

SOME HEALTH EFFECTS OF COAL

Human activities and all our social constructs are a subsystem of the natural environment and are intrinsically dependent on the health of ecosystems. Human health is therefore embedded in and intimately dependent on the natural environment... [Health Canada, *The Canadian Handbook on Health Impact Assessment*]

This flyer has been produced by the technical and research committees of CoalWatch Comox Valley Society with two primary purposes in mind:

1. To explain why health must be considered in the environmental assessment (EA) process of the proposed Raven Underground Coal Mine Project;
2. To provide information on how coal affects environmental and human health, both near where coal is mined, and resulting global effects.

"The environmental assessment (EA) process is a comprehensive planning process to predict and assess the effects of a proposed project, program or policy." However, social and health impact assessments have been identified as areas that "are not considered or are inadequately treated in project environmental impact assessment." Rather, the practice has been to attempt to deal with health problems created by a project instead of "setting in place appropriate preventive strategies as an integral part of the original development."

Health assessment needs to be integrated into EA for reasons such as: (1) addressing public concerns; (2) minimizing the need for separate health and environmental impact assessments; (3) demonstrating cost effectiveness; (4) minimizing the adverse and maximizing the beneficial effects on health; and (5) supporting the concept of sustainable development.

The bottom line is that it makes sense to include health considerations within EA for economic and social reasons and to ensure that the health and well-being of individuals and society are not compromised.

If one uses the World Health Organisation's (WHO) Determinants of Health guidelines to establish the baseline profile and the effects analysis, then two key questions have to be considered:

- How do the environmental effects of the project contribute to the inequitable distribution of power, money, and resources?
- How does the project affect the quality of daily life, who benefits, and who pays the costs?

We propose another question: Why is not Health Canada one of the "responsible authorities" (RAs) in the Raven Coal EA process? The people of central Vancouver Island would like to know the answer.

While the proponent's draft Application Information Requirements (dAIR) document proposes "a human health risk assessment based on chemical toxicity of country foods, there is no analysis proposed for the other aspects of health."

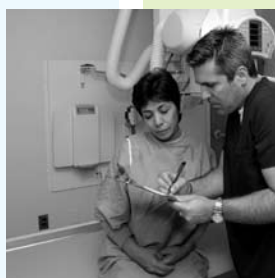
There are no details about how the activities at the mine site, including mining, blasting, processing, and loading for transport will affect the health of people who live in the vicinity. Neither is there any clear information on what will be the effects on air and water quality for people living nearby. There still has not been a full mapping and assessment of the groundwater and aquifers that provide well water for local residents and businesses, so there's no way to tell if or how water sources may be affected.

People in Port Alberni are justifiably concerned about the health effects of large numbers of coal trucks travelling through city streets and having a coal port on the city's waterfront.

Health Canada's Health Impact Assessment guidelines recommend collecting the "best available qualitative and quantitative evidence using a range of methods," but the dAIR suggests only a very narrow range of baseline data. Clinical psychologist Dr. Sheila Clarkson (retired) says,

The dAIR completely misses critical components... glosses over ... known issues likely to impact human health and wellness in the project areas. The section on Environmental Health Valued Components for humans addresses only 'non-carcinogenic toddlers and carcinogenic adults.' This overlooks documented health concerns in coal mining areas that include low birth weights, elevated preterm birth rates, as well as increased rates of heart, respiratory, and kidney disease in adults.

In 2008, the World Health Organisation calculated that pollution from coal particulates cause approximately 1 million deaths annually across the world, about one-third of all premature deaths related to all air pollution sources. Also in 2008, the Harvard Medical School estimated the annual cost of "externalities" (see p. 3) from coal combustion in the US to be US\$345 billion; one-third of that, US\$187 billion, resulted from air pollution that contributes to heart, lung, kidney, and neurological disease. Each stage in the life cycle of coal—extraction, transport, processing, and combustion—generates a waste stream and carries multiple hazards for health and the environment.



What is health?

Health is a state of complete physical, mental, and social well-being, and not merely the absence of disease or infirmity.

World Health Organisation, 1948

WHAT IS COAL?

