# Responsible Growth * NE

Hello: The attachment is the electronic version of the paper scoping document that was presented earlier today (10/26/18) to Grant Pfeifer.

This electronic file is exactly the same as the paper document. The paper document contains 2 additional pages in Section 4: Appendix: Photographs--Forest Fire Smoke, Pend Orielle County Area. The 2 additional pages in the paper document are the photos on pages 96 and 97, but with the heading changed to "... Pend Oreille and Bonner Counties", as some of the pictures on pages 96 and 97 are from Bonner County.

Thank you,

John Endres
Responsible Growth*NE Washington

# Scoping Elements of the Environment for the HiTest Sands/PacWest Newport Silicon Smelter Project: Scoping Questions

**Submitted by: Responsible Growth*Northeast Washington**

**Summary**. The HiTest Sands/PacWest Newport Silicon Smelter Project contradicts a multitude of elements of the Washington State Growth Management Act, the Pend Oreille County Comprehensive Plan, the Pend Oreille County Development Regulations, the Washington State Carbon Policy, the Washington State 20-Year Forest Health Strategic Plan: Eastern Washington, Pend Oreille County Updated Shoreline Master Plan, Revised Code of Washington 84.34.200, Federal Clean Water Act, and Executive Order 89-10: Protection of Wetlands.

The dramatic alteration of the rural setting and livelihoods of Newport and surrounding areas will be devastating. The adverse impacts of smelter emissions are well known, and area citizens' health will be compromised. That the smelter will be located within 1 to 2 miles of 11 Newport schools is particularly disturbing. The toxic Sulfur and Nitrogen Oxides emissions will produce acid rain that will exacerbate the already poor health of our forests, and will compromise our soils ability to support agriculture and sustain our forest and wildlife ecosystems. The health of our rivers, lakes, (riparian, wetlands), and streams will also suffer. (and could potentially exceed Nitrogen and Sulfur critical loads). The beautiful Pend Oreille River is 303(d) listed for Category 5 pollutants and therefore does not meet water quality standards for Water Temperature, PCBs, pH, and Mercury. None of these 4 pollutants has an EPA-approved TMDL (Total Maximum Daily Load). The smelter site will be located at the apex of the troubled Little Spokane River watershed.

In addition to the toxic smelter stack and other emissions; this project will cause significant damage to the Newport area topography and infrastructure due to excessive excavation and earth movement to accommodate the massive increase in truck and rail transportation. The constant noise and vibration of the submerged arc furnaces, the heavy truck and rail traffic, and the loading/unloading of materials will disturb and harm people and wildlife and potentially alter existing migratory routes

The adverse impacts of toxic emissions; excessive noise, light, heavy transportation and energy use (flicker disturbances, availability, and cost) will all have a severe negative impact on existing business and tourism—this will have untold negative consequences on our economy.

In addition, the secretive (and potentially illegal) process of orchestrating this project without citizen input by ignoring the Washington State Growth Management Act, and the Pend Oreille Comprehensive Plan is also discussed.

We submit that the contradictions of the Growth Management Act, the Pend Oreille County Comprehensive Plan, and the Pend Oreille County Development Regulations violate the inalienable rights of Newport, Pend Oreille County, and Northeast Washington citizens; and also the citizens of North Idaho.

## *Contents*

**ELEMENTS OF THE ENVIRONMENT**

**INTRODUCTION: Overview of Pend Oreille County.**
This introduction is taken from the **"Section 1: "PEND OREILLE COUNTY Description of Pend Oreille County"** *web page.* This section provides a good overall description of the natural environment of Pend Oreille County and is used throughout the Scoping document.

**Scoping Questions are numbered in sequence and appear throughout this document, e.g., SQ##**

**SECTION 1 Natural Environment.** This section describes the status of our current environment. *Note: underlined topics = PacWest "line-outs". We disagree with all of the line outs.*

**(a) Earth.** Forests, Soils, Agriculture, Topography, Geology, Unique physical features, Erosion / enlargement of land area (accretion)

**(b) Air.** Air Quality, Odor, Climate

**(c) Water.** Surface water movement/quantity/quality, Runoff/absorption, Floods, Groundwater movement/quantity/quality, Public water supplies

**(d) Plants and Animals.** Habitat for and numbers or diversity of species of plants, fish, or other wildlife, Unique species, Fish or wildlife migration routes, Public water supplies

**(e) Energy and Natural Resources.** Amount Required/rate of use/efficiency, Source/availability, Nonrenewable resources, Conservation and renewable resources, Scenic resources.

