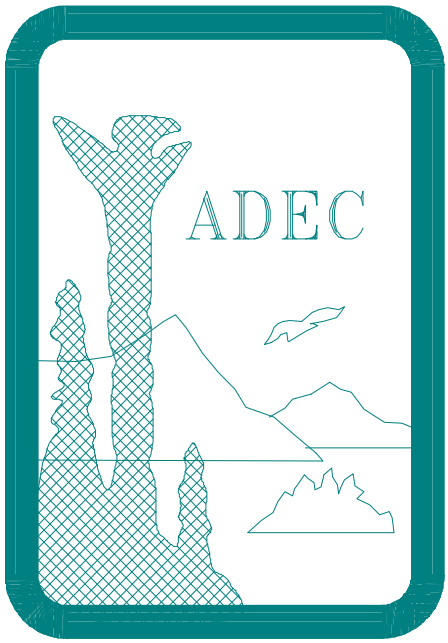
Skagway Air Monitoring Study of Airborne Fine Particulate Matter During 2004-5

Final Report

April 2007



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Acknowledgements:

This study would not have been possible except for the dedicated efforts of a number of people, particularly the site operators: Tim Gladden of the City of Skagway Public Works Department and the environmental staff of the Skagway Traditional Council (Marion Twitchell, Lance Twitchell, Amber Bethe, and Jennifer Potratz). We also thank Bob Ward, City Manager of Skagway, for facilitating the monitoring efforts within the community.

Ambient air monitoring was performed in Skagway, Alaska during the entire year of 2004 and the first quarter of 2005 as part of a two-prong air monitoring effort between the Alaska Department of Environmental Conservation (DEC) and 1) the City of Skagway and 2) the Skagway Traditional Council. These two independent but coordinated projects were undertaken to determine if fine particulates posed a health threat to the residents of this community. Skagway had been on the DEC list of communities to be assessed for potential wook smoke impacts since the late 1990's and residents had continued to express concerns over emissions from the White Pass Railroad, the cruise ships, and re-entrained road dust.

After several planning meetings in Skagway to identify candidate monitoring sites, two $PM_{2.5}$ (PM refers to Particulate Matter, and 2.5 refers to the size of the particulates, i.e., 2.5 micro-meters or less) monitoring sites were established: one to be operated by the City, the other by the Traditional Council (Figure 1).

Figure 1: Location of the $PM_{2.5}$ monitors in Skagway

The City site contained two $PM_{2.5}$ samplers and was located at the Skating Rink adjacent to the Recreation Center near 11th Ave. and Main St (Figure 2). The City site was operated by the City's public works staff.

The Traditional Council's $PM_{2.5}$ monitoring site contained a single $PM_{2.5}$ sampler located behind the Police Station near First Ave and State St. (Figure 3) and operated by Council staff.

Figure 2: $PM_{2.5}$ monitoring site operated by the City of Skagway

Figure 3: $PM_{2.5}$ monitoring site operated by the Skagway Tribal Council

DEC staff shipped air samplers to Skagway in December 2003 and trained local operators on monitoring operation during site start-up at the beginning of 2004. Ambient monitoring at the City site took place on an every sixth day sampling frequency during the first half of 2004, and then on an every third day sampling frequency through the second half of 2004 and the first quarter of 2005. The January to March period was sampled both in 2004 and 2005 to ensure capture of a complete year's worth of fine particulate data. The Traditional Council monitoring site ran from February through September 2004 when loss of staff forced them to terminate the project.

In order to provide quality control over the monitoring study, DEC air quality monitoring staff performed monthly checks on the samplers' performance. In addition, audits were conducted on all samplers once per quarter by DEC's Quality Assurance staff to independently assess precision. Following DEC's internal review, all data were submitted to the U.S. Environmental Protection Agency's AQS database.

