American Conference of Governmental Industrial Hygienists (ACGIH) publish exposure guidance values for non-regulated particulates (sometimes referred to as nuisance dusts or "inert" dust). These values are for healthy workers and are not appropriate comparison values for communities where sensitive or susceptible individuals (e.g., elderly, young, people with pre-existing disease, asthmatics) may be exposed. They are included here strictly for comparison to the workplace and as unacceptable community exposure level. The EPA publishes a reference value in the

National Ambient Air Quality Standards (NAAQS) for particulate matter 10 μm in size and below (PM_{10}) that includes more sensitive individuals and is more appropriate for the Ambler community. The NAAQS value listed in Table 3 is for exposures of up to 24 hours in length and that are not to be exceeded more than once per year on average over 3 years. Other agency/institution values are listed in Table 3.

Agency/Corp	TLV /Reference value (mg/m^3)	Ambler – Activity based (mg/m^3)	Ambler – no activity (mg/m^3)
NIOSH	15 total	Only PM10 measured	Only PM10 measured
	5 respirable	Est. 2.6	0.376
ACGIH	10 inhalable	Est. 4.5	
	3 respirable	Est. 2.6	
EPA	0.15 total (PM10)	5.2	0.376

Table 3. Table compares reference values to Ambler activity-based samples and no activity samples. Respirable refers to the size fraction of particles that can reach the gas-exchange region of the lung. Inhalable particles reach upper respiratory tract. In general inhalable (larger particles) are less likely to reach the gas-exchange region of the lung and are therefore less likely to cause a toxic response than respirable particles.

For comparison purposes Ambler levels had to be estimated in some cases to the equivalent reference value level (respirable or inhalable). This was accomplished by using the particle's aerodynamic diameter and the mass percent charts in reference 3.

The dust data indicate that dust levels exceed EPA PM10 recommendations by more than 30 times during ATV riding and are approximately 2 times the recommended level during background activities. Dust levels approach workplace guidelines. Ambler dust levels are considered a public health hazard for the community.

Reference samples	The average asbestos level of all the reference samples ("background" samples) collected during activity-based sampling was 0.007 f/cc (computed as phase contrast microscopy equivalent [PCMe]; fibers ≥ 5 μm in length and >0.25 μm in width. All fibers were chrysotile. The average of the high volume sampling was 0.023 f/cc PCMe.

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Unfortunately, the high volume samples were over loaded with dust and required an indirect analysis of the samples. This may account for the discrepancies between high volume sampling and other background measurements.
To examine the risk associated with breathing background levels an average of all samples was taken. This resulted in a asbestos level of 0.012 f/cc. Assuming snow coverage from October 15 to May 1 and a 24 hour per day exposure during non-snow covered days and a 60 year exposure a resulting risk of 1×10^{-4} would be estimated (See Appendix B). A 60 year exposure is used because the population of Ambler appears to be fairly stable. This is a conservative estimate because it uses the air values from indirect sampling in computing the mean and assumes no time spent indoors, where levels of most environmental contaminants resulting from an exterior source are usually much lower.
</td></tr>
<tr><td>Activity-based scenarios</td><td>
Unfortunately the severe dust conditions caused overloading of the majority of activity-based samples. However, enough samples were able to be analyzed to draw some broad conclusions and calculate risk for several scenarios (see Table 3).
<table>
<tr><th>Scenario</th><th>Activity Level</th><th>Exposure f/cc PCMe</th><th>Integrated Risk Information System (IRIS) Risk</th></tr>
<tr><td>“Background”</td><td></td><td>0.012</td><td>1.1E-03</td></tr>
<tr><td rowspan="2">Lead ATV rider</td><td>High</td><td>0.051</td><td>1.6E-03</td></tr>
<tr><td>Low</td><td>0.051</td><td>3.9E-04</td></tr>
<tr><td rowspan="2">Trailing ATV rider</td><td>High</td><td>>0.212</td><td>>1.2E-03</td></tr>
<tr><td>Low</td><td>>0.212</td><td>>1.2E-03</td></tr>
<tr><td rowspan="2">Walking</td><td>High</td><td>0.212</td><td>1.2E-03</td></tr>
<tr><td>Low</td><td>0.212</td><td>4.0E-04</td></tr>
<tr><td colspan="4">Table 3</td></tr>
</table>
Stationary monitoring
These monitors were placed beside the road to monitor exposures to an individual walking beside the road. The monitors were placed downwind to simulate a worse case. Two walking scenarios (1/2 hour walking/day and 1.5 hours walking/day) were computed. ATSDR noted many people walking in the Ambler community and people walking as far as the airport (approximately 1.5 miles). At the time of the visit there was a gasoline shortage so it is unknown if these walking
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patterns were typical of days when gasoline is not in short supply. The values used here represent the low end of walking durations but assume that not all time spent walking is spent in the dust plume of an ATV.

Walking for 1.5 hours per day represents an increased risk of developing asbestos induced lung cancer/mesothelioma of 1.2 x 10^{-03} (or 1.2 in 1000). Walking ½ hour per day results in an increased risk of 4.0 x 10-^{04} (4 in 10,000).

Both of these scenarios exceed the EPA's risk range that is commonly thought of as an acceptable range of risk to the community (1 x10^{-04} to 1 x 10^{-06}; or 1 in 10,000 to 1 in 1,000,000).

Lead ATV riders

Lead ATV riders were exposed to an average of 0.051 f/cc. A rider exposed to this asbestos level for 8 hours a day, 168 days/year, for 60 years would have an additional risk for developing mesothelioma and lung cancer of 1.6 x 10^{-03} (or 1.6 in 1000). A rider who only rides 2 hours per day would have a risk of 3.9 x 10^{-04} (or 3.9 in 10,000).

Both of these scenarios exceed the EPA's risk range that is commonly thought of as an acceptable range of risk to the community (1E -04 to 1E-06; or 1 in 10,000 to 1 in 1,000,000).

Trailing ATV riders

Because of dust overloading on filters no samples could be analyzed for trailing ATV riders. Trailing ATV rider exposure should exceed both lead rider levels and stationary monitors (dust/asbestos disperses from the riders as it moved toward the stationary monitors). Lead riders would be expected to have less exposure to dust/asbestos than the stationary monitors because for the most part the lead rider is constantly moving into less dusty air (one exception is the two turnaround points at both ends of the course). Trailing ATV riders would be expected to exceed the stationary monitoring risk of 1.2 x 10^{-03} (1.2 in 1000) because the trailing ATV rider spent more time in the dust plume and because the dust concentration is the highest directly over the road (4).

Trailing ATV riders are most likely the highest exposed of all the activity-based sampling scenarios. Accurate levels of exposure could not be determined but are considered a public health concern.

Smoking	Many researchers have examined the effects of smoking on the development of asbestos-related disease; particularly bronchogenic carcinomas also known as lung cancer. Hammond et al. (5) performed a study in which age-standardized mortality ratios were examined. The mortality ratio for nonsmoking asbestos workers is approximately 5. The ratio for smokers not exposed to asbestos is approximately 11. This means nonsmoking asbestos workers have 5 times the rate of lung cancer that workers not exposed to asbestos have; and smokers have 11 times the rate of lung cancer as nonsmokers. When Hammond's group examined workers that both smoked and were exposed to asbestos they found a 53 fold increase in lung cancer. This is much greater than would have been predicted by simply adding the two rates together. Several other researchers have found similar effects but not to this magnitude (6,7,8). The large increase in cancer when asbestos exposure and smoking are combined indicates something important is occurring physiologically. There are many theories as to why this is happening. Perhaps one of the more compelling explanations is that smoking stops or slows clearance of asbestos fibers from the lung. This is particularly important to the community of Ambler for a couple of reasons. • Many of the villages in the Ambler area have very high smoking rates, some as high as 50% (9). The rate of smoking in Ambler is not known but personal observation suggests it is much higher than in the U.S. general population. • Dust overloading of the lungs can also decrease clearance and thus could also exacerbate asbestos effects. It has been shown earlier that Ambler has high dust levels in the village's air.

Recommendations

- The gravel from the Ambler gravel pit at the end of the airport road should not be used for road gravel or in any manner that leaves it exposed to the air (buried or in a solid matrix where exposure to asbestos/dust is eliminated may be acceptable).
- The gravel pit should be marked as a hazard and trespassing prevented. A marked barrier at the end of the road would be minimally acceptable.
- A short-term solution for asbestos/dust suppression from the road needs to be implemented. Frequent watering is a possibility for a short-term solution. A good water supply is available, the Kobuk River. Unfortunately the proper watering equipment was not available to the city and is expensive. There may be some ability to modify existing equipment to provide a viable short-term solution. There are other dust suppression technologies that should be explored through engineering consultants.
- A long-term solution to asbestos/dust suppression needs to be developed. This will require the cooperation of many state, local, and tribal governments and engineering groups to devise a solution.
- The school yard needs to have a barrier applied and asbestos free material placed on top of the barrier
- Education material should be provided to the community about asbestos and its health effects. Along with this material education on the importance of proper cleaning of homes for dust/asbestos control needs to be provided to the community. The importance of smoking cessation needs to be a central message to the community.
- ATSDR should, in cooperation with local health care (the Maniilaq Association) devise an health care provider education program that includes reference materials, education materials, and if needed, presentations by ATSDR physicians. Information on the adverse synergistic effects of smoking and asbestos in the development of lung cancer should be provided to the community along with materials and information on how to stop smoking.

