



PEBBLE WATCH



October 2010 | BBNC

Inside: Meteorology

This issue of *Pebble Watch* focuses on the Pebble Partnership's data release "Report Series A: Meteorology," an overview of meteorological data collected between 2005 and 2007 in areas near the Pebble deposit and proposed port sites. Inside, we summarize the report, explain how the data will be significant for permitting, and provide a focused look at wind data collected by the two meteorological stations closest to the deposit site. Our science team also supplies some answers to questions community members first asked Pebble developers in 2005 ("Re-wind: Revisiting 180 Questions," page 4).

About Pebble Watch

Pebble Watch is an impartial, educational and fact-based initiative of the BBNC Land Department to disseminate information regarding the proposed Pebble Mine project to BBNC shareholders and interested parties. Pebble Watch does not attempt to integrate or interpret data; this would occur during an Environmental Impact Statement process. Instead, we seek to help BBNC shareholders better understand data by providing summaries as well as context, such as how the data may be used in the permitting process and how it relates to regulatory benchmarks.

*Produced by
the BBNC Land Department*

**Questions? Call
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 Bristol Bay
Native Corporation

Meteorological Data Collection and Pebble Mine Project

Among the reports project developers have released to the public is "Report Series A: Meteorology." This portion of the *Pebble Partnership Pre-Permitting Environmental & Socio-Economic Data Series* describes the meteorological monitoring program maintained since 2005 by Pebble developers in anticipation of air quality permitting needs.

Report Summary

"Report Series A: Meteorology" contains an Overview, Annual Data Reports and related materials. The Overview explains that meteorology data has been collected by Hoeffler Consulting Group in and near the Pebble deposit since 2005 for planning and project air permitting purposes. A program overview describes the types and locations of meteorological stations collecting data, how data will be used for air quality permit submissions, and when data releases will be made available to the public.

According to the report, of the nine stations collecting data, seven collect permitting-quality data. Six of these seven stations are near the Pebble deposit, about 19 miles northwest of the communities of Iliamna and Newhalen; the seventh, to the east, is at a proposed port site on Cook Inlet. Another two stations near the mine area are collecting data for design purposes.

Data reports have been released for three of seven stations collecting permitting-quality data (Pebble 1, Pebble 4, and Pebble Port). Only one year of data is available for Pebble 4 (2007); the other two include 2005-2007 data. Data collected includes wind speed and direction, temperature, solar radiation, precipitation, evaporation, relative humidity and barometric pressure. A table lists general information about each station,

including dates of operation, whether it is collecting data for permitting or project planning, and which of its data sets have so far been validated for accuracy; a map locates the stations.

The report further provides some "points of interest": maximum recorded wind gusts and hourly wind speeds, and maximum and minimum recorded temperatures for both the potential port and deposit sites. Data sets accompany the report.

The report explains that the baseline environmental meteorological data is required "as part of an Environmental Baseline Document and project permit application process, in part to assess the project's potential effects on air quality."

Pebble Watch Says...

Collecting detailed and specific information about surrounding weather conditions is a required part of the permitting process, used by state and federal agencies to identify factors that could affect air quality during construction or mine operation.

Measuring weather conditions, such as wind or solar radiation, is critical to air quality because these conditions help



*Wind study monitoring station.
Photo: Pebble Limited Partnership*

How Weather Affects Air Quality

- **Temperature:** Higher temperatures can promote chemical reactions that add to increased particle pollution and creation of ozone.
- **Relative humidity:** Low relative humidity reduces air movement, causing pollutants to build. High relative humidity causes particles to absorb moisture and swell, reducing visibility.
- **High pressure:** High pressure affects other weather conditions that contribute to increases in pollutant concentrations. For example, temperatures and humidity increase on the tail end of high pressure systems.
- **Wind speed:** As pressure builds over an area and winds decrease, particle pollution builds up, providing a more favorable environment for chemical reactions that create ozone and particle pollution.
- **Wind direction:** Responsible for transport and travel of pollutants. Predominant wind direction can have a considerable effect on regional air quality, as follows:
 - **Upwind sources:** Air quality can worsen in your community if the wind is blowing from a region with numerous sources of pollution. Winds from areas with little or no pollution can make your air quality better. Very light to no wind can be a problem for urban areas, because all the pollution that a city creates stays in one place.
 - **Recirculation:** The clockwise rotation of winds in a high pressure system can create a phenomenon called recirculation, causing a dirty parcel of air in one location to circle back around to where it started after accumulating more pollution. Recirculation often plays a role in the worst air quality episodes.

determine what regions and resources may be affected by a pollutant, how long they are exposed to a pollutant, and if conditions are likely to promote chemical interactions that might create more pollutants, such as ozone.