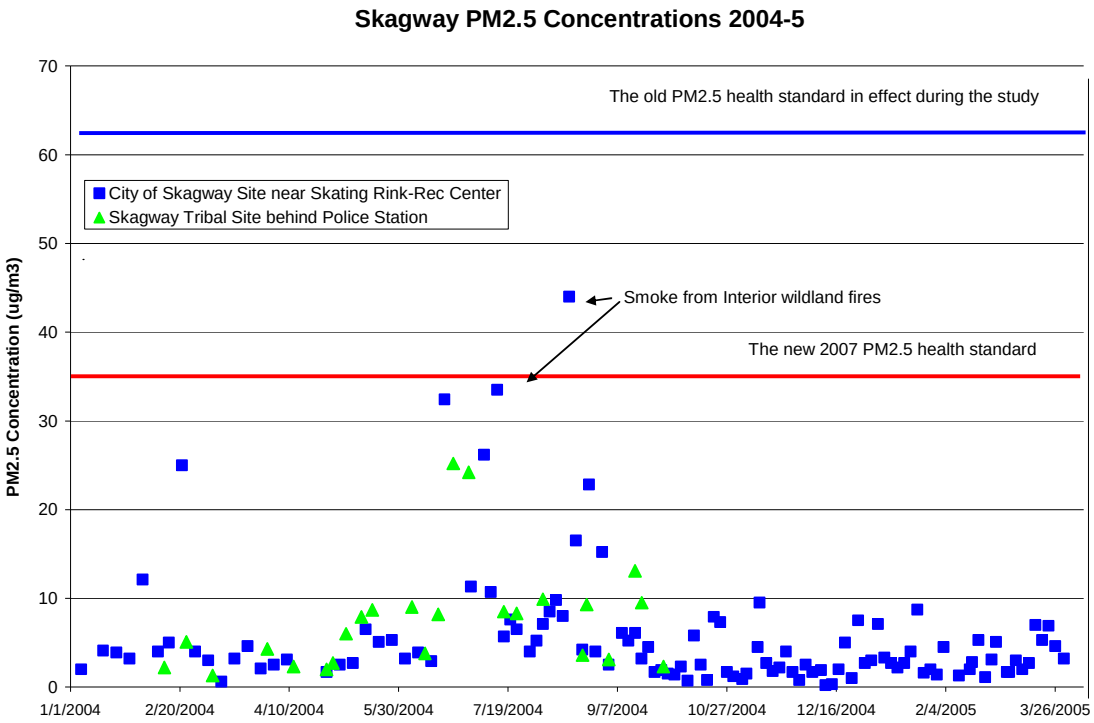

Figure 4: Plot of all concentration values of samples taken during the study from both the City and Traditional Council sites.

Figure 4 shows a plot of the measured concentrations for both the City and the Traditional Council sites. Of the 137 24-hour samples collected, only 14 values were above 10 $\mu g/m^3$. The two highest values detected during the study (44 $\mu g/m^3$ and 33 $\mu g/m^3$) occurred during the summer when wildland fire activity in Interior Canada sent smoke streaming into northern Southeast Alaska (see Appendix 3 for associated news stories). The third highest value (32.4 $\mu g/m^3$) reflects the smoke that emanated from a barge fire near Haines (see Appendix 3 for news story). Table 1 below provides a list of the 8 highest values recorded during the study.

Table 1: Highest 8 $PM_{2.5}$ sample concentrations measured in Skagway in 2004

Date	$PM_{2.5}$ concentration ($\mu g/m^3$)
8/16/2004	44.0
7/14/2004	33.5
6/20/2004	32.4
7/8/2004	26.2
6/24/2004	25.2
2/21/2004	25.0
7/1/2004	24.2
8/25/2004	22.8

The City site had a 77% capture rate for the first 6 months of 2004 while operating with one sampler, and an 80% capture rate for the last 6 months of the year while using two samplers. Capture rate is a measure of the study's completeness (i.e., the proportion of valid samples obtained relative to the number of samples scheduled), with 75% being the performance goal.