Coal is an organic, combustible sedimentary rock that also contains minerals and inorganic material within the organic matter. The compressed organic matter laid down in typically saline inland sea basins or swamps millions of years ago is interspersed with finely weathered rock material, known as shale. The heaviest metals accumulate in the coal and shale strata because their densities and electronic charge mean they tend to concentrate in depositional environments. Coal and coal shales, therefore, concentrate and accumulate the heaviest of metals, amongst other elements, most of which are bio-toxic and some of which are also radioactive. Coal classification ranges from anthracite – the hardest – down through bituminous, sub-bituminous, and lignite, also known as brown coal.

WHY IS COAL TOXIC?

Coal is toxic because elements such as arsenic, mercury, lead, nickel, cadmium, selenium, vanadium, and copper are accumulated and concentrated within coal and associated strata.

Coal seams can have six times as much arsenic, five times as much uranium, four times as much mercury, and three times as much lead compared to a typical basalt (hard igneous rock). These elements are referred to as toxic heavy metals because of their negative physiological effects, both chronic and acute, on plants, animals, and aquatic life.

Radioactive elements such as uranium, thorium, and radium are also accumulated and concentrated within coal strata. These are toxic in their own right and toxic via the radioactivity they emit.

Coal seams, even ones considered "low sulphur," contain significant amounts of sulphur and sulphides, the biotoxicity of which increases when exposed to air or water.

The fine particulate nature of coal dust and its toxic constituents are readily inhaled. These lodge in the lungs, where they can travel to the heart and circulatory system. They can also be ingested.

Coal strata also contain hydrocarbons and benzene-ring derivatives within their organic layers that are considered carcinogenic. Coal seams outgas methane when their layers are disrupted.

Any water found within coal strata will be saline and contaminated with organic derivatives and toxic metals.



Photo:
Gary Fiegehen

As the Medical Health Officers for Central and North Island, we strongly support the incorporation of health assessments into any project undergoing an environmental assessment. The environment and human health are intimately intertwined such that we require a healthy environment to be able to maintain our individual and collective health and well-being. The people and populations who must live with the consequences of environmental projects, such as coal mining, should have the opportunity for a full and transparent health assessment.

The health parameters used in the health assessment would provide the balance to the effects that any large project may cause. The process of developing the health assessment, monitoring impacts, and surveillance for negative and positive outcomes, when done collaboratively, can contribute to a healthier community.

Dr. Paul Hasselback and Dr. Charmaine Enns

The Mercury-Coal Connection

Mercury is a heavy metal that is naturally found in several forms in the environment. When elemental mercury is released into soil and water, microscopic organisms may convert it into methylmercury, which builds up in the bodies of fish, marine mammals, wildlife, and people (bioaccumulation) and concentrates up the food web (biomagnification).

Mining and burning coal causes mercury (Hg) to be released into air and water. This toxic heavy metal has many nasty effects on all living organisms. And it just doesn't stay where it is burned or mined. It travels all over the world (see map below),

Effects of Toxic Chemicals on our Minds and Bodies

Some chemicals build up in our bodies, or bioaccumulate, throughout our lives (PBDEs, PCBs, dioxins, and methylmercury, for example). What is the relationship between toxic chemicals and rising rates of autism, attention-deficit hyperactivity disorder, and other learning and developmental disabilities? Scientific evidence implicates environmental exposures as discernable contributors to adverse health outcomes, such as cancer, neurodegenerative diseases, reproductive health problems, diabetes, and learning and developmental disabilities.

Industrialization of the developing world means higher energy consumption and more pollution. Many air pollutants remain in the atmosphere long enough to be transported over intercontinental distances. Four such pollutants that have implications for human health, global climate, regional environmental quality, and sustainable economic development are:

- Ozone and ozone precursors
- Airborne particles
- Mercury
- Persistent Organic Pollutants (POPs)



Winter sunrise over Fanny Bay. Lynne Wheeler photo.

How does mercury get into our bodies?

Atmospheric mercury, once deposited onto land, can be reemitted into the atmosphere, taken up by plants, or transported to water bodies by surface runoff. In water, anaerobic bacteria convert mercury into methylmercury, a very potent neurotoxin. Methylmercury can bio-accumulate more than a million-fold in the aquatic food chain.

Human consumption of fish with high concentrations of mercury increases the risk of adverse health effects including mental retardation, cerebral palsy, deafness, blindness, and dysarthria in those exposed *in utero* as well as sensory and motor impairment in exposed adults. According to the (US) National Academy of Sciences, more than 60,000 children born each year (in the US) may suffer learning disabilities due to mercury.