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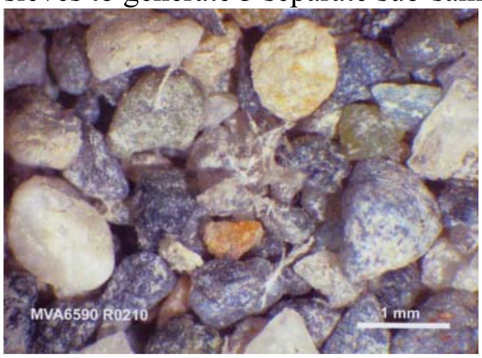
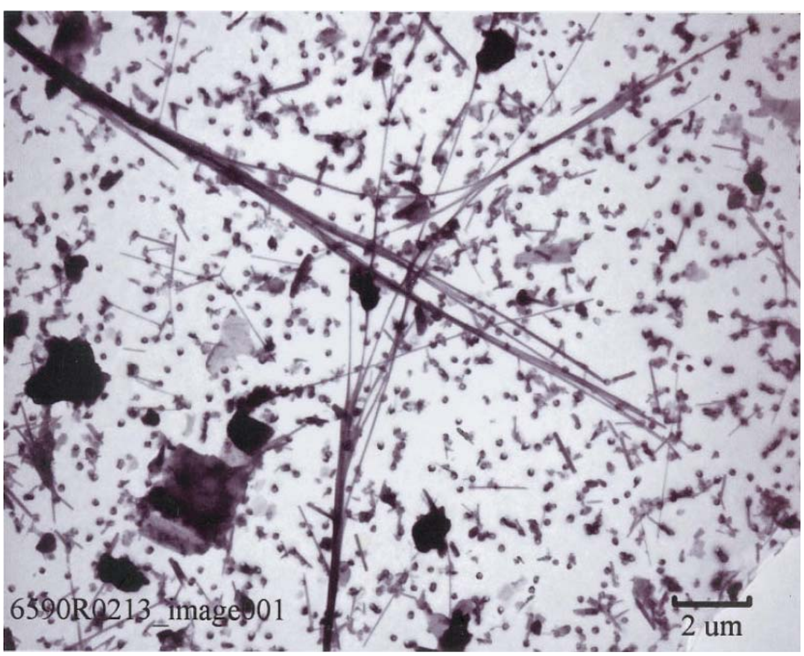
Appendix A --- Comprehensive Soil Method and Random Sampling Points.

A new method that combines the preparation procedure of wet sieving used in an EPA Region 1 method with polarized light microscopy (PLM) and transmission electron microscopy (TEM) from other soil methods is being developed between Region 8 EPA and MVA scientific consultants. The method involves sieving with 1 mm and 300 µm sieves to generate 3 separate sub-samples for analysis. The coarse fraction (>1 mm) is analyzed by stereomicroscopy and PLM. The intermediate fraction (1 mm to 300 µm) is analyzed by PLM. The TEM analysis usually only occurs if no asbestos is detected by PLM in the 3 fractions. The Comprehensive Soil Method has been tested and shown to be sensitive at levels of asbestos in soils below 0.1%. Information about fiber aspect ratio and size is collected during the PLM and TEM analysis. The results of the analyses of the individual fractions are combined to form one result per sample by weighting the results for each fraction based on the proportion of weight of each fraction. For example, a hypothetical sample with a total weight of 6 grams that has results of: Coarse fraction – 2% in 2 grams, Intermediate fraction of 4% in 3 grams and Fine fraction of 1% in 1 gram would yield a weighted average asbestos percentage of 2.8% ((2x2 + 4x3 + 1x1)/6).

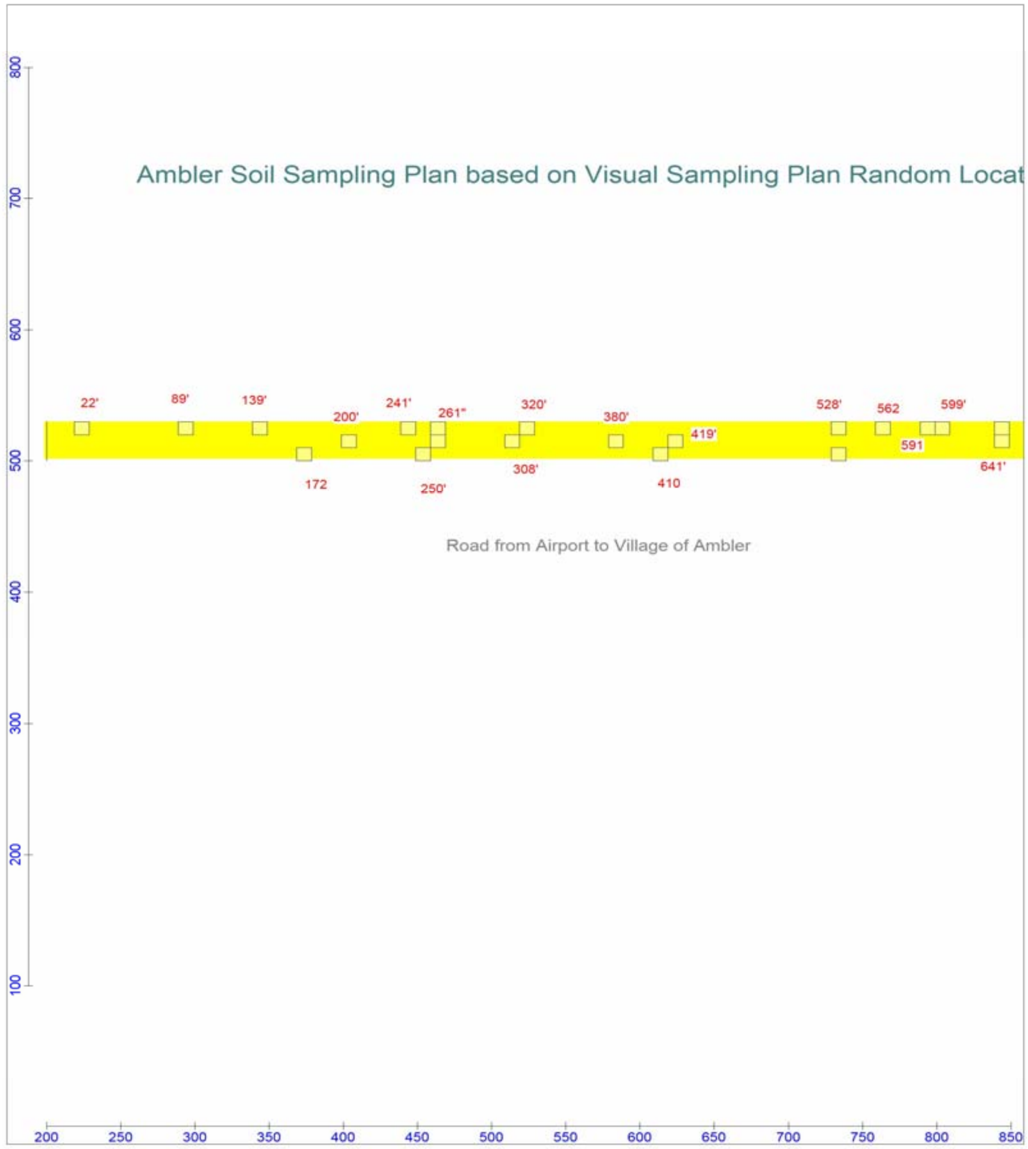


ATSDR selected this method because it:

1) has a low detection level
2) leaves long fibers generally intact (especially compared to CARB 435)
3) gives some idea of the size distribution in the sample



TEM image of chrysotile in the fine fraction of Ambler soil.



Random sampling of soils from the airport road was performed along the activity-based sampling route. Random points were selected using Visual Sampling Plan software (10). Sampling points are represented by squares.

Appendix B – Assumptions and calculations

Assumptions and calculations.

Because ATSDR was asked "what is the risk of being exposed to asbestos from riding ATVs in Ambler?" we looked at this one scenario along with limited surrogate background data. These calculations do not consider the added risk of performing other tasks in Ambler such as digging up streets for projects, working outdoors, playing at the school, etc.

Assumptions			Reference
Unit Risk for lifetime exposure	0.23cc/f		1
Number of days/year with no snow cover	168		2
Number of hours /day riding ATV	High	8	3
	Low	2	
Number of hours/day walking on road	High	1.5	4
	Low	.5	
Number hours/day exposed to background	24 – (event duration)		
Number of years spent in Ambler	60		5

1. From EPA IRIS file. Represents the combined risk of getting lung cancer and mesothelioma from a lifetime (70 years- 24 hours/day) exposure. Less than lifetime exposures are estimated here and adjusted to a lifetime exposure. Technically a unit risk should be calculated for each exposure period because of the models used to calculate the lifetime unit risk. Since that was not possible using the IRIS database less than lifetime exposures are estimates.
2. Interviews with citizens of Ambler suggested snow cover in Ambler from October to mid-May. However some citizens noted that in recent years the weather has warmed and snow cover does not occur for as long a period of time. This observation would be consistent with meteorological data. Therefore the assumption used here assumes snow cover from mid-October until the first of May or 168 days of no snow cover per year.
3. Interviews with citizens of Ambler suggested that in summer months of no snow and long days some individuals would ride ATVs up to 8 hours/day. This was not observed while ATSDR was in Ambler, but the city had a gasoline shortage. A low estimate of exposure was 2 hours/day with the mean expected to be closer to the low estimate.
4. This was based on observation and the distance to the dump, cemetery and airport. Several people were observed walking in Ambler.
5. The population of Ambler was considered extremely stable with most people spending the majority of their lives in Ambler. The effects of immigration and emigration on asbestos risk were not included here.

Risks were calculated using the following equation:

$$Risk_{lung\_cancer\&meso} = [asbestos\frac{f}{cc}] * (unit\_risk) * (duration_{adjusted})$$

where:

$[asbestos\frac{f}{cc}] =$ The average concentration of PCMe asbestos fibers in air reported as fibers per cubic centimeter. PCMe is defined as particles that have an aspect ratio $\geq$ 3:1, > 5 µm in length, and > 0.25 µm in width.

(unit_risk) = risk for a continuous lifetime exposure to asbestos as reported in the EPA IRIS file. www.epa.gov/iris Unit risk = 0.23 per f/cc

$$duration_{adjusted} = \frac{hrs}{day} * \frac{day}{24hrs} * \frac{days}{yr} * \frac{yr}{365days} * \frac{yrs\_in\_ambler}{70yr\_life}$$

Appendix C --- General Asbestos Information

Asbestos and asbestos-related health effects

Asbestos is a general name applied to a group of silicate minerals consisting of thin, separable fibers in substantially parallel sides. Asbestos minerals fall into two groups, serpentine and amphibole. Serpentine asbestos has relatively long and flexible crystalline fibers; this class includes chrysotile, the predominant type of asbestos used commercially. Fibrous amphibole minerals are brittle and have a rod- or needle-like shape. Amphibole minerals regulated as asbestos by OSHA include five classes: crocidolite, amosite, and the fibrous forms of tremolite, actinolite, and anthophyllite. Other unregulated amphibole minerals, including winchite, richterite, and others, can also exhibit fibrous asbestiform properties (11).

Asbestos fibers do not have any detectable odor or taste. They do not dissolve in water or evaporate into the air, although individual asbestos fibers can easily be suspended in the air. Asbestos fibers do not move through soil. They are resistant to heat, fire, and chemical and biological degradation. As such, they can remain virtually unchanged in the environment over long periods of time.

The following sections provide an overview of several concepts relevant to the evaluation of asbestos exposure, including analytical techniques, toxicity and health effects, and the current regulations concerning asbestos in the environment.