Although only 8 samples were taken on the same day at both the City and the Traditional Council sites to compare inter-site variability, Table 2 suggests that the Traditional Council site had somewhat higher concentrations on average than the City site.

Table 2: Comparison of concentration values between the City and Traditional Council sites

	Inter-site Comparison		
	City	Tribal	Difference
4/27/2004	1.7	2.0	0.3
7/17/2004	5.7	8.5	2.8
7/23/2004	6.5	8.3	1.8
8/4/2004	7.1	9.9	2.8
8/22/2004	4.2	3.6	-0.6
9/3/2004	2.5	3.1	0.6
9/15/2004	6.1	13.1	7.0
9/18/2004	3.2	9.5	6.3

Appendix 1 includes the complete data set for the City $PM_{2.5}$ monitoring site and Appendix 2 includes the collected data for the Traditional Council monitoring site.

In conclusion, the Skagway air monitoring study found ambient air quality in the community in general to be good. The calculated annual average for the City site was 5.9 $\mu g/m^3$, which was well below the *annual* state and federal ambient air quality standard of 15 $\mu g/m^3$. Similarly, all of the monitoring data was well below the *daily* state and federal ambient air quality standard of 65 $\mu g/m^3$ that was in place at the time of the study. As of the writing of this report, the new 2007 *daily* state and federal ambient air quality standard has been lowered to 35 $\mu g/m^3$. As shown in Figure 4, except for the wildland fire high concentration on August 16, 2004, all daily concentrations were still below this new reduced standard. Natural events such as wildland fires are typically not considered violations of the ambient air standards.

Appendix 1. City of Skagway site values.

Date	Site 2 PM2.5 concentration (ug/m3)	Flag
1/6/2004	2.0	
1/16/2004	4.1	1
1/22/2004	3.9	
1/28/2004	3.2	
2/3/2004	12.1	
2/10/2004	4.0	
2/15/2004	5.0	
2/21/2004	25.0	1, 2
2/27/2004	4.0	
3/4/2004	3.0	
3/10/2004	0.6	
3/16/2004	3.2	
3/22/2004	4.6	
3/28/2004	2.1	
4/3/2004	2.5	
4/9/2004	3.1	1
4/27/2004	1.7	
5/3/2004	2.5	
5/9/2004	2.7	
5/15/2004	6.5	
5/21/2004	5.1	
5/27/2004	5.3	
6/2/2004	3.2	
6/8/2004	3.9	
6/14/2004	2.9	
6/20/2004	32.4	2
7/2/2004	11.3	
7/8/2004	26.2	
7/11/2004	10.7	
7/14/2004	33.5	
7/17/2004	5.7	
7/20/2004	7.6	1
7/23/2004	6.5	
7/29/2004	4.0	
8/1/2004	5.2	1
8/4/2004	7.1	
8/7/2004	8.5	
8/10/2004	9.8	
8/13/2004	8.0	1
8/16/2004	44.0	E
8/19/2004	16.5	
8/22/2004	4.2	
8/25/2004	22.8	
8/28/2004	4.0	1
8/31/2004	15.2	
9/3/2004	2.5	1
9/9/2004	6.1	
9/12/2004	5.2	
9/15/2004	6.1	
9/18/2004	3.2	1
9/21/2004	4.5	
9/24/2004	1.7	
9/27/2004	1.9	
9/30/2004	1.5	
10/3/2004	1.4	
10/6/2004	2.3	
10/9/2004	0.7	1
10/12/2004	5.8	
10/15/2004	2.5	
10/18/2004	0.8	
10/21/2004	7.9	
10/24/2004	7.3	
10/27/2004	1.7	
10/30/2004	1.2	
11/3/2004	0.9	
11/5/2004	1.5	
11/10/2004	4.5	
11/11/2004	9.5	
11/14/2004	2.7	
11/17/2004	1.8	
11/20/2004	2.2	
11/23/2004	4.0	
11/26/2004	1.7	
11/29/2004	0.8	
12/2/2004	2.5	
12/5/2004	1.7	
12/9/2004	1.9	
12/11/2004	0.2	
12/14/2004	0.3	
12/17/2004	2.0	1
12/20/2004	5.0	
12/23/2004	1.0	1
12/26/2004	7.5	
12/29/2004	2.7	
1/1/2005	3.0	2
1/4/2005	7.1	2
1/7/2005	3.3	1, 2
1/10/2005	2.7	1
1/13/2005	2.2	
1/16/2005	2.7	