Of course, meteorological information provides only part of this picture.

After the type and quantity of potential emissions is known, other factors that are considered include comparison to national air quality standards and pre-existing (“background”) emissions in the region. Depending on the type of facility, quantity of expected emissions, and regional air quality concerns, a new potential “source” of emissions can be subject to stricter monitoring guidelines, specific controls, or additional permit submittals.

The Permitting Process

The State of Alaska Department of Environmental Conservation (ADEC) Division of Air Quality requires air quality permits for mine construction and mine operation. At the federal level, the Environmental Protection Agency (EPA) Air Quality Permit review can require a Prevention of Significant Deterioration (PSD) permit or a Minor New Source Review permit. Which permits are required depends upon the type of pollution source, its location and how its emissions are classified under existing National Ambient Air Quality Standards (NAAQS).

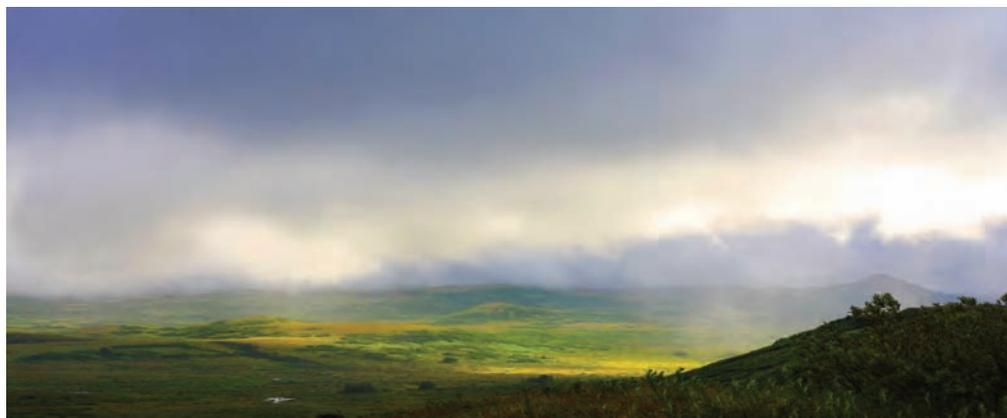
A PSD permit is generally required of large emitters and for certain industries. It does not prevent emissions increases, but is designed to ensure that “any decision to permit increased air pollution... is made only after careful evaluation of all the consequences” and includes a public process. Stated goals are to protect public

health and welfare, as well as air quality in “national parks, national wilderness areas ... and other areas of special national or regional natural, recreational, scenic, or historic value,” and to ensure preservation of existing clean air resources is considered along with a region’s need for economic growth.

National Standards & Regional Data

EPA’s NAAQS establish permissible levels for six common air pollutants: Carbon monoxide, sulfur dioxide, nitrogen dioxide, ozone, lead, inhalable particulate matter (PM) containing particles smaller than 10 micrometers (PM₁₀), and PM containing particles smaller than 2.5 micrometers (PM_{2.5}). These are called “criteria pollutants” because they are regulated based on health and environmental science-based criteria. The Clean Air Act additionally provides guidelines for 189 “hazardous air pollutants.”

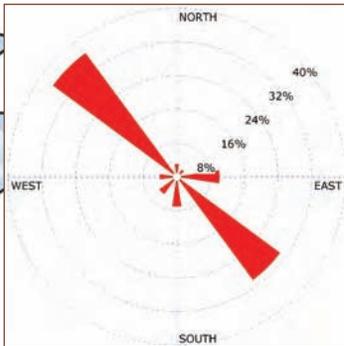
The closest source of data on regional criteria pollutants near Pebble is a monitoring station at Tuxedni Wilderness, a small seabird refuge made up of two islands at the mouth of Tuxedni Bay off Cook Inlet, near the northern coast of Lake Clark National Park and Preserve. The U.S. Fish & Wildlife Service (USFWS) is Federal Land Manager of the site and monitors air quality here because it is classified as a federal Class I air quality area under the Clean Air Act. The classification provides for additional protection from manmade air pollution by requiring consideration of air quality and air quality related values (AQRVs), including: vegetation, wildlife, soils, water quality, visibility, odor, and cultural and archaeological resources. The remainder of Lake Clark National Park and Preserve is a Class II air quality area.