Methods for Measuring Asbestos Content

A number of different analytical methods are used to evaluate asbestos content in air, soil, and other bulk materials. Each method varies in its ability to measure fiber characteristics such as length, width, and mineral type. For air samples, fiber quantification is traditionally done through phase contrast microscopy (PCM) by counting fibers with lengths greater than 5 micrometers (>5 µm) and with an aspect ratio (length to width) greater than 3:1. This is the standard method by which regulatory limits were developed. Disadvantages of this method include the inability to detect fibers less than 0.25 (<0.25) µm in diameter and the inability to distinguish between asbestos and nonasbestos fibers.

Asbestos content in soil and bulk material samples is commonly determined using polarized light microscopy (PLM), a method which uses polarized light to compare refractive indices of minerals and can distinguish between asbestos and nonasbestos fibers and between different types of asbestos. The PLM method can detect fibers with lengths greater than approximately 1 µm (~1 µm), widths greater than ~0.25 µm, and aspect ratios (length-to-width ratios) greater than 3. Detection limits for PLM methods are typically 0.25%–1% asbestos.

Scanning electron microscopy (SEM) and, more commonly, transmission electron microscopy (TEM) are more sensitive methods that can detect smaller fibers than light microscopic techniques. TEM allows the use of electron diffraction and energy-dispersive x-ray methods, which give information on crystal structure and elemental composition, respectively. This information can be used to determine the elemental composition of the visualized fibers. SEM does not allow measurement of electron diffraction patterns. One disadvantage of electron microscopic methods is that determining asbestos concentration in soil and other bulk material is difficult (11).

For risk assessment purposes, TEM measurements are sometimes multiplied by conversion factors to give PCM equivalent fiber concentrations. The correlation between PCM fiber counts and TEM mass measurements is very poor. A conversion between TEM mass and PCM fiber count of 30 micrograms per cubic meter per fiber per cubic centimeter (µg/m3)/(f/cc) was adopted as a conversion factor, but this value is highly uncertain because it represents an average of conversions ranging from 5 to 150 (µg/m3)/(f/cc) (12). The correlation between PCM fiber counts and TEM fiber counts is also very uncertain, and no generally applicable conversion factor exists for these two measurements (12). Generally, a combination of PCM and TEM is used to describe the fiber population in a particular air sample.

Asbestos Health Effects and Toxicity

Breathing any type of asbestos increases the risk of the following health effects:

Malignant mesothelioma— cancer of the membrane (pleura) that encases the lungs and lines the chest cavity. This cancer can spread to tissues surrounding the lungs or other organs. The great majority of mesothelioma cases are attributable to asbestos exposure (11).

Lung cancer—cancer of the lung tissue, also known as bronchogenic carcinoma. The exact mechanism relating asbestos exposure with lung cancer is not completely understood. The combination of tobacco smoking and asbestos exposure greatly increases the risk of developing lung cancer (11).

Noncancer effects—these include asbestosis, scarring, and reduced lung function caused by asbestos fibers lodged in the lung; pleural plaques, localized or diffuse areas of thickening of the pleura (lining of the lung); pleural thickening, extensive thickening of the pleura which may restrict breathing; pleural calcification, calcium deposition on pleural areas thickened from chronic inflammation and scarring; and pleural effusions, fluid buildup in the pleural space between the lungs and the chest cavity (11).

Not enough evidence is available to determine whether inhalation of asbestos increases the risk of cancers at sites other than the lungs, pleura, and abdominal cavity (11).

Ingestion of asbestos causes little or no risk of non-cancer effects. However, some evidence indicates that acute oral exposure might induce precursor lesions of colon cancer and that chronic oral exposure might lead to an increased risk of gastrointestinal tumors (11).

ATSDR considers the inhalation route of exposure to be the most significant in the current evaluation. Exposure scenarios that are protective of the inhalation route of exposure should be protective of dermal and oral exposures.

The scientific community generally accepts the correlations of asbestos toxicity with fiber length as well as fiber mineralogy. Fiber length may play an important role in clearance and mineralogy may affect both biopersistence and surface chemistry. ATSDR, responding to concerns about asbestos fiber toxicity from the World Trade Center disaster, held an expert panel meeting to review fiber size and its role in fiber toxicity in December 2002 (13). The panel concluded that fiber length plays an important role in toxicity. Fibers with lengths <5 µm are essentially non-toxic in terms of association with mesothelioma or lung cancer promotion. However, fibers <5 µm in length may play a role in asbestosis when exposure duration is long and fiber concentrations are high. More information is needed to definitively reach this conclusion.

In accordance with these concepts, it has been suggested that amphibole asbestos is more toxic than chrysotile asbestos, mainly because physical differences allow chrysotile to break down and to be cleared from the lung, whereas amphibole is not removed and builds up to high levels in lung tissue (14). Some researchers believe the resulting increased duration of exposure to amphibole asbestos significantly increases the risk of mesothelioma and, to a lesser extent, asbestosis and lung cancer (14). However, OSHA continues to regulate chrysotile and amphibole asbestos as one substance, as both types increase the risk of disease (15). Currently, EPA's Integrated Risk Information System (IRIS) assessment of asbestos also currently treats mineralogy (and fiber length) as equipotent (12).

Evidence suggesting that the different types of asbestos fibers vary in carcinogenic potency and site specificity is limited by the lack of information on fiber exposure by mineral type. Other data indicate that differences in fiber size distribution and other process differences can contribute at least as much as fiber type to the observed variation in risk (16).

Counting fibers using the regulatory definitions (see below) does not adequately describe risk of health effects. Fiber size, shape, and composition contribute collectively to risks in ways that are still being elucidated. For example, shorter fibers appear to deposit preferentially in the deep lung, but longer fibers may disproportionately increase the risk of mesothelioma (11,16). Some of the unregulated amphibole minerals, such as the winchite (from Libby, MT), can exhibit asbestiform characteristics and contribute to risk. Fiber diameters greater than 2–5 µm are considered above the upper limit of respirability and thus do not contribute significantly to risk. Methods are being developed to assess the risks posed by varying types of asbestos and are currently awaiting peer review (16).

Current Standards, Regulations, and Recommendations for Asbestos

In industrial applications, asbestos-containing materials are defined as any material with >1% bulk concentration of asbestos (11,17,18). It is important to note that 1% is not a health-based level, but instead represents the practical detection limit in the 1970s when OSHA regulations were created. Studies have shown that disturbing soil containing <1% amphibole asbestos, however, can suspend fibers at levels of health concern (19). Friable asbestos (asbestos which is crumbly and can be broken down to suspendible fibers) is listed as a hazardous air pollutant on EPA's Toxic Release Inventory (20). This classification requires companies that release friable asbestos at concentrations >0.1% to report the release under Section 313 of the Emergency Planning and Community Right-to-Know Act.

OSHA's permissible exposure limit (PEL) is 0.1 f/cc for asbestos fibers with lengths >5 µm and with an aspect ratio (length:width) >3:1, as determined by PCM (15). This value represents a time-weighted average (TWA) exposure level based on 8 hours per day for a

40-hour work week. In addition, OSHA has defined an "excursion limit," which stipulates that no worker should be exposed in excess of 1 f/cc as averaged over a sampling period of 30 minutes (15). Historically, the OSHA PEL has steadily decreased from an initial standard of 12 f/cc established in 1971. The PEL levels prior to 1983 were determined on the basis of empirical worker health observations, while the levels set from 1983 forward employed some form of quantitative risk assessment. ATSDR does not, however, support using the PEL for evaluating exposure for community members, because the PEL was developed as an occupational exposure for adult workers.

In response to the World Trade Center disaster in 2001 and an immediate concern about asbestos levels in buildings in the area, the Department of Health and Human Services, EPA, and the Department of Labor formed the Environmental Assessment Working Group. This work group was made up of ATSDR, EPA, CDC's National Center for Environmental Health, the National Institute for Occupational Safety and Health (NIOSH), the New York City Department of Health and Mental Hygiene, the New York State Department of Health, OSHA, and other state, local, and private entities. The work group set a re-occupation level of 0.01 f/cc after cleanup. Continued monitoring was also recommended to limit long-term exposure at this level (21). In 2002, a multiagency task force headed by EPA was formed specifically to evaluate indoor environments for the presence of contaminants that might pose long-term health risks to residents in Lower Manhattan. The task force, which included staff from ATSDR, developed a health-based benchmark of 0.0009 f/cc for indoor air. This benchmark was developed to be protective under long-term exposure scenarios, and it is based on risk-based criteria that include conservative exposure assumptions and the current EPA cancer slope factor. The 0.0009 f/cc benchmark for indoor air was formulated on the basis of chrysotile fibers and is therefore most appropriately applied to airborne chrysotile fibers (22).

NIOSH has set a recommended exposure limit of 0.1 f/cc for asbestos fibers longer than 5 μm. This limit is a TWA for up to a 10-hour workday in a 40-hour work week (23). The American Conference of Government Industrial Hygienists has also adopted a TWA of 0.1 f/cc as its Threshold Limit Value ® (24).

EPA has set a maximum contaminant level (MCL) for asbestos fibers in water of 7,000,000 fibers longer than 10 μm per liter, on the basis of an increased risk of developing benign intestinal polyps (25). Many states use the same value as a human health water quality standard for surface water and groundwater.

Asbestos is a known human carcinogen. Historically, EPA's IRIS model calculated an inhalation unit risk for cancer (cancer slope factor) of 0.23 per f/cc of asbestos (12). This value estimates additive risk of lung cancer and mesothelioma using a relative risk model for lung cancer and an absolute risk model for mesothelioma.

This quantitative risk model has significant limitations. First, the unit risks were based on measurements with phase contrast microscopy and therefore cannot be applied directly to measurements made with other analytical techniques. Second, the unit risk should not be used if the air concentration exceeds 0.04 f/cc because the slope factor above this concentration might differ from that stated (12). Perhaps the most significant limitation is that the model does not consider mineralogy, fiber-size distribution, or other physical aspects of asbestos toxicity. EPA is in the process of updating their asbestos quantitative risk methodology given the limitations of the IRIS model currently used and the knowledge gained since this model was implemented in 1986.