The persistence of mercury and the bioaccumulation of toxic organic mercury compounds in the aquatic food chain has raised concern of the local and long-range atmospheric transport of mercury as the linkage between anthropogenic mercury emissions and high methylmercury concentrations in fish.

Inorganic mercury is converted to methyl mercury in waterbodies. As a result, the primary source of exposure to methylmercury is through consumption of contaminated fish and seafood. Methylmercury is present at some level in all fresh and saltwater fish, but some fish have higher levels than others. Because methylmercury builds up in muscle tissue, eating large, predatory fish and other marine wildlife at the top of the aquatic food web commonly causes higher exposures.

Methylmercury exposure occurs in fetuses and infants because it readily crosses the placenta and can be present in breastmilk. Mercury exposure can also occur through consumption of food items that are not fish. It has been detected in commercial high fructose corn syrup which is presently ubiquitous in processed foods, including baby formula.

Coal dust, and contaminated water used for agricultural purposes, can result in amounts of mercury occurring in produce, fruits, dairy products, eggs, and meats. While the amounts may be almost negligible in isolation, because mercury bioaccumulates, there is lifelong exposure.

TOXIC TRADE: The Coal-to-Mercury Cycle between Alaska and Asia



While the map above refers to Alaska, the same is true for British Columbia. When we consider coal export plans, we need to consider that byproducts of the coal may return to haunt us. In fact, there is a growing body of scientific research examining the ways that emissions cross oceans to cause pollution problems halfway around the world.

The Task Force on Hemispheric Transport of Air Pollution has found that as much as a quarter of ground level ozone pollution in the northern mid-latitudes arrives from the stratosphere. Downwind of eastern Asia (i.e. in North America), researchers have clearly documented that marine air can import ozone concentrations that exceed air quality standards. Scientists have also shown that soot, dust, and mercury can travel from one continent to another.

The Seattle think tank Sightline says sulphur compounds, soot, and other byproducts of Asian coal combustion are detectable on mountaintops in western North America. Mercury is especially likely to travel across the Pacific Ocean. An Oregon researcher estimates that as much as 18% of the mercury in Oregon's Willamette River comes from sources overseas, increasingly from China. Another study found that human-created pollution from Asia contributed to 14% of the mercury dropped on central Oregon.

While there are none there now, up to six new coal ports have been proposed for the Washington and Oregon coasts. There is a large coal port at Roberts Bank near Vancouver, BC. Adding another at Port Alberni on Vancouver Island means a massive export of coal and an equally massive return of pollution.

COAL DUST IS A SERIOUS HEALTH HAZARD

Whether you live near the mine or along a coal truck route, you will be exposed to coal dust. In coal mining areas in the USA, studies showed that people living in coal mining areas had higher rates of health problems, including cardiopulmonary disease, chronic obstructive pulmonary disease, high blood pressure, lung disease, and kidney disease.

Trains and trucks hauling coal release toxic air pollutants, including tons of nitrogen oxide (NO_x) and particulate matter (PM) into the air every year, primarily through diesel exhaust. Some of the health effects of NO_x and PM include increased asthma, wheezing, and cough in children; heart rhythm disturbance, ischemic heart diseases, and congestive heart failure; and higher rates of infant mortality. In addition to NO_x and PM, the coal dust also contains heavy metals, such as selenium, lead, and mercury. The dust may be carcinogenic, and has been linked to lymphomas.



Worker health and safety is a major concern. Black lung disease, or pneumoconiosis, is the primary illness in underground coal miners. In the 1990s, over 10,000 former US miners died from this, and the rate has more than doubled since 1995. Accidents (gas leaks, explosions, flooded tunnels) also take a toll. Since 1900, over 100,000 have been killed in coal mining accidents in the US.

Some specific concerns for Port Alberni



- ★ Coal would be trucked by B-train trucks—6 trips/hour, 24 hours/day, 7 days/week, in all seasons, for 16 years (838,656 trips coming and going) on Hwy 4, dangerously winding through Cathedral Grove and over “the Hump,” then down a main city street past the hospital, businesses, and residential areas to Port Alberni’s waterfront. In addition to air pollution from diesel trucks and coal dust, heavy truck traffic damages roads, repairs for which are a cost to the city.

- ★ Daily wind at the Port Alberni waterfront is driven by a strong summertime diurnal convection pump caused by the unique microclimate and geomorphology of the Alberni Valley. This

strong wind is likely to transport coal dust far beyond the local study area, causing direct exposure to the marine, terrestrial, and freshwater ecosystems to the extent that coal dust is transported by the wind.