**SECTION 2 Built Environment.** This section describes the impacts of the smelter on our environment and includes our questions and concerns. *Note: underlined topics = PacWest "line-outs"*

**(a) Environmental Health.** Noise, Risk of Explosion, Releases or potential releases to the environment affecting public health, such as toxic or hazardous materials

**(b) Land and Shoreline Use.** Relationship to existing land use plans and to estimated population, Housing, Light and Glare, Aesthetics, Recreation, Historic and cultural preservation, Agricultural crops

**(c) Transportation.** Transportation systems, vehicular traffic; waterborne, rail, and air traffic; Parking; Movement/circulation of people or goods; Traffic hazards

**(d) Public Services and Utilities.** Fire, Police, Schools, Parks or other recreational facilities, Maintenance, Communications, Water/stormwater, Sewer/solid waste, Other Governmental services or utilities.

**SECTION 3 Alternatives.** Alternatives to Coal Reductants for $SiO_2$, Alternatives to pure Silicon extraction from $SiO_2$, Alternatives to Silicon for Solar Cells, Alternatives to Heavy Industrial Exploitation

**SECTION 4** ***Appendices***
**SECTION 5** ***References***

**ELEMENTS OF THE ENVIRONMENT.**

**INTRODUCTION**: **Overview of Pend Oreille County**. *From:* "Section 1: "PEND OREILLE COUNTY Description of Pend Oreille County" *web page*: http://pendoreilleco.org/wp-content/uploads/2015/08/Section-1_Pend-Oreille-County.pdf

***Note:*** *Sections of this web page document have been copied directly into this Scoping Document to facilitate the description of the overall current status of Pend Oreille County's natural environment and other features. Elements of this web page document will be referenced throughout subsequent sections of this Scoping Document. Paragraph numbers and page numbers of the web page have been added to this scoping document by the scoping document authors (e.g., P1-p2 = page 1, paragraph 2). Also, (e.g., P34-bp4 = page 34, bullet point 4)*

**PEND OREILLE COUNTY**
**DESCRIPTION OF PEND OREILLE COUNTY** *(1)*

*(P18-p1)*
Just as the Rocky Mountains plunge into the United States on their majestic march from British Columbia, a western range called the Selkirk Mountains, runs in close parallel down into Idaho and Washington. This rugged spur offers exposed segments of the North American Continent and the Kootenay Arc, tectonic plates that began colliding over a billion years ago, and provides exceptional year-round settings for a variety of recreational opportunities. This lesser range is home to bighorn sheep, elk, moose, deer, bear, cougar, bobcats, mountain caribou, and several large predatory birds such as bald eagles and osprey.

*(P18-p2)*
Not far from where these Selkirk Mountains end, Pend Oreille County begins its association with the Pend Oreille River. Pend Oreille County is a relatively small county that looks like the number "1" set in the northeast corner of the State of Washington. Pend Oreille County is 66 miles long and 22 miles wide. British Columbia is across the international border to the north. Spokane County and the regional trade center, the City of Spokane, lie to the south. Idaho's Bonner and Boundary counties form the eastern border, and Stevens County, Washington forms the western border. (For a map of Pend Oreille County, see Appendix A)

*(P18-p3)*
Encompassing more than 1400 square miles, most of Pend Oreille County takes the form of a long, forested river valley. This area, known as the Okanogan Highlands, is unique since it is the only area in the country where plant and animal species from both the Rocky Mountain Region and the Cascade Mountain region can be found. Pend Oreille County ranks 25th in size compared to Washington's other 39 counties. There are fifty five lakes, 48 creeks and numerous wetlands dotting the natural meadows, the forested foothills and the mountains. There are seventy mountain peaks within our county borders, the highest of which is Gypsy Peak (7309'). Several of the peaks are the endpoints of interstate hiking trails and offer exceptional vistas into Idaho and Canada. Nestled within these forests and mountains are the Cusick Flats and other sections of the county with areas of specific agricultural land use.

*(P18-p4)*
The county is predominantly a hilly to mountainous terrain on both sides of the Pend Oreille River as it flows north through the entire county but for the very southern 10 miles of the county. This southern area is headwaters of the Little Spokane River with the watershed divide running roughly east-west from Newport to the Sacheen Lake area. The southerly regions of the county, along with the Pend Oreille River lowlands, have historically been the easily accessible, low elevation areas and are best suited for human settlement. All of the major towns in the county are located along the Pend Oreille River and virtually all agricultural land is part of the Pend Oreille River floodplain or along creek bottoms in the southern third of the county.