Appendix D - Example of dust data collected with the DataRAM 4

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 "Tag Number  ", 1
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 "Start Date  ", 16-Aug-2005
 "Log Period  ", 00:02:00
 "Number      ", 61
 "CalFactor   ", 1.000000
 "Unit        ", 0
 "Unit Name   ", "(MASS )ug/m3"
 "SIZE_CORRECT", "DISABLED"
 "TEMPUNITS   ", C
 "Max MASS    ", 8194.029000
 "Max MASS  @ ", 36  ,15:59:30  ,16-Aug-2005
 "Avg MASS    ", 4259.632000
 "Max Diam    ", 4.127006
 "Max Diam @  ", 6  ,14:59:30  ,16-Aug-2005
 "Avg Diam    ", 3.730545
 "ALARM       ", "DISABLED"
 "ALARM_LEVEL ", 0.0
 "AUTO_ZERO   ", "DISABLED"
 "AZ INTERVAL ", 1
 "Errors      ", 0000
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     1,     115.7,  27.1,   44,   0.2447  ,14:49:30  ,16-Aug-2005
     2,      15.7,  27.1,   42,   0.1438  ,14:51:30  ,16-Aug-2005
     3,     260.2,  27.2,   42,   0.4221  ,14:53:30  ,16-Aug-2005
     4,     651.3,  27.4,   41,   1.3660  ,14:55:30  ,16-Aug-2005
     5,    2748.4,  27.5,   41,   4.0408  ,14:57:30  ,16-Aug-2005
     6,    2632.7,  27.5,   41,   4.1270  ,14:59:30  ,16-Aug-2005
     7,    1293.2,  27.5,   40,   2.6439  ,15:01:30  ,16-Aug-2005
     8,      75.4,  27.5,   40,   0.4067  ,15:03:30  ,16-Aug-2005
     9,    2523.9,  27.5,   40,   3.0901  ,15:05:30  ,16-Aug-2005
    10,    2317.9,  27.5,   39,   3.3550  ,15:07:30  ,16-Aug-2005
    11,    3151.3,  27.5,   39,   4.1270  ,15:09:30  ,16-Aug-2005
    12,    3933.2,  27.5,   39,   4.1270  ,15:11:30  ,16-Aug-2005
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    14,    4529.3,  27.4,   38,   4.1270  ,15:15:30  ,16-Aug-2005
    15,    4562.6,  27.3,   39,   4.1270  ,15:17:30  ,16-Aug-2005
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42,	5905.2,	27.6,	38,	4.1270	,16:11:30	,16-Aug-2005
43,	6376.9,	27.6,	39,	4.1270	,16:13:30	,16-Aug-2005
44,	5327.2,	27.6,	39,	4.1270	,16:15:30	,16-Aug-2005
45,	3162.2,	27.6,	39,	4.1270	,16:17:30	,16-Aug-2005
46,	5025.4,	27.6,	39,	4.1270	,16:19:30	,16-Aug-2005
47,	5882.5,	27.6,	39,	4.1270	,16:21:30	,16-Aug-2005
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51,	3363.2,	27.7,	39,	4.1141	,16:29:30	,16-Aug-2005
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57,	3931.8,	27.9,	39,	4.1270	,16:41:30	,16-Aug-2005
58,	3709.9,	27.9,	39,	4.1270	,16:43:30	,16-Aug-2005
59,	4905.4,	27.9,	39,	4.1270	,16:45:30	,16-Aug-2005
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61,	7417.7,	27.9,	39,	4.1270	,16:49:30	,16-Aug-2005

APPENDIX E – Exposure Investigation Protocol

Exposure Investigation Protocol for
Ambler, AK

July, 2005

A02F

Prepared by

John Wheeler, ATSDR
Richard Robinson, ATSDR

Table of Contents

I. PROJECT OVERVIEW

i. Summary

The Maniilaq Association contacted ATSDR's Region 10 office "concerned as to the level of safety to the health of the population in the service area" from exposure to naturally occurring asbestos. Asbestos (chrysotile) has been identified in a local rock quarry. This quarry has been the source of gravel in Ambler in a number of projects including surfacing of all the roads. We know from the Diamond XX study and the California Air Resources Board's "Slodusty Road" study that asbestos on roads can be a substantial source of airborne asbestos. Three hundred eleven people live in Ambler, AK.

It is unknown what the level of exposure to asbestos is in the community. The primary means of transportation is by 4-wheelers which readily stir up road surface dust/asbestos as they travel over it. Also the gravel has been used for the "pads" that homes sit upon (in a permafrost area homes are not built on foundations but sit on post and gravel pads). We plan on having the sampling performed by EPA's ERT in which they will simulate actual activities to collect both personal samples and stationary samples. This type of sampling, activity-based, provides us a unique opportunity to determine realistic exposure levels. It should be noted that ATSDR and ERT have cooperated in the past for these types of studies (e.g., Quincy Mine, Michigan) and this study will be similar to that sampling. ATSDR will also be collecting data on weather, including snow loads, and road use patterns to better estimate exposure periods.

The impact will be upon the decision making ability of both ATSDR and the Maniilaq Association. Depending upon the outcome of the study ATSDR can make recommendations and provide education to limit exposure (water roads, HEPA vacs, education about dust suppression, etc.). Local government and residents can take action upon those recommendations and explore unique means by which to educate people and eliminate exposures. If an acceptable risk is found residents can be assured as to the safety of their environment.

ii. Investigators and collaborators

Agency for Toxic Substances and Disease Registry

Division of Health Assessment and Consultation, Exposure Investigation Section

John Wheeler	Will be providing educational material to community members and officials. Will be investigating the site for health consultation. Will be investigating climate and other factors that may affect exposure. EICB will fund the ISO-10312 asbestos analysis at Lab Cor in Seattle, WA

Division of Health Assessment and Consultation, Exposure Investigation Section
Richard Robinson Regional lead. Site activity coordination. Obtains local equipment (ATVs).

US Environmental Protection Agency

Emergency Response Team
Brian Brass In charge of all sampling.

Emergency Response Team
To be determined Sampling personnel that will ride ATVs and participate in activity-based sampling.

II. INTRODUCTION

i. Background

The Ambler Naturally Occurring Asbestos Site (site) is located in Ambler Alaska on the north bank of the Kobuk River, near the confluence of the Ambler and Kobuk Rivers. It lies 45 miles north of the Arctic Circle and is 138 miles northeast of Kotzebue, 30 miles northwest of Kobuk and 30 miles downriver from Shungnak. The area encompasses 9.5 square miles of land. Temperatures average –10 to 15 degrees Fahrenheit during the winter and 40 to 65 degrees during the summer. Snowfall averages 80 inches and precipitation is 16 inches total per year. The population is 274 with 89 students enrolled in the village school. The residents are Kowagniut Inupiat Eskimos with a traditional subsistence lifestyle.

August 3, 2003 – Alaska Department of Transportation (ADOT) collected three soil samples at the gravel pit. Results reported on October 3, 2003, indicated 1%, 2% and 10% Chrysotile.

November 3, 2003 – Alaska Occupational Safety and Health collected soil samples and wipe samples at the school as part of a limited health survey for the school construction employees. Asbestos was detected under the school building in gravel laid down from the gravel pit, original soil was non detect for asbestos, trace amounts were found in exterior gravel located in a pile prepared for the school's playground, and from the road. Asbestos fibers were detected inside the building. An air sample collected in a hallway next to the main entry way had 0.01 fibers of asbestos/cc (OSHA standard is 0.1 fibers/cc). It is unknown if this sample was analyzed by TEM or PCM and if it represents only 1 sample. Wipe collected for positive or negative testing from two different windowsills had asbestos fibers.

June 2, 2004 – The Alaska Native Tribal Health Consortium (ANTHC) collected discrete soil samples from the water treatment pad, lift station pad and gravel stockpile. Results were 2-5% chrysotile from fines only from gravel and 1.24-1.99% chrysotile from the gravel.

August 19, 2004 – ANTHC re-sampled the water treatment pad (1.7%), lift station pad (5%), washeteria pad (0.75%) and the gravel stockpile and from the borrow pit (1.46%).

August – September 2004 – Alaska Department of Environmental Conservation (ADEC) collected air samples for 8 weeks every 3 days for 24 hours during these months. The highest dust samples (3 filters) were analyzed for asbestos. None were detected. One sample was collected from the playground, which contained 12 inches of loam. Asbestos was detected, but not quantified. ATSDR is currently unaware of the type of sampling that was performed by ADEC, but we are trying to obtain that information from the data source.

May 20, 2005 – Alaska Division of Public Health (ADPH) conducted a Public Health Evaluation and Assessment and performed a medical records search to determine if any asbestos-related diseases have ever been identified in residents of Ambler, Kobuk, Shungnak, and Kiana. They reviewed all death certificates from 1980 to the present to see if there were any residents of Maniilaq villages who had died from an asbestos-related diagnosis. There were no residents with any asbestos-related diagnoses on the death certificate. A review of the State Cancer Registry and the Alaska Native Tumor Registry to see if there were any asbestos-related cancers that had been diagnosed and reported from any residents of Ambler, Kobuk, Shungnak, and Kiana. There were no residents who had been diagnosed with mesothelioma from any of these villages dating back to 1970. There were no reported cases of lung cancer from Ambler, Kobuk, or Shungnak dating back to 1970. There were five reported cases of lung cancer, all from the village of Kiana. These five cases occurred from 1984 to 2003, and they included four different cell types of lung cancer.

ADPH also reviewed computerized medical records in the RPMS medical record system. There were no residents of the four villages who ever had been diagnosed with any asbestos-related disease. Existing chest x-rays were reviewed from 128 residents from the four villages who were 50 years and older – 28 of these residents were from Ambler. Because of the past epidemics of tuberculosis and other common pulmonary diseases, there were many abnormalities. Of the 28 residents of Ambler whose chest x-rays were reviewed, two had pleural changes that were probably caused by prior exposure to asbestos. Of the 100 residents of Kobuk, Shungnak, and Kiana whose chest x-rays were reviewed, seven had pleural changes that might have been caused by prior exposure to asbestos. The asbestos-related changes were in the form of pleural plaques, and their appearance suggests that they were due to asbestos exposure many years ago, possibly due to occupational exposure. After receiving the information from reading the chest x-rays, a medical epidemiologist from the Section of Epidemiology visited Maniilaq, reviewed all available medical records, and with the help of a local interpreter, interviewed the patients who were still living and who agreed to be interviewed. Several of the residents described past employment working in mines. Many of the residents worked in mining many years ago, and they were unable to provide detailed information that would enable specific characterization of exposure to asbestos. Of the 9 people with pleural plaques suspicious for asbestos exposure, 1 recalled working in asbestos mine, 1 worked with asbestos as a construction worker, 1 was repeatedly exposed to high levels of mine dust while washing her husband's clothing, 1 refused interview, 2 had other medical conditions not-related to asbestos that definitively explained the x-ray findings, and the results for the remaining 3 were inconclusive because they had non-asbestos related lung diseases but these diseases did not definitively account for the x-ray changes. There are no medical tests to determine the amount of asbestos a person has been exposed to during their lifetime. There are no medical tests that are uniquely specific to identifying asbestos-related disease, but general clinical tests of lung function and chest x-rays are used to diagnose the disease and its impact. It is particularly difficult to identify mild cases.