1/19/2005	4.0	
1/22/2005	8.7	
1/25/2005	1.6	
1/28/2005	2.0	1
1/31/2005	1.4	
2/3/2005	4.5	
2/10/2005	1.3	
2/15/2005	2.0	1
2/16/2005	2.8	
2/19/2005	5.3	
2/22/2005	1.1	
2/25/2005	3.1	
2/27/2005	5.1	
3/4/2005	1.7	
3/5/2005	1.7	
3/8/2005	3.0	
3/11/2005	2.0	2
3/14/2005	2.7	2
3/17/2005	7.0	1
3/20/2005	5.3	
3/23/2005	6.9	
3/26/2005	4.6	2
3/30/2005	3.2	

* Flag 1 denotes post-sampling weighing occurred >10 days from sample end date (critical criteria).

** Flag 2 denotes filter sampled >30 days from pre-weigh (operational criteria).

Appendix 2. Skagway Traditional Council Site values

Date	Site 1 PM2.5 concentration (ug/m3)	Flag
2/13/2004	2.2	
2/23/2004	5.1	
3/6/2004	1.3	
3/31/2004	4.3	
4/12/2004	2.3	
4/27/2004	2.0	1, 2
4/30/2004	2.7	1
5/6/2004	6.0	1
5/13/2004	7.9	
5/18/2004	8.7	1
6/5/2004	9.0	
6/11/2004	3.8	
6/17/2004	8.2	
6/24/2004	25.2	
7/1/2004	24.2	1, 2
7/17/2004	8.5	
7/23/2004	8.3	
8/4/2004	9.9	
8/22/2004	3.6	
8/24/2004	9.3	2
9/3/2004	3.1	
9/15/2004	13.1	
9/18/2004	9.5	
9/28/2004	2.3	

Appendix 3. News articles on air quality events affecting Skagway during Summer 2004.

Fires in Interior, B.C. create Juneau haze

Level of fine-particulate pollution has doubled in Juneau since last week

Smoke screen: The Chilkat Mountains are almost obscured by haze, as viewed from the Mendenhall Wetlands near Sunny Point. Smoke from fires in northeast Alaska and British Columbia are largely responsible for the haze.
MICHAEL PENN/THE JUNEAU EMPIRE

By ELIZABETH BLUEMINK
JUNEAU EMPIRE

Friday, June 25, 2004

Large forest fires raging in northeast Alaska and British Columbia are likely contributing to hazy conditions in Juneau and have caught the attention of state air regulators concerned about possible health effects.

The regulators said Thursday they are watching Juneau's level of lung-irritating fine particulate pollution, which they attribute mostly to the wildfires, to see if it could cause air quality problems here or in other Southeast communities.

"We've kind of got an abnormal condition here," said Gerry Guay, program manager for the Air Monitoring Division in the Alaska Department of Environmental Conservation.

Smoke creeping in from the northeast fires has combined with the current high pressure system in Juneau to create a buildup of haze over the past seven days. The level of fine particulate pollution - a major component of haze - has doubled in Juneau since late last week, according to data collected by the state air monitoring division. If those levels worsen considerably over the weekend, Guay said his division may issue an air-quality advisory encouraging people with respiratory problems to restrict their outdoor activities.

The average particulate levels measured Wednesday and Thursday at the state's air monitoring station at Floyd-Dryden Middle School were 20 to 21 micrograms per cubic meter, well below the federal air quality limit of 65 micrograms.