*(P19-p1)*
The Pend Oreille River, the second largest in Washington State, flows through the county in a northerly direction for about 155 miles from its headwaters at Pend Oreille Lake in Idaho to the Columbia River in British Columbia, Canada. The northward-flowing river, fed by more than twenty-two tributaries, also supports a modest amount of farming as it courses through our rural county.

*(P19-p2)*
During the ice age, the Pend Oreille Lobe of the Missoula glacier formed the Pend Oreille River. The Missoula Glacier, part of the Cordillera Ice Sheet, extended south and covered the valley. During the retreat of ice, the formation of recessional lakes and the laying down of materials in still water were widespread. Alluvial sediments deposited on the wide, nearly level of undulating lakebeds, and low outwash terraces along the river, were most prevalent. As the glacier receded, tremendous overflows from lakes hundreds of feet deep carved unique features in the basin. Today, the river is the main artery in the county. It provides spectacular sanctuaries for an abundance of wildlife and buttresses pristine forests of Western Larch, Douglas Fir and Ponderosa Pine, interspersed with groves of Aspen, Maple and Poplar.

*(P19-p3)*
Pend Oreille River valley's sides are comprised of glacial drift, colluvium and rock outcrops. Dolomite bedrock can be seen on both sides of Box Canyon for about .75 miles south of Box Canyon Dam. Granite rocks are exposed between Lost Creek and the east branch of LeClerc Creek. From the upstream end of Box Canyon to Tiger, the river flows through predominantly glacial lake deposits of buff-colored silt, fine sand and gravel. These deposits are nearly continuous on the river up to Dalkena, where the Newport Fault is exposed along the edge of the river. On the east bank of the river, materials vary from glacial lake deposits to metavolcanic rocks of the Windermere Group. FOR A MORE SPECIFIC DESCRIPTION OF THE SOILS OF PEND OREILLE COUNTY SEE Appendix B.

*(P19-p4)*
Wetlands are extensive and relatively diverse in the county. Wetlands are those areas intermittently or permanently covered by shallow surface water or saturated with ground water. Jurisdictional criteria for wetlands normally entail the presence of hydrophytic vegetation, hydric soils and wetland hydrology. Wetlands within the riparian zone, including sloughs, are classified Riparian Habitat. Wetlands mapped as Priority Habitat in the county are near Calispell Lake and Calispell Flats. The designating criteria for wetlands include significant large concentrations of waterfowl; a waterfowl migration staging area; nesting waterfowl, including cavity-nesting species; winter bald eagle use and great blue Heron foraging areas. These are important habitats for migrating, wintering and breeding waterfowl. Large concentrations of waterfowl stop during spring and fall migrations on sloughs and the larger ponds and in

wetlands adjacent to the river corridor, principally Calispell Lake and the Calispell Flats. Waterfowl productivity studies indicate that there are important waterfowl nesting areas near Cusick Sough, Tacoma-Trimble Slough, Everett Island and Indian Island.

*(P20-p1)*
All of the amphibian species in the study area breed in aquatic habitats, particularly in seasonal or persistently flooded wetlands. Two Priority species, the Columbia spotted frog (Rana luteiventris) and northern leopard frog (Rana pipiens) thrive in our wetlands.

*(P20-p2)*
Over ninety per cent of the original forests between the major roads east and west of the Pend Oreille River have been logged or burned at least once, or permanently cleared for agriculture or residential development. A large part of this area is in open fields (pasture, hay fields and fallow land). Seasonally flooded wetlands are extensive. Wetland types include seasonally flooded fields, scrub-shrub and forests; persistently flooded, emergent wetlands; persistently flooded, shallow riverine sloughs; old sloughs that are presently connected to the river only during flood conditions and ponds not evidently connected hydrologically to the river. There are eighteen sloughs, thirteen major tributary mouths and six major islands between Albeni Falls and Box Canyon Dam.

*(P20-p3)*
Today, land use in the county is mostly rural with large areas of forest, mountains, valleys and open pastures with widely dispersed homes, subdivisions and ranches. Development within the Pend Oreille River drainage area includes timber harvesting, grazing, mining, heavy industry, urban and residential development and recreation sites. Current land use in Pend Oreille County is public, private, forest, agriculture, rural, residential or industrial.