In response to these results, ATSDR and U.S. EPA are undertaking this project to determine the potential risk to road user.

ii. Justification for the exposure investigation

Two major studies; 1) Slodusty Road by the California Air Resources Board and 2) The Diamond XX study in California have concluded that serpentine materials used for road gravel, when contaminated with asbestos, can lead to significant risk levels for people exposed beside the road and occupants in vehicles on the road. The gravel used for Ambler roads has been shown to contain up to 10% asbestos. The EI is needed to collect basic information concerning road conditions in Ambler and to determine if exposures can be occurring.

iii. Objectives

1) Meet with residents and community leaders to discuss asbestos issues.
2) Obtain activity based samples of road dust to determine if exposure is occurring and at what level.
3) Learn about activity patterns, life style, and weather patterns to help assess exposure.

III. METHODS

i. Exposure investigation design

Perimeter Air Sampling

Air sampling will be conducted at fixed locations proximal to where the activities are being conducted. For the purpose of this Sampling and Analytical Plan, these fixed locations will be referred to as perimeter samples because they are being collected on the perimeter of the activities.

Site background/reference and perimeter samples will be collected concurrently with the ATV sampling. Up to five perimeter samples will be collected during ATV activities based on meteorological data.

Background Air Sampling

Background or reference samples will be collected to develop a reference point from which to evaluate the activity-based sampling. For Asbestos, a high volume (1-20L/m) air sampler will be used to collect in excess of 4,000 liters and achieve a detection limit below that of the personal air samplers. Three background samples will be collected for each activity-based sampling event. Background sampling locations will be selected once the team arrives at the site.

Activity-Based Air Sampling

For all activity-based sampling events, asbestos samples will be collected from the breathing zones of the event participants at two distinct flow rates, a high flow of approximately 9 liters per minute (L/min) for approximately two hours for a target volume of 1080 liters (L) and a low volume sample of approximately 3.5 L/min for a volume of 420 L. Using these sample collection parameters will provide a sensitivity limit of less than or equal to 0.0033 f/cc.

Real-time dust measurements will be collected with a dust monitor (DataRam or similar unit) carried by an ATV. Results from dust monitoring will be retained for possible use in dust emissions modeling.

The National Oceanic and Atmospheric Administration (NOAA) meteorological weather station located in Ambler, Alaska will be employed to measure wind speed, wind direction, relative humidity, temperature, and barometric pressure, proximal to the activities.

- The ATV scenario is described below:

  - 2.2.3.1 Two ATVs
  -

  Two event participants will ride ATVs back and forth along a portion of the road at the same time until a sufficient volume of air has been collected to achieve the required detection limit. The riders, one lead rider and one following rider, will vary the vehicle speed between 5 and 30 miles per hour (mph). Riders will strive for an average speed of 15 mph. The average speed is a target speed only; vehicle speeds will be adjusted to meet road conditions. Vehicles will be equipped with a speedometer and odometer to record speeds and distance traveled. Global positioning units will be used to estimate average speed.

  Each ATV will be fitted with two personal sampling pumps for asbestos set at two distinct flow rates (3.5 and 9 liters per minute), sampling cassettes will be inspected for dust loading after 1 hour and the filters changed if needed. The sampling pumps will be carried in a backpack while the dust monitor will be mounted to the ATV. The cassettes for the personal sampling pumps will be attached to the shoulder straps of the backpack proximal to the riders' lapels in the breathing zone.

  If it is necessary to relieve a rider from the activity, a backup rider will be suited up and ready prior to the exchange. The active rider will stop the vehicle, dismount the vehicle, remove the backpack and transfer it to the replacement rider. The relief rider will don the backpack and mount the ATV from the opposite side. The original rider will assist the relief rider with donning and adjusting the backpack. The exchange is anticipated to take less than 60 seconds, so the sampling pumps and event time clock will not be halted during the exchange. If the exchange requires more than 60 seconds, the pump and event clock will be stopped until activity is re-initiated.

Soil Sampling

Three soil samples will be collected from the road to determine moisture content, particle size, and the presence of asbestos-containing material (ACM) on the road surface. One sample will be collected from each end of the test section of the road and one in the center. Samples will be collected from an area measuring approximately 12 square inches and to a depth of two inches below the ground surface. Sufficient soil will be collected to fill one eight-ounce jar. The samples will be homogenized before analysis of moisture content. An off-site laboratory will quantify the percent moisture, particle size and percent ACM by weight.

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ii. Exposure investigation population

The study will not be collecting samples on exposed populations. Only EPA personnel from the emergency response team will be utilized to collect activity-based samples. This team has conducted these tests before and knows how to use personal protective equipment and the regulations required to protect personnel.

Sampling locations will be located on the outskirts of the town. This will help prevent any exposure to local community members. There is only one road into and out of town so it will be impossible to shut the road down. However, the activities that are planned are not out of the ordinary activities that take place on the road everyday. In addition, bystanders will be discouraged and anyone walking on the road will be encouraged to wait until sampling is completed.

iii. Data collection/sampling procedures

SAMPLING METHODOLOGY

- The selection of air sampling locations on the road is biased. That is, they will not randomly selected using a statistically valid methodology. Sampling locations will be selected to collect air based on types of activities associated with road use and in locations where these activities are likely to occur. This approach is necessary to meet the data quality objective of determining concentrations of asbestos during typical activities along the road.
- U.S. EPA ERT sample collection Standard Operating Procedures (SOPs) will be followed for all sampling events. Specific SOPs for the following topics referenced for site work are, Soil Sampling #2012, General Air Sampling Guidelines #2008, and #2015 Asbestos Sampling.
- On-site air sampling for asbestos fibers in air will be conducted using International Standards Organization (ISO) Method 10312. The method includes the following

field procedures for collecting a sample:

- Each sampling pump shall be calibrated with a representative 0.8 micron pore size mixed cellulose ester filter cassette in line; (Note: this is a modification to the ISO 10312 method. The method specifies a maximum 0.45-micron pore size.) For personal sampling, sampling cassettes shall be fastened near the worker's lapel proximal to the worker's mouth. The top cover from the cowl extension on the sampling cassette shall be removed ("open-face") and the cassette oriented face down. The joint between the extender and the monitor body shall be wrapped with tape to help hold the cassette together and provide a marking surface to identify the cassette. At least 2 field blanks (or 10% of the total samples, whichever is greater) shall be submitted for each set of investigative samples. Top covers shall be removed from the field blank cassettes and stored in a clean area (e.g., closed bag or box) during sampling. Top covers shall be replaced onto field blank cassettes when sampling is completed. Sampling pumps shall be set at flow rates that range from 1.5 to 10 L/min (depending on sampling event). Sampling rates shall be adjusted to achieve the required detection limit without overloading the cassette with dust. The purpose of adjusting sampling rates is to obtain optimum fiber loading on the filter. For asbestos samples, dusty atmospheres require smaller sample volumes to obtain countable samples. This is the likely case with the activity-based sampling. Top covers and small end caps shall be replaced onto sampling cassettes at the end of the sampling event. Samples shall be shipped upright, with the conductive cowl attached, and in a rigid container with packing material to prevent jostling or damage. Untreated polystyrene foam shall not be used in the shipping container as electrostatic forces may cause fiber loss from sample filter.

Soil samples will be collected using disposable stainless steel trowels and filling the appropriate container.

Quality Control Samples

A field quality control (QC) program shall be implemented to assure conformance with data quality protocols established by the U.S. EPA. The field QC program is normally comprised of additional collected field QC samples, including those samples described in the following sections.

Duplicate Samples

A field duplicate sample is a second sample collected at the same location as the original sample. Duplicate samples are collected simultaneously or in immediate succession, using identical recovery techniques, and treated in an identical manner during storage, transportation, and analysis. At least two duplicates will be collected.

Performance Samples

A performance sample may be submitted for analysis. The performance sample employs a known concentration of chrysotile asbestos on a filter that is submitted to measure the analytical accuracy.

Lot Blanks

Lot Blanks are samples of the collection media, from the same manufacturer's lot as those being used for sample collection, submitted to the laboratory for analysis to detect potential contamination or issues with the sampling media. Lot blanks will be submitted for the asbestos filter cassettes.

Field Blanks

Field blanks are used to assess the potential introduction of contaminants from sample containers or during the transportation and storage procedures.

iv. Data analysis

Asbestos by TEM

Transmission Electron Microscopy (TEM) methods provide much greater resolution than the Phase Contrast Microscopy method, and can be used to confirm the presence of asbestos fibers. These methods use the same criteria of greater than 5 micrometers (um) and an aspect ratio of greater than 3 to 1 for identifying fibers. In combination with other techniques, TEM methods can specifically identify asbestos fibers versus other kinds of fibers (fiberglass, rock wool, etc.) and have a much greater ability to detect shorter and thinner asbestos fibers.

Laboratory analysis using TEM will identify and determine asbestos fiber concentrations using established TEM methodology (ISO 10312).

All asbestos structures/fibers observed will be counted, described and recorded per the Libby Protocols Spreadsheet (NADES).
The analytical sensitivity limits required for this method are:

- 0.0033 structures or fibers/cc for activity based sampling; and
- 0.0005 structures or fibers/cc for ambient air sampling.

Soil Moisture and Particle Size

Soil samples will be analyzed by an off-site lab for moisture content via American Society for Testing and Materials (ASTM) Standard D6565-00 Test Method for Determination of Water (Moisture). Particle size analysis will be determined using ASTM Standard D422-63 Test Method for Particle-Size Analysis of Soils.

Data interpretation

Soil samples collected will be used to indicate the presence or absence of asbestos in the samples. The percent asbestos (by visual area) will represent a qualitative interpretation of the extent of contamination but will not be used for health based risk decisions other than to determine areas of concern.