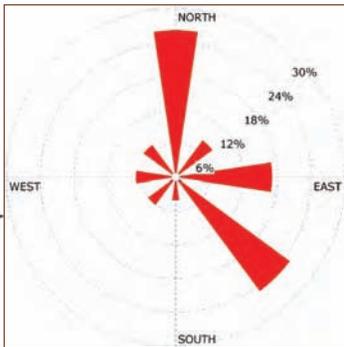
Valleys in the proposed Pebble Mine area. Photo: Bristol



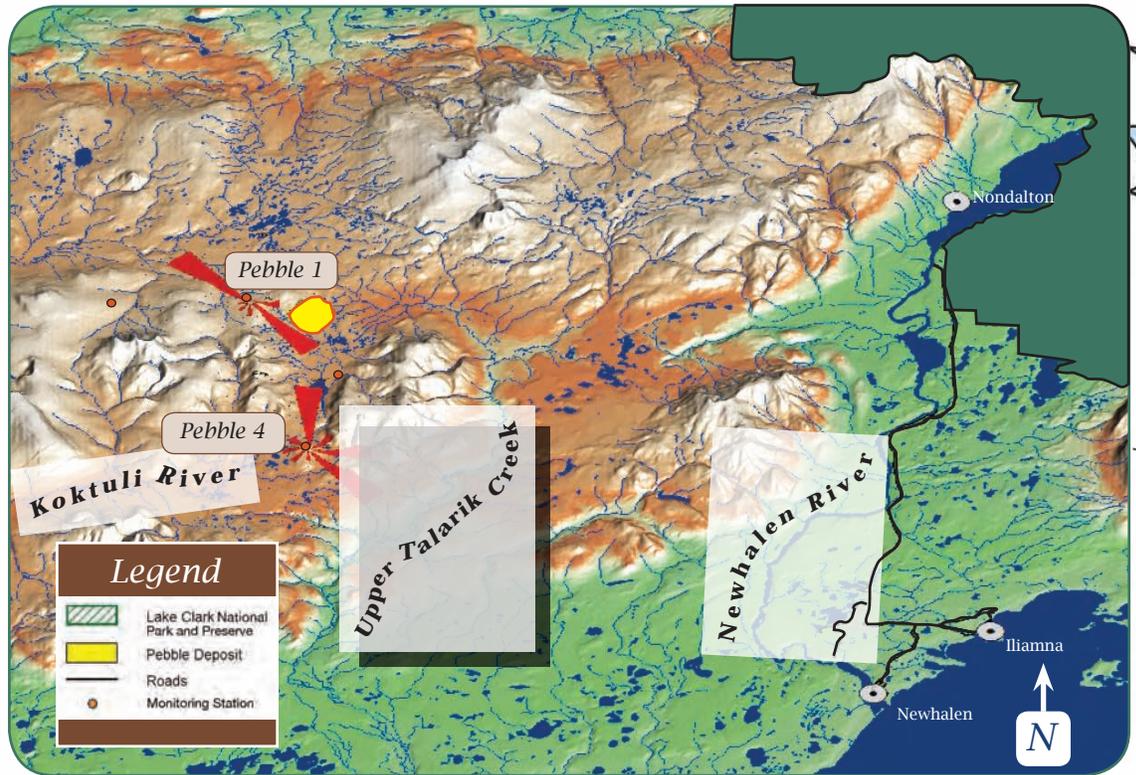
A TALE OF TWO STATIONS



Station 1 wind rose



Station 4 wind rose



Wind data superimposed on a map of the study area suggests how winds follow topography.

Graphic: BBNC Pebble Watch

As an example of how to read and use the information in the report, the Pebble Watch science team has highlighted data from two meteorology stations located within five miles of the proposed mine area.

Each station consists of an instrumented 36-foot high sectional tower secured with three guy wires and associated equipment nearby, including a small insulated building housing a data-logger and power supply. The wind and other data-collection instruments collect data continuously, as one-hour averages of one-second observations, as required by the PSD program and the ADEC permitting process.

A "wind rose," a diagram that shows wind speed and direction collected over time, provides a meaningful way to represent and understand this kind of data. The wider part of each fan-blade shape in these roses indicates the direction from which the wind was blowing. The length indicates the percent of the time it blew from that direction.

Pebble 1 is located at a proposed mill site, atop a knoll just west of the first discovered mine ore body, at about 1,550 feet elevation. Pebble 4 is located at a proposed tailings site, on another knoll, five miles south of the mine ore body, at about 1,200 feet elevation.

At Pebble 1, a wind rose that combines wind direction information collected from 2005-2007 shows winds predominantly from the northwest and southeast.

Five miles south, at Pebble 4, winds in 2007 were predominantly from the north, east and southeast. Winds were from the north more than a quarter of the time, and from the south or southeast more than 40 percent of the time.