However, even at much lower levels, fine particulate pollution can trigger respiratory problems such as asthma, according to a 2004 report by the federal Environmental Protection Agency.

The EPA is now reviewing the 65-microgram limit for fine particulates.

"There may be no safe level," said Guay, the state air division official.

Guay said his agency would issue a health advisory if fine particulate levels exceed 40 micrograms.

Haze usually affects Juneau for one of two reasons: smoke from wildfires in Canada and the Interior of Alaska or low clouds and fog from the Pacific, said Tom Ainsworth, a National Weather Service meteorologist based in Juneau.

Otherwise, "Juneau has some of the best air quality, anywhere I've ever been, " Ainsworth said.

Wetter weather beginning next Tuesday likely will cause Juneau's haze to dissipate, Ainsworth said.

But for now, a curving windflow traveling clockwise from northeast Alaska over the Yukon and northern British Columbia is bringing smoke from those area's wildfires to the Alaska Panhandle.

"The windflow hasn't changed in eight days," Ainsworth said.

As of Thursday evening, four major fires near Fort Yukon, Fairbanks and Tok had consumed hundreds of thousands of acres, crossed the Taylor Highway and stranded residents of Chicken. Also, the fire hazard potential for the Southeast's Tongass National Forest remained high due to dry conditions.

"We definitely want it to rain soon," said Pamela Finney, spokeswoman for the U.S. Forest Service in Alaska.

http://www.juneauempire.com/stories/062504/loc_jnuhaze.shtml

Web posted Tuesday, July 13, 2004

Air health advisory extended as smoky skies linger

By ELIZABETH BLUEMINK
JUNEAU EMPIRE

Pollution watch: Gus van Vliet of the state's air quality program checks the view of Thunder Mountain on Monday while explaining the air quality monitors on the roof of Floyd Dryden Elementary School.
Michael Penn / Juneau Empire

State regulators are extending an air health advisory in the Juneau area through Friday due to smoky conditions caused by fires in Alaska and western Canada.

Air monitoring by the Alaska Department of Environmental Conservation shows that fine particle pollution in Juneau remains below the federal health standard, but elevated enough to warrant caution, said Gerry Guay, program manager for DEC's air monitoring program.

The advisory will run through Friday. It advises those suffering from respiratory illness or heart disease, as well as the elderly and children, to limit their exposure to the smoke and outside exertion. All others are cautioned to limit prolonged outdoor exercise. Also remaining in effect is an open burning ban announced last week by Capital City Fire and Rescue.

Juneau's haze appears to be the result of wildfires hundreds of miles away, with little contribution of fine particle pollution from locally docked cruise ships, Guay said. He based his conclusion on a previous study that showed minimal air quality impact from the ships, and the fact that the air monitor for the Juneau area is in the Mendenhall Valley, where it is probably not affected by ship emissions.

National Weather Service meteorologist Chris Maier said the haze will likely persist through Thursday, when a front is expected to bring rain and wind. Weekend showers should also keep the haze out, Juneau-based Maier said.

The haze has been appearing off and on for several weeks, during periods of sunny weather. By now it has turned into a subject of local conversation, catching the attention of residents, tourists and business people alike.

"Gosh, it's hazy!" exclaimed Sarah Dunlap, co-owner of Alaska Fly-n-Fish Charters in Juneau, on Monday. "We aren't (seeing) those long vistas."

Though the haze hasn't stopped any Fly-n-Fish tours yet, Dunlap said that her husband, Butch Laughlin, could hardly make out the island's prominent Eagle Peak when he flew close by the scenic spot on Monday.