Because of the limitations of soil data, this protocol highly emphasizes the collection of appropriate air data through activity-based sampling. Air results will be examined with a number of risk-models to determine the cancer health risk associated with the asbestos air level. These include the EPA IRIS model, the OSHA regulatory model, the Berman-Crump protocol model, and the new ATSDR calculator for making less than lifetime exposure estimates. This will require a laboratory analysis for B-C protocol structures; the details of which will be worked out following the preliminary analysis. Note: The majority of fibers found in Ambler to-date are from the serpentine rock found in the quarry and only include chrysotile. This makes using the IRIS unit risk (that does not consider mineralogy) appropriate. If a substantial number of protocol structures (> 10 μm) are found the IRIS unit risk may not be appropriate.

v. Records management

Provide information on any foreseeable data entry, editing, and management responsibilities. Describe how information will be kept confidential, who will have access to it, and assurances that all summary reports and papers produced from he investigation will *not* include any individual identifying information.

vi. Fieldwork coordination

Describe who will do the sampling, when the sampling will take place, how samples will be shipped to specific labs.

vii. Quality assurance

Data Quality Objectives (DQOs) are statements that define the type, quality, quantity, purpose, and use of data to be collected. The design of a study is closely tied to the data quality objectives, which serve as the basis for important decisions regarding key design features such as the number and location of samples to be collected, and the analyses to be performed.

Presenting appropriate DQOs helps ensure that the project plan is carefully thought out and that the data collected will provide sufficient information to support the key decisions, which must be made following the investigation. DQOs identified for this sampling event at the Ambler Naturally Occurring Asbestos Site are:

- To determine the concentrations of asbestos fibers in air on the road during typical, ambient conditions;
- To determine the asbestos exposures by inhalation that individuals may experience through typical All Terrain Vehicle use of the road;
- To determine the contribution of potential background sources of asbestos to air quality on the road; and
- To determine if respirable asbestos in roadbed materials are a source for airborne contaminants on the road.

IV. COMMUNITY INVOLVEMENT

During the testing, ATSDR personnel will be meeting with community leaders and members to inform them about asbestos and the steps they can take to help eliminate exposure. We will be describing the process by which we are collecting samples, how those samples will be processed and how we will share our findings with them. We will be describing the ATSDR Health Consultation process and the possibility for future public meetings.

The materials to be used are fact sheets, presentations, and the Toxicological Profile for Asbestos. All these materials have previously been reviewed (Oak Ridge HS Health Consultation) through ATSDR clearance and peer review processes. Materials cover what asbestos is, the toxicity of asbestos, and what a person (or community) can do to limit exposure to asbestos.

V. RISK/BENEFIT INFORMATION

Only EPA federal employees will be involved in sample collection. The EPA Emergency Response Team will be involved. They have extensive experience in this type of collection and have performed these identical studies in different venues. Risk/benefit analysis is N/A here.

VI. INFORMED CONSENT PROCEDURES

Informed consent procedures are for subjects that will participate in the study and need to know of any risks associated with the study. This investigation will not employ any individuals other than government workers that have previously performed similar investigations. The investigators have all had proper training and will be equipped with

PPE to eliminate any exposure. The investigators will be performing routine activities that are carried out by the residents of Ambler on a daily, if not greater, basis.

VII. PROCEDURES FOR NOTIFYING PARTICIPANTS OF INDIVIDUAL AND OVERALL RESULTS

The community will be notified through ATSDR regional office, conference call, and release of a Public Health Consultation.

VIII. ASSURANCES OF CONFIDENTIALITY

No personal identifier data will be collected because samples are strictly environmental.

VIII. ESTIMATED TIME FRAME

August 15 - 19, 2005 Collect samples
August 20 - November 1 Analyze samples
November 1 - December 31 Prepare reports.

IX. PROJECTED BUDGET AND SOURCE OF FUNDING

ATSDR's cost is only for laboratory sample analysis. Estimated cost is for 40 samples at $500/sample or $20,000. The funds will be allocated from the EI section, EICB, ATSDR

APPENDIX F

Site Specific Sampling Plan
For the
AMBLER NATURALLY OCCURING ASBESTOS SITE

Ambler, Alaska

Prepared by:

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
La Plaza Business Park, 4220 Maryland Parkway
Las Vegas, Nevada 89119
&
AGENCY FOR TOXIC SUBSTANCE AND DISEASE REGISTRY
1200 Sixth Avenue, ATS-197
Seattle, Washington 98101

Approvals:

____

Brian Brass, U.S. Environmental Protection Agency Environmental Response Team Date

____

Richard Robinson, Agency for Toxic Substance and Disease Registry Date

____

U.S. Environmental Protection Agency Date

Table of Contents

SECTION 1
INTRODUCTION

1.1 GENERAL SITE INFORMATION

The Ambler Naturally Occurring Asbestos Site (site) is located in Ambler Alaska on the north bank of the Kobuk River, near the confluence of the Ambler and Kobuk Rivers. It lies 45 miles north of the Arctic Circle and is 138 miles northeast of Kotzebue, 30 miles northwest of Kobuk and 30 miles downriver from Shungnak. The area encompasses 9.5 square miles of land. Temperatures average –10 to 15 degrees Fahrenheit during the winter and 40 to 65 degrees during the summer. Snowfall averages 80 inches and precipitation is 16 inches total per year. The population is 274 with 89 students enrolled in the village school. The residents are Kowagniut Inupiat Eskimos with a traditional subsistence lifestyle.

1.2 ENVIRONMENTAL ASSESSMENT

August 3, 2003 – Alaska Department of Transportation (ADOT) collected three soil samples at the gravel pit. Results reported on October 3, 2003, indicated 1%, 2% and 10% Chrysotile.

November 3, 2003 – Alaska Occupational Safety and Health collected soil samples and wipe samples at the school as part of a limited health survey for the school construction employees. Asbestos was detected under the school building in gravel laid down from the gravel pit, original soil was non detect for asbestos, trace amounts were found in exterior gravel located in a pile prepared for the school's playground, and from the road. Asbestos fibers were detected inside the building. An air sample collected in a hallway next to the main entry way had 0.01 fibers of asbestos/cc (OSHA standard is 0.1 fibers/cc). Wipe collected for positive or negative testing from two different windowsills had asbestos fibers.

June 2, 2004 – The Alaska Native Tribal Health Consortium (ANTHC) collected discrete soil samples from the water treatment pad, lift station pad and gravel stockpile. Results were 2-5% chrysotile from fines only from gravel and 1.24-1.99% chrysotile from the gravel.

August 19, 2004 – ANTHC re-sampled the water treatment pad (1.7%), lift station pad (5%), washeteria pad (0.75%) and the gravel stockpile and from the borrow pit (1.46%).

August – September 2004 – Alaska Department of Environmental Conservation (ADEC) collected air samples for 8 weeks every 3 days for 24 hours during these months. The highest dust samples (3 filters) were analyzed for asbestos. None were detected. One sample was collected from the playground, which contained 12 inches of loam. Asbestos was detected, but not quantified.

May 20, 2005 – Alaska Division of Public Health (ADPH) conducted a Public Health Evaluation and Assessment and performed a medical records search to determine if any asbestos-related diseases have ever been identified in residents of Ambler, Kobuk, Shungnak, and Kiana. They reviewed all death certificates from 1980 to the present to see if there were any residents of Maniilaq villages who had died from an asbestos-related diagnosis. There were no residents with any asbestos-related diagnoses on the death certificate. A review of the State Cancer Registry and the Alaska Native Tumor Registry to see if there were any asbestos-related cancers that had been diagnosed and reported from any residents of Ambler, Kobuk, Shungnak, and Kiana. There were no residents who had been diagnosed with mesothelioma from any of these villages dating back to 1970. There were no reported cases of lung cancer from Ambler, Kobuk, or Shungnak dating back to 1970. There were five reported cases of lung cancer, all from the village of Kiana. These five cases occurred from 1984 to 2003, and they included four different cell types of lung cancer.

ADPH also reviewed computerized medical records in the RPMS medical record system. There were no residents of the four villages who ever had been diagnosed with any asbestos-related disease. Existing chest x-rays were reviewed from 128 residents from the four villages who were 50 years and older – 28 of these residents were from Ambler. Because of the past epidemics of tuberculosis and other common pulmonary diseases, there were many abnormalities. Of the 28 residents of Ambler whose chest x-rays were reviewed, two had pleural changes that were probably caused by prior exposure to asbestos. Of the 100 residents of Kobuk, Shungnak, and Kiana whose chest x-rays were reviewed, seven had pleural changes that might have been caused by prior exposure to asbestos. The asbestos-related changes were in the form of pleural plaques, and their appearance suggests that they were due to asbestos exposure many years ago, possibly due to occupational exposure. After receiving the information from reading the chest x-rays, a medical epidemiologist from the Section of Epidemiology visited Maniilaq, reviewed all available medical records, and with the help of a local interpreter, interviewed the patients who were still living and who agreed to be interviewed. Several of the residents described past employment working in mines. Many of the residents worked in mining many years ago, and they were unable to provide detailed information that would enable specific characterization of exposure to asbestos. Of the 9 people with pleural plaques suspicious for asbestos exposure, 1 recalled working in asbestos mine, 1 worked with asbestos as a construction worker, 1 was repeatedly exposed to high levels of mine dust while washing her husband's clothing, 1 refused interview, 2 had other medical conditions not-related to asbestos that definitively explained the x-ray findings, and the results for the remaining 3 were inconclusive because they had non-asbestos related lung diseases but these diseases did not definitively account for the x-ray changes. There are no medical tests to determine the amount of asbestos a person has been exposed to during their lifetime. There are no medical tests that are uniquely specific to identifying asbestos-related disease, but general clinical tests of lung function and chest x-rays are used to diagnose the disease and its impact. It is particularly difficult to identify mild cases.

In response to these results, ATSDR and U.S. EPA are undertaking this project to determine the potential risk to road users.

1.3 PROBLEM STATEMENT

Since the 1960's the Ambler gravel pit, located 2 miles outside of the village, has been used to provide gravel for the airport, village roads and foundation pads for houses, the school and clinic. The village is located in an area of high concentration of naturally occurring asbestos. In August 2003, the Alaska Department of Transportation and Public Facilities (ADOT) visited Ambler to check on the quantity of gravel available for an airport expansion project. As part of their assessment, they collected soil samples to identify whether asbestos was present in the source material. Test results showed the presence of a potentially harmful form of asbestos in the gravel pit, chrysotile at concentrations up to 10%. These results raised concerns in the community over exposure to airborne asbestos from the road dust in particular; there is a concern that individuals using the gravel roads could be exposed to airborne asbestos fibers. Therefore, it is necessary to examine the potential health risk to road users due to inhalation of airborne asbestos fibers on and near the road.

1.4 PROJECT PURPOSE

The primary purpose of this project is to collect data that accurately represents the exposure of typical road users to respirable asbestos fibers in air. Breathing zone air samples for asbestos fibers will be collected during typical road user activities, primarily, ATV use. Results from sampling will be submitted to State and federal health officials to screen the human health risk associated with use of the road.

Ambient air concentrations of asbestos in the village of Ambler will also be quantified by collecting air samples from up to five locations within town.