- ★ A similar problem exists in the context of the strong tidal and river flows, and related currents and circulation of the Somass estuary.

These currents will transport any coal- or dredge-related pollution up the estuary and down the Alberni Inlet to Barkley Sound, which is also exposed to complex and strong ocean and coastal currents and winds.

- ★ Alberni gets about 2,000 mm of rain/yr. Coal dust from the trucks will be washed into storm sewers and end up in local streams and the Inlet, important fish-bearing waters. Settling ponds at the port for washing down the trucks is another source of pollutants to the Inlet.

- ★ The head of the Inlet is underlain by deposits from decades of pulp mill effluent, including dioxins, furans, PCBs, and many other toxic substances. The harbour will have to be dredged to accommodate huge Panamax freighters, which will stir up these pollutants, and which will also be entrained in the water every time a tugboat is used.

- ★ Port Alberni has a very sensitive airshed with complex and localised meteorological conditions. Characteristic thermal inversions trap pollutants and lead to exceedances of air quality objectives for fine particulates (PM 2.5) up to 40% of the time for some winter months.

- ★ Ship exhaust influences need to be analysed: the number of ships, fuel grade, port duration, idling exhaust, and potential exposures, especially during summer heat and inversion conditions, should be addressed.

- ★ Placing an industrial installation like a coal transport and storage depot within a populated city neighbourhood is poor planning. This proposed coal port will subject area residents to increased stresses caused by noise, traffic, dust, exhaust, and light pollution that will result in a loss of enjoyment of their homes. They will also be at a higher risk in the event of port accidents and emergencies, such as fire and smoke damage from all potential sources and hazardous substance releases.

- ★ Since this area is within the Pacific Rim of Fire extreme seismic zone, it is in a high risk tsunami and earthquake region.

Mental and Emotional Health Also Affected

Individual health outcomes are significantly dependent on psychosocial factors and stresses. As surely as heavy metals in water or coal dust in air can be directly linked to health problems, the stresses in the psychological environment of the areas to be affected by this mine can negatively impact health outcomes. Concerns about stress and mental health should be included in the scope of the health assessment.

The medical literature is clear about the interaction of physical and psychological factors in the development of and healing from disease. As much as 30% or more of health outcomes can be accounted for by stress and psychosocial factors.

This proposed mine began to affect people’s health from the day it was announced.



As reported on March 23, 2012, in the *Alberni Valley News* (p. 7), a report recently released by the Vancouver Island Health Authority (VIHA) says “Alberni’s infant mortality rate is 10.7 per 1,000 people, which is above the BC average of 3.4 per 1,000. As well, infant death and stillbirth rates are 120% and 85% higher, respectively, than the VIHA average.”

“The Alberni region also has the highest rate of rheumatoid arthritis and the second highest rate of diabetes in VIHA.... The data is region wide and not Port Alberni specific, and therefore must be taken into context.”

Nonetheless, these are definite concerns that need to be considered when deciding whether or not to turn Port Alberni into a coal export town.

“EXTERNALITIES”

“Externality” is a term used in economics. Externalities are those costs that governments and industries often ignore when they tout the economic benefits attributed to a project. They are effects on a third party (or society in general) that are not necessarily minor or localised. Often, those who suffer from external costs do so involuntarily.



Photo: Sierra Club, Virginia Chapter

Externalities include the social and environmental “side effects” of a project, such as air and water pollution resulting from mining and burning fossil fuels. In the case of the air pollution from coal mining, for example, they can be the high physical, emotional, and financial costs of disease and health care borne by residents and health agencies. In a study conducted in a coal-mining area of Virginia, where mine trucks

went through residential areas, the following results were documented:

Fine particulate matter and ozone have the greatest impact on human health...they are responsible for increased morbidity and mortality. The death rate from air pollution is approximately 40% of that for tobacco use. The health costs are approximately \$4.8 billion. Interventions that reduce air pollution are accompanied by a comparable percentage fall in respiratory illness in children, and a substantial decrease in death rate. A one-third reduction of air pollution in Virginia could lower children’s respiratory illnesses by approximately one-third, reduce death rate by 3% and save Virginia 1.6 billion dollars per year.