Apparently, news of the major wildfires and Juneau's haze has traveled as far south as Texas. "This morning I took a booking for two people in Texas who had obviously heard about it," said Barbara Kelly, sales manager for Alaska Discovery Wilderness Tours.

http://www.juneauempire.com/stories/071304/sta_.shtml

Blaze on barge subdued Monday

Fire on vessel with junked cars may have been started by spontaneous combustion

By ERIC FRY
JUNEAU EMPIRE

June 21, 2004

Firefighters attacking the scrap-metal barge fire near Haines on Sunday attribute success to their long hours and to quick thinking and hard work by the barge operators.

The fire on the barge W.J. Carbon was put out by 8:30 a.m. Monday, said Marcy Johnson, director of business development for Channel Construction, which leases the barge and owns the tug - the Lumberman - that was pulling it.

"There was still smoke in Haines this morning," said Capt. Eric Daigneault of the Fairweather Express, a passenger catamaran owned by Chilkat Cruises & Tours that helped fight the fire. "The whole valley from Haines to Skagway was choked with smoke. It was thick, black."

The barge caught fire about 2:15 p.m. Sunday as it was being towed from Juneau to Haines to take on more scrap metal, such as junked cars. Coast Guard officials said the fire might have been started by spontaneous combustion.

No one was injured. Two state ferries and three cruise ships in the area were delayed by the Coast Guard on Sunday.

During the fire, Channel Construction owner William "Shorty" Tonsgard and his nephew, Loren Tonsgard, an equipment operator, flew to the scene and boarded the barge, Johnson said.

The men on the barge used heavy machinery to draw water from Lynn Canal and spread it over the vessel, to move junk cars around so water could penetrate layers of metal, and even to pick up cars so firefighters could douse them, said people at the scene.

"That's what really helped us to get things under control," said Lt. Dave Gross of the Haines Volunteer Fire Department.

The barge was scheduled to be docked at Haines on Monday night and to be examined by a marine surveyor, the affected companies and the Coast Guard this morning, said Lt. Bill Jeffries of the Coast Guard Marine Safety Office in Juneau.

The Haines Volunteer Fire Department will stand by at the dock.

"There are probably still some hot spots bedded down in the structure so we're going to stand by when they tie up," said Fire Chief Scott Bradford.

Jeffries said the barge fire didn't pollute Lynn Canal and doesn't pose such a problem now. The vessel is stable, he said.

The state Department of Environmental Conservation said there were no reports of effects to the shoreline or wildlife.

The fire was fought by Coast Guardsmen on the cutter Anacapa, Haines volunteer firefighters on the tour boat Fairweather Express, and crew on the tugboat Le Chevel Rouge. Bradford said another tug boat helped, as well. A TEMSCO helicopter also dumped water from the air several times.

Daigneault skippered the Fairweather Express, which was the first rescue boat on scene, at 2:45 p.m. It carried some volunteer firefighters, company president Tom Crandall and engineer Bud Barber.

"When we rolled up on the scene a fuel tank or something exploded and we just got hammered with little bits and pieces of cars," Daigneault said. "We had bits and pieces of flaming debris landing on the boat."

The Fairweather Express backed off, but Daigneault saw a man on the barge near a truck containing tanks of diesel fuel, propane and liquid oxygen. Daigneault placed his ship next to the barge's stern, and firefighters pumped seawater through hoses onto the tanks of explosive materials.

"It was our job to make sure the fire wasn't headed toward any of that equipment," Daigneault said.

Until nearly 11 p.m., when the Coast Guard dismissed the vessel, Daigneault kept the Fairweather pressed against the barge. The Coast Guard continued to fight the fire through the night. Crew on the Anacapa couldn't be reached for comment Monday.

"It was getting so hot we were having to hose down the back of the boat," Daigneault said. At times the fire was 50 feet over their heads.

"I would say a third of (the barge) was cooking. It was getting so hot the steel (from cars) was melting and running over the side of the barge," he said.

Gross, of the Haines Volunteer Fire Department, said, "basically, it was just dumping as much water as you could on it for as long as you could."

Gross arrived home at the end of Father's Day, at about midnight.

"My son was sleeping next to the door waiting for me," he said.