PERMITTING:

Data summarized here may be used in applying for the following permits and others:



Under the federal Clean Air Act (as required based on emissions):

- EPA Prevention of Significant Deterioration (PSD) permit
- EPA Minor New Source Review permit
- EPA Greenhouse gas emission permit (being phased into effect beginning January 2011)
- AQRV Review (for PSD applicants within 300 km of a Class I air quality area), coordinated by ADEC in conjunction with the Tuxedni Wilderness Federal Land Manager (USFWS)

Required by the State of Alaska (ADEC):

- ADEC Air Quality permits for mine construction and mine operation
- Title V operating permit (issued after operations begin), as required by EPA based on emissions
- Visibility impact assessment, as required.



REWIND: REVISITING '180 QUESTIONS'

In 2005, the report "Response to the Nushagak-Mulchatna Watershed Council: 180 Questions About the Pebble Project," was created, with answers supplied by project developer Northern Dynasty Minerals (NDM). To help connect past discussion to current data, BBNC's Pebble Watch team has selected some of the Q&A's on Air Quality that we believe best relate to the Meteorology data collection.

Q. 49. What are the potential sources of contamination to air as a result of operations at Pebble?

In general, potential sources of contamination to air as a result of operations at the Pebble Project include dust and certain particulates from heavy equipment. †

Pebble Watch Says: Mine operations involved in processing and transporting ore could add to particulate pollution through the spread of coarse particulate matter (PM₁₀) such as dust from mine activities or vehicle loading and movement, and the transport of fine particulate matter (PM_{2.5}) in vehicle exhaust.

The amount, size, and shape of particulates, along with the chemical makeup of any particles being transported, should be part of the project's monitoring program to determine the potential effects of mine activities on regional air quality. However, the chemical components of any potential emissions cannot be known until a development plan is available.

Q.51. Of the various alternatives for power that are being considered, which is projected to have the lowest air quality impact?

In general, power generated from hydroelectric and natural gas generating plants, transmitted to the proposed Pebble mine site from the Rail Belt Grid via the Kenai

Peninsula, is expected to have the lowest air quality impact. NDM is currently using this power alternative for mine planning purposes. †

Pebble Watch Says: A current energy plan for the site has not been made publicly available. However, new EPA regulations being phased in starting in 2011 will require consideration of increased greenhouse gas emissions, such as carbon dioxide (CO₂) and methane (CH₄).

Q.52. How will dust be controlled in the mine environment?

NDM will employ a number of different approaches to avoid and reduce project-related dust at the mine site. This includes dust generated from mining activities, milling activities, and tailings disposal.†

Techniques and processes currently being evaluated include:

- blasting techniques that do not create large dust plumes;
- keeping tailings material saturated or under water;
- containing dust from the crushing and grinding process within the mill building; and
- undertaking all concentrate handling within enclosed areas.

Pebble Watch Says: Air permits issued by US EPA and the State of Alaska typically set project- and site-specific guidelines for project-related contaminants, including allowable limits and required control methods for dust/particulates.

Q.53. How will dust be controlled along the transportation corridor?

Dust control measures to be employed along the transportation corridor will depend on the type of road surfacing, which

has not yet been determined.†

In general, NDM may employ a number of different approaches to avoid and reduce project-related dust along the transportation corridor. These include:

- utilizing a concentrate pipeline, rather than concentrate trucks;
- road watering; and
- a truck-wash system at the mill site and the port site.

Pebble Watch Says: See previous answer.

Q.55. We are aware that Red Dog Mine had a problem with lead and zinc concentrate dust being released along the road to the port, and that this dust contaminated vegetation and soil, thereby affecting berries as a subsistence resource. How will similar contamination be avoided at the Pebble operation?

NDM is evaluating a range of options for transporting mineral concentrate from the mine to the port site.† Techniques and approaches currently being evaluated to control concentrate (or fugitive) dust from being released to the environment include:

- containing dust from the crushing and grinding process within the mill building;
- undertaking all concentrate handling within enclosed areas;
- utilizing a concentrate pipeline, rather than concentrate trucks; and
- a truck-wash system at the mill site and the port site.

Pebble Watch says: Meteorological data such as wind direction and intensity are among factors considered in air permitting, and it is likely any permits would set some specifications for dust control. However, air permitting addresses air quality, not deposition on plants or soil.

† The original answer further states that the information is being gathered and/or more information will be provided within mine planning materials submitted with the permit application in 2006. (The Pebble Limited Partnership has since notified the state of a new mine development plan in progress, which will take into account the discovery of Pebble East in late 2005. No updated mine development plan has yet been released.)