1.5 DATA QUALITY OBJECTIVES

Data Quality Objectives (DQOs) are statements that define the type, quality, quantity, purpose, and use of data to be collected. The design of a study is closely tied to the data quality objectives, which serve as the basis for important decisions regarding key design features such as the number and location of samples to be collected, and the analyses to be performed.

Presenting appropriate DQOs helps ensure that the project plan is carefully thought out and that the data collected will provide sufficient information to support the key decisions, which must be made following the investigation. DQOs identified for this sampling event at the Ambler Naturally Occurring Asbestos Site are:

- To determine the concentrations of asbestos fibers in air on the road during typical, ambient conditions. (The Ambler area is typical of a continental interior region of Alaska. Temperatures during the long summer days are mild, with maximums mostly in the high 60s and low 70s, with occasional climbs into the 80s. The sun does not set during the period from early June early July. The freeze-free period averages 89 days annually, extending from May to late August. Annual precipitation amounts are 16 inches (80 inches of snow), which is typical for continental climate. Ambler also follows the pattern of nearly all Alaskan stations, with precipitation amounts building up to a maximum during late summer and the fall months. Snow has been recorded during all months except July. Surface winds are seldom strong during any season of the year, nor do they show much seasonal variation. Prevailing winds are from north at 10 miles per hour for the majority of the year.)
- To determine the asbestos exposures by inhalation that individuals may experience through typical All Terrain Vehicle use of the road;
- To determine the contribution of potential background sources of asbestos to air quality on the road; and
- To determine if respirable asbestos in roadbed materials are a source for airborne contaminants on the road (Is asbestos, present in the roadbed aggregate, release to the atmosphere in measurable amounts).

SECTION 2
SAMPLING PROCEDURES

2.1 OVERVIEW OF ASBESTOS SAMPLING PLAN

2.1.1 Health and Safety Plan

A Health and Safety Plan (HASP) specific to the air sampling activities has been developed by the U.S. Environmental Response Team (ERT). Health and safety considerations are paramount to the success of the sampling activity and the HASP will be strictly adhered to during site activity.

2.1.2 Site Access

The site is public property controlled by the local tribal council and community. The U.S EPA will be responsible for obtaining site access to the property before sampling begins.

2.2 SAMPLING PROCEDURES

2.2.1 Perimeter Air Sampling

Air sampling will be conducted at fixed locations proximal to where the activities are being conducted. For the purpose of this Sampling and Analytical Plan, these fixed locations will be referred to as perimeter samples because they are being collected on the perimeter of the activities.

Site background/reference and perimeter samples will be collected concurrently with the ATV sampling. Up to five perimeter samples will be collected during ATV activities based on meteorological data.

2.2.2 Background and In-Village Air Sampling

Background or reference samples will be collected to develop a reference point from which to evaluate the activity-based sampling. For Asbestos, a high volume (1-20L/m) air sampler will be used to collect in excess of 4,000 liters and achieve a detection limit below that of the personal air samplers. Three background samples will be collected from upwind locations for each activity-based sampling event. Samples will be collected at a flow rate of approximately 10 L/m.

Background or reference air samples will be collected to determine the ambient air concentration of asbestos occurring from undisturbed geologic sources or contaminants which are occurring solely from a source other than the activity based sampling.

Sampling locations shall be selected based on wind direction, similarity of the air shed and environmental conditions to those found on-site.

Background samples for ambient air will be collected upwind of the site at a great enough distance to minimize the likelihood of interference from the site. Since site-related and background air concentrations are expected to fluctuate, background and on site samples will be collected simultaneously.

Air samples will also be collected in the Village of Ambler to aid in evaluating potential asbestos exposure to residents of the village. Approximately 5 sampling locations will be selected based on recommendation by the local community. The Village samples will be collected using a high volume (1-20L/m) air sampler to collect in excess of 4,000 liters and achieve a detection limit below that of the personal air samplers. Samples will be collected over approximately an eight hour period.

2.2.3 Activity-Based Air Sampling

For all activity-based sampling events, asbestos samples will be collected from the breathing zones of the event participants at two distinct flow rates, a high flow of approximately 9 liters per minute (L/min) for approximately two hours for a target volume of 1080 liters (L) and a low volume sample of approximately 3.5 L/min for a volume of 420 L. Using these sample collection parameters will provide a sensitivity limit of less than or equal to 0.0033 f/cc.

Real-time dust measurements will be collected with a dust monitor (DataRam or similar unit) carried by an ATV. Results from dust monitoring will be retained for possible use in dust emissions modeling.

The National Oceanic and Atmospheric Administration (NOAA) meteorological weather station located in Ambler, Alaska will be employed to measure wind speed, wind direction, relative humidity, temperature, and barometric pressure, proximal to the activities. Portable meteorological instruments and flagging tape will also be used to determine on-site conditions.

- The ATV scenario is described below:

2.2.3.1 Two ATVs

Two event participants, wearing appropriate Personal Protective Equipment, will ride ATVs back and forth along a 1000 foot long portion of the road (currently anticipated to be between the Ambler Airport and the Village of Ambler) at the same time until a sufficient volume of air has been collected to achieve the required detection limit. The riders, one lead rider and one following rider, will vary the vehicle speed between 5 and 30 miles per hour (mph). Riders will strive for an average speed of 15 mph. The average speed is a target speed only; vehicle speeds will be adjusted to meet road conditions. Vehicles will be equipped with a speedometer and odometer to record speeds and distance traveled. Global positioning units will be used to estimate average speed.
Each ATV will be fitted with two personal sampling pumps for asbestos set at two distinct flow rates (3.5 and 9 liters per minute), sampling cassettes will be inspected for dust loading after 1 hour and the filters changed if needed. The sampling pumps will be carried in a backpack while the dust monitor will be mounted to the ATV. The cassettes for the personal sampling pumps will be attached to the shoulder straps of the backpack proximal to the riders' lapels in the breathing zone.

If it is necessary to relieve a rider from the activity, a backup rider will be suited up and ready prior to the exchange. The active rider will stop the vehicle, dismount the vehicle, remove the backpack and transfer it to the replacement rider. The relief rider will don the backpack and mount the ATV from the opposite side. The original rider will assist the relief rider with donning and adjusting the backpack. The exchange is anticipated to take less than 60 seconds, so the sampling pumps and event time clock will not be halted during the exchange. If the exchange requires more than 60 seconds, the pump and event clock will be stopped until activity is re-initiated.

2.2.4 Soil Sampling

Three composite soil samples will be collected from the road to determine moisture content, particle size, and the presence of asbestos-containing material (ACM) on the road surface. One sample will be collected from each end of the test section of the road and one in the center. Samples will be collected from an area measuring approximately 12 square inches and to a depth of two inches below the ground surface. Sufficient soil will be collected to fill one eight-ounce jar. The samples will be homogenized before analysis of moisture content. An off-site laboratory will quantify the percent moisture, particle size and percent ACM by weight.

Soil Sampling. Soil sampling will be conducted using modified ERT/REAC SOP #2012, *Soil Sampling*. The collection of samples from near-surface soil can be accomplished with tools such as spades, shovels, trowels, and scoops. The surface material will be removed to the required depth (0-2 inches) and soil samples will be collected using dedicated equipment (i.e., trowels, bowls, spoons, etc.). The following procedure will be used to collect surface soil samples:

Using GPS or other appropriate means to navigate to the predetermined sampling location.

1. Remove sticks, rocks, and vegetation from the sampling area.
2. Mark a one-square-foot area to be sampled with the edge of a trowel.
3. Remove soil to a depth of approximately 3 inches using a stainless steel trowel.
4. Accumulate an adequate volume of soil in a stainless mixing bowl.
5. Repeat steps 1 through 7 for the remaining three sampling locations.
6. Thoroughly mix the soil to obtain a sample that is representative of the entire sampling location using a stainless steel spoon.
7. When compositing is complete, transfer aliquots of the mixed sample into appropriate, labeled containers and secure the caps tightly.
8. Follow appropriate packing and shipping procedures.

Alternatively, a section of the grassy area may be cut and the top layer of grass and/or sod pulled back prior to soil sampling or a plug of grass will be removed to a depth of 3 inches. Use of these alternate techniques may minimize the disturbance to the property. The above method will be modified accordingly either beginning with step 4 or step 6, depending on the technique chosen.

Sampling locations will be determined randomly using the Visual Sampling Plan program. Seven samples, comprised of four sub-samples each will be collected. See Visual Sampling Plan output for details.

2.3 SAMPLING METHODOLOGY

-
- The selection of air sampling locations on the road is biased. That is, they will not randomly selected using a statistically valid methodology. Sampling locations will be selected to collect air based on types of activities associated with road use and in locations where these activities are likely to occur. This approach is necessary to meet the data quality objective of determining concentrations of asbestos during typical activities along the road.
-

U.S. EPA ERT sample collection Standard Operating Procedures (SOPs) will be followed for all sampling events. Specific SOPs for the following topics referenced for site work are, Soil Sampling #2012, General Air Sampling Guidelines #2008, and #2015 Asbestos Sampling.

-

On-site air sampling for asbestos fibers in air will be conducted using International Standards Organization (ISO) Method 10312. The method includes the following field procedures for collecting a sample:

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- Each sampling pump shall be calibrated using a primary or secondary calibration standard with a representative 0.8 micron pore size mixed cellulose ester filter cassette in line; (Note: this is a modification to the ISO 10312 method. The method specifies a maximum 0.45-micron pore size.) Another project specific modification is that all pumps will be Pre- and Post calibrated using the actual filter employed to collect the sample.
-
- For personal sampling, sampling cassettes shall be fastened near the worker's lapel proximal to the worker's mouth. The top cover from the cowl extension on the sampling cassette shall be removed ("open-face") and the cassette oriented face down. The joint between the extender and the monitor body shall be wrapped with tape to help hold the cassette together and provide a marking surface to identify the cassette. At least 2 field blanks (or 10% of the total samples, whichever is greater) shall be submitted for each set of investigative samples. Top covers shall be removed from the field blank cassettes and stored in a clean area (e.g., closed bag or box) during sampling. Top covers shall be replaced onto field blank cassettes when sampling is completed. Sampling pumps shall be set at flow rates that range from 1.5 to 10 L/min (depending on sampling event). Sampling rates shall be adjusted to achieve the required detection limit without overloading the cassette with dust. The purpose of adjusting sampling rates is to obtain optimum fiber loading on the filter. For asbestos samples, dusty atmospheres require smaller sample volumes to obtain countable samples. This is the likely case with the activity-based sampling. Top covers and small end caps shall be replaced onto sampling cassettes at the end of the sampling event. Samples shall be shipped upright, with the conductive cowl attached, and in a rigid container with packing material to prevent jostling or damage. Untreated polystyrene foam shall not be used in the shipping container as electrostatic forces may cause fiber loss from sample filter.