Other examples of externalities include social, economic, and environmental effects, such as: loss of the Baynes Sound shellfish industry; high costs for residents and others to pay for water treatment; loss of business for tourism providers; loss of use of fish and country foods, particularly by First Nations communities; displacement of residents who may have to move from an area for health reasons; and loss of fish and wildlife from an area that has been polluted, to list a few.

Climate change attributed to greenhouse gas emissions is a major externality caused by the burning of fossil fuels. Some economists consider it a “unique challenge for economics; it is the greatest example of market failure we’ve ever seen.” [wikipedia.org]

While governments may say a given project will result in positive economic benefit for a region, or bring in X number of tax dollars, the costs for health care, environmental remediation, or infrastructure (roads, bridges, etc.) may outweigh the perceived economic benefits of a project.

As citizens, we have to become aware of the externalities that could result from a project and ensure they are considered by governments BEFORE they grant a permit for a project to go ahead.

WHAT ARE SOME OF THE EFFECTS OF COAL MINING ON WATER?



A good deal of health concerns relate to water, whether it's water for fish and wildlife, or water for people. Coal contains mercury, lead, cadmium, arsenic, manganese, beryllium, chromium, and other toxic and carcinogenic substances. Coal crushing, processing, and washing releases tons of particulate matter and chemicals on an annual basis and contaminates water, harming community public health and ecological systems.

Over the life cycle of coal, chemicals are emitted directly and indirectly into water supplies... Chemicals in the waste stream include ammonia, sulphur, sulphate, nitrates, nitric acid, tars, oils, fluorides, chlorides, and other acids and metals, including sodium, iron, cyanide, plus additional unlisted chemicals.

A recent study found that emissions and seepage of toxins and heavy metals into fresh and marine water were significant. For example, elevated levels of arsenic in drinking water have been found in coal mining areas, along with groundwater contamination. In one study of drinking water in four counties in West Virginia, heavy metal concentrations (thallium, selenium, cadmium, barium, lead, and arsenic) exceeded drinking water standards in 25% of the households.



Coal mined at the proposed Raven project will be crushed and washed for export. Impurities removed from the coal by screening and washing will be placed in waste piles. As with the mining waste, rain will percolate through these piles, dissolving soluble components and washing them into local water bodies. This runoff is acidic and contains heavy metals. Salmon and trout in Cowie Creek, the Tsable River, and Wilfred Creek are at serious risk from mine water pollution and changes in seasonal flow patterns.

Acid mine drainage can release toxins for centuries. Taxpayers paid \$69 million to clean up the Britannia mine that killed Britannia Creek and affected millions of salmon in the Squamish Estuary. After the Mount Washington mine destroyed the Tsolum River fishery, taxpayers paid \$6 million to restore the river. Government Public Accounts for 2010 estimated that taxpayers could be liable for more than \$594 million to clean up contaminated mines and oil, gas, and energy sites. Under our current system, if a mine pollutes and then goes broke, neighbours and others are likely out of luck and out of pocket.



Somass Estuary

In Port Alberni, the harbour will have to be dredged to accommodate Panamax-sized vessels. The deposition of over four decades of pulp mill effluent containing dioxins, furans, PCBs, and many other toxic substances will be stirred up. The Inlet and Somass estuary is a major migration corridor for salmon. The "re-pollution" of this marine environment may have major effects on the First Nations food fishery, on tourism, and on the sport fishing industry.



EARTH DAY 2012

I'm not a narrow thinker
Like a fish inside a bowl.
I love this place I live in
And I just don't want that coal.

When I look at where we've been with that
From the mining to the burning
The tale is full of warning signs
But are we up for learning?

For the sake of air and water
We wouldn't burn it here.
So why should we feel good about
Exporting what we fear?

We want to heal our waterfront
The reasons are a-plenty
So should we pile it high in soot
And kill Outlook 20/20?

Who should have a greater say?
A one-track corporation?
Or those who hang through thick and thin
Our residents and First Nations?

They said that Quinsam would be good
Their A. I. R. was wordy
But their promise for good testing
Now shows the water's dirty.

If you go to paint an image
Of what we want to be
Do you dream a dirty coal port
Or the sun on land and sea.

And which one do you think would grab
A tourist on the run?

Which one would make them want to leave
Or stay and have some fun?

The plan to grow and flourish
Will certainly abort
If we dumb-down and settle
For log and coal exports.

So let us count our blessings
Our needs and rights from birth
Let us pay our homage now
And celebrate the Earth.

By Mary Conley
Port Alberni, BC

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Contact us at www.coalwatch.ca