Soil samples will be collected using disposable stainless steel trowels and filling the appropriate container.

2.3.2 Quality Control Samples

A field quality control (QC) program shall be implemented to assure conformance with data quality protocols established by the U.S. EPA. The field QC program is normally comprised of additional collected field QC samples, including those samples described in the following sections.

2.3.2.1 Duplicate Samples

A field duplicate sample is a second sample collected at the same location as the original sample. Duplicate samples are collected simultaneously or in immediate succession, using identical recovery techniques, and treated in an identical manner during storage, transportation, and analysis. At least two duplicates will be collected.

2.3.2.2 Performance Samples

A performance sample may be submitted for analysis. The performance sample employs a known concentration of chrysotile asbestos on a filter that is submitted to measure the analytical accuracy.

2.3.2.3 Lots Blanks

Lot Blanks are samples of the collection media, from the same manufacturer's lot as those being used for sample collection, submitted to the laboratory for analysis to detect potential contamination or issues with the sampling media. Lot blanks will be submitted for the asbestos filter cassettes.

2.3.2.4 Field Blanks

Field blanks are used to assess the potential introduction of contaminants from sample containers or during the transportation and storage procedures.

2.4 ANALYTICAL METHODOLOGY

2.4.1 Asbestos by TEM

Transmission Electron Microscopy (TEM) methods provide much greater resolution than the Phase Contrast Microscopy method, and can be used to confirm the presence of asbestos fibers. These methods use the same criteria of greater than 5 micrometers (um) and an aspect ratio of greater than 3 to 1 for identifying fibers. In combination with other techniques, TEM methods can specifically identify asbestos fibers versus other kinds of fibers (fiberglass, rock wool, etc.) and have a much greater ability to detect shorter and thinner asbestos fibers.

Laboratory analysis using TEM will identify and determine asbestos fiber concentrations using established TEM methodology (ISO 10312). ISO 10312 is the method selected by the EPA's Asbestos Technical Review Workgroup for activity based sampling. The method is in the process of being modified into a Superfund Method. Use of this method will permit comparison to other sites. Should both the high and the low volume samples be overloaded, the high volume sample will be analyzed by the indirect method ISO 13794-Ambient air - Determination of asbestos fibres - Indirect-transfer transmission electron microscopy method

All asbestos structures/fibers observed will be counted, described and recorded per the Libby Protocols Spreadsheet (NADES).
The analytical sensitivity limits required for this method are:

- 0.0033 structures or fibers/cc for activity based sampling; and
- 0.0005 structures or fibers/cc for ambient air sampling.

2.4.3 Asbestos, Soil Moisture and Particle Size

Asbestos content of soil samples will be determined using PLM-Visual Estimation (PLM-VE) technique 1000 point count (Analysis of Asbestos Fibers In Soil by Polarized Light Microscopy). Prior to analysis, soil samples will be prepared using ISSI Libby-01 Soil Sample Preparation.

Soil samples will be analyzed by an off-site lab for moisture content via American Society for Testing and Materials (ASTM) Standard 4643-00 Test Method for Determination of Water (Moisture). Particle size analysis will be determined using ASTM Standard D422-63 Test Method for Particle-Size Analysis of Soils. Soil moisture will be measured on site using a soil moisture probe.

2.5 SAMPLING SCHEDULE

Asbestos sampling activities are to be conducted during the third week in August 2005. The schedule is based on historical weather patterns and may be adjusted should actual or forecast weather conditions differ. Ideally, road soils would be less than 50% available moisture [per United States Department of Agriculture, Natural Resource Conservation Service, Estimating Soil Moisture by Feel and Appearance (Program Aid 1619)] and there would be at least 3 days of dry weather (no measurable precipitation) prior to sampling. However, soil moisture in the 30 to 70th percentile based on estimates derived from a one-layer hydrological model (Huang et al., 1996, van den Dool et al., 2003) will be acceptable as they are representative of average summer conditions. This model uses daily precipitation totals from observation stations that are input to the model. However, since Ambler is such a remote location, barring torrential down pours or snow cover, sampling will likely occur regardless of weather conditions, with the acknowledgement that additional data may need to be collected in the future. It is assumed that sampling activities will occur over a one-week period. It is anticipated that laboratory analysis will be completed within 45 days of sample collection and final data validation will be completed within five days of delivery of the completed electronic data packages.

2.5.2 Numbers of Samples to Be Collected

2.5.2.1 Activity Based Sampling

It is anticipated that 12 activity-based, 15 perimeter and nine background/reference air samples will be collected and submitted for TEM analysis. The ATV riding activity will be repeated three times. Three ambient air background samples will be collected for each activity-based sampling event. The background samples will be collected upwind of the locations of the activity-based sampling.

Table 1: Number of Samples to Be Collect							
Activity Description	Number of Personnel Required	Number of Events	Number of Samples	Number of Background Samples	Number of Perimeter Samples	Total Number of Samples*	Comments
Two ATVs	3	3	12	9	15	36*	
Duplicates/co-located			1	1	1	3	
Samples in Town	2	2	5	2	NA	14	
Soil Samples	2	1	7	0	NA	7**	
Field Blanks			2			2	
					Total #	55	

* A high (1080l) and low (420l) volume sample will be collected on the ATV riders. Only the higher volume sample will be analyzed, if it is readable. ** Soil samples not included in totals.

2.6 SAMPLE IDENTIFICATION AND DOCUMENTATION

2.6.1 Data Sheets and Log Books

Electronic SCRIBE software will be used to record and manage sampling information. Information in the datasheets will include, at a minimum, the following:

- Location at the site and activity being conducted during sample collection;
- Date and time of sample collection;
- Sample description
- Description of temperature and general weather conditions at the time of sample collection; and
- The unique sample identification number for each sample.

SCRIBE forms will be completed, signed, and dated by the recorder.
A logbook will be kept with details of sampling activities. All notes written in paper logs will be written with waterproof ink. All corrections to data entered will be made by crossing out the error with a single horizontal line, initialing the correction, and entering the correct information. Crossed-out information shall be readable.

2.6.2 Photographs

Photographs will be taken during each air-sampling event. The photographs will be used to provide backup documentation of compliance with this SAP. The camera will be equipped with a device to record the date and time on the photograph, if possible.

Videos clips of the activities will also be taken to further document the effort.

2.6.3 Sample Labeling

Each sample will be identified with an adhesive label bearing a unique sample identification number as designated by the SCRIBE sample management program.

2.7 DECONTAMINATION

Decontamination of personnel and equipment used during the sampling activities will be carried out in compliance with the site-specific Health and Safety Plan.

SECTION 3
QUALITY ASSURANCE

3.1 DATA QUALITY OBJECTIVES

The DQOs to be followed for air and soil sampling are outlined in Section 1.5 of this Site Specific Sampling Plan.

3.2 SPECIAL TRAINING REQUIREMENTS/CERTIFICATION

All field staff conducting sampling will have proper OSHA training and participate in a medical monitoring program. Field staff will attend a briefing from the field team leader during each sampling session to address any site-specific training requirements or hazards. All sampling activities are conducted in compliance with the site-specific Health and Safety Plan.

3.3 SAMPLE HANDLING AND CUSTODY PROCUDURES

Chain of custody procedures will be used to maintain and document sample collection and possession. During the sampling process, the SCRIBE-based Chain of Custody Record (COCR) form will be completed. The completed COCR will be signed, as required, as each sample package recipient receives and relinquishes possession of the sample package, and the COCR will accompany samples during shipment.

3.3.1 Sample Packaging and Shipment

The air sample filter cassettes will be packaged and shipped to the analytical laboratory using standard methodology. In addition to sample handling and shipment instructions included in Section 2.3 of this plan, the following procedures will also be incorporated into field procedures.

3.3.1.1 Cooler Preparation

In preparation for sample shipment:

- Plastic coolers, or similar, will be used for each sample shipment;
- Coolers shall be inspected prior to shipment for cleanliness;
- All cooler drain plugs will be sealed with tape;
- All previous shipping labels will be removed.

3.3.1.2 Packing Samples in Coolers

Each sample will be placed in an individual plastic bag. See section 2.3 for additional details on sample packing.

3.3.1.3 Closing and Shipping of Coolers

Sample documentation will be enclosed in sealed plastic bags taped to the underside of the cooler lid. Coolers will be secured with packing tape and custody seals as described below:

- Cooler lids will be taped shut with strapping tape, encircling the cooler several times;
- Chain of custody seals will be placed on two sides of the lid after closing the lid (one in front and one on the side);
- “This Side Up” arrows will be placed on the sides of the cooler; and
- Coolers will then be shipped to the laboratory by overnight courier as soon as possible. Daily shipments are not required since the samples are not temperature sensitive and the site is in a remote location with limited overnight shipment capabilities.

3.4 SELECTION OF ANALYTICAL LABORATORIES

Samples for asbestos will be analyzed by analytical laboratories selected and qualified by EPA. This effort will be coordinated between the OSC, the EPA-ERT Work Assignment Manager, and the Region 10 Laboratory Contracts Coordinator.

3.5 DATA VALIDATION

Table 2

QA/QC ANALYTICAL SUMMARY and FIXED LABORATORY ANALYTICAL METHODS
Ambler Asbestos Gravel Pit Site
Ambler, AK

Laboratory	Matrix	Parameters/Method	Method Description/ Sensitivity	Total Field Samples[a]	QA/QC Sample Summary Analyses				Total Field and QA/QC Analyses/ Containers	Precision and Accuracy
					Method Blank	Duplicates	Lot Blanks	Field Blanks		
Commercial Laboratory	Air	TEM Asbestos/ ISO 10312	TEM/ 0.0033 fibers/cc TEM/ 0.0005 fibers/cc	55	NA	3	>2 or as required by lab	2	62	Per ISO Method
Commercial Laboratory	Soil	Particle Size Soil Moisture Asbestos by PLM	NA Per Method 0.2%	7	NA	NA		NA	7	Per ISO Method

[a] Total number of field samples is estimated.
[b] Total analyses and containers includes both field and QA/QC aliquots to be submitted for fixed laboratory analysis.
Key:
cc = Cubic centimeter.
ISO = International Organization for Standardization.
NA = not applicable.
QA = Quality assurance.
QC = Quality control. .
TEM = Transmission Electron Microscopy.

SECTION 4
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