*(P20-p4)*
The towns and communities of Metaline, Metaline Falls, Ione, Cusick, Usk, Dalkena, Furport, Newport and Oldtown and the Kalispel Indian Reservation are located along the river. Residential developments, public recreation and public access sites are also located along the Pend Oreille River. Residential, recreation and retirement home development along the river is on the rise. Numerous subdivisions exist or are under development. Forests, agricultural and open lands along the river are being replaced by the development of residential subdivisions.

*(P20-p5)*
Continental and maritime air masses influence the climate of northeastern Washington. Most of the weather systems affecting the northeastern part of the state are controlled by prevailing westerly winds; winters can be rather long and are affected by cold air from the Canadian arctic moving parallel to major north-south drainage systems. Air from the Pacific Ocean has a moderating effect throughout the year. Summers are generally warm and sunny with light rainfall, although localized thunderstorms occasionally cause heavier amounts of precipitation. Due to the continental effect, summers are warmer and winters are colder than in coastal areas. Daily average temperatures range from 15 degrees F to 30 degrees F in the winter and 46 degrees F to 76 degrees F in the summer. Annual precipitation varies from 15 to 25 inches in the valleys to 40 or more inches in the mountains. In the valleys, snow generally begins in November and remains on the ground through February.

*(P20-p6)*

A number of developed and undeveloped recreation sites exist throughout Pend Oreille County. The U.S. Forest Service, Washington State Department of Natural Resources, Washington State Department of Fish and Wildlife, Seattle City Light and the Pend Oreille Public Utility (PUD), have created recreation sites, as have a handful of private enterprises. Approximately 60 percent of Pend Oreille County is in public ownership.

*(P21-p1)*
Pend Oreille County residents and visitors have a variety of outdoor nature opportunities and recreation use in the mountains through all seasons of the year because of public land. In the past decade, the county, especially the southern part, has experienced continued population growth, becoming a bedroom community to the nearby City of Spokane. With those changes, the Little Spokane River Watershed and the Pend Oreille River corridor, prominently private lands, have become more urban and suburban in nature, reducing opportunity for public recreation areas, open space and wildlife migration corridors.

*(P24-p6)*
Newport has remained the most stable community in Pend Oreille County. Businesses have come and gone, but the population within the incorporated city limits of nearly 2200 has gradually grown since 1910's. Newport has a variety of businesses and services, many of which have been in the community for 50 years or more. Newport is the County Seat and home to the Hall of Justice, the County Courthouse, Sheriff's Office and Jail. Newport has the County's only hospital, nursing home, assisted living center and funeral home. THE NEWPORT MINER newspaper started in Newport in 1897. The Great Northern depot, built in 1920, is now the office of Stimson Lumber Company. The Idaho and Washington Northern Railroad (I&WNRR) depot, built in 1907, now houses the Pend Oreille County Historical Museum.

*(P25-p1)*
Oldtown's (Idaho) population is approximately 180 residents. The population rises to about 500 when one includes the nearby, unincorporated residential area. The town has about 30 small businesses and a City Hall. The closure of the Crown Pacific Mill in 1996 along with several other mills in the area, has depressed Oldtown's economy. Tri-Pro Cedar bought the Crown Pacific Mill around the year 2000. Between the towns, on level land in the river valley, are hay meadows and pastures. There are many private residential subdivisions along the Pend Oreille River as well as the lakeshores in Pend Oreille County. 4600 acres of Kalispel Indian Reservation lands stretch for 10 miles along the east side of the Pend Oreille River. These lands support isolated residential development, grazing, some timber harvesting, hay production and collection of the camas plant.

*(P25-p2)*
North of the Kalispel Indian Reservation, along the east side of the river, is land known as the Flying Goose Ranch. Bonneville Power Administration purchased the Flying Goose Ranch in 1992 for transfer to the Tribe. The Tribe is implementing a 10-year restoration plan to reproduce lost riparian forest and wetlands, and enhance existing uplands. A small section of Reservation land is located on the west side of the river just north of Cusick. This area supports small light-industrial development; a new rest stop/visitor center has been built, future plans include a café inside the visitor center building.

*(P25-p3)*
The current economy of Pend Oreille County depends upon a variety of economic sectors including forest products, agriculture, tourism, and government agencies. Ponderay Newsprint and Ponderay Valley Fiber

in Usk are the larger, private employers in Pend Oreille County. The main crops raised on agricultural lands along the river are small grains and hay. Recent downturns in the economy and timber prices have greatly influenced the population of the County.

*(Pages 34-35) (P34-bp1-9)*
CONCLUSIONS

- Pend Oreille County has an incredibly rich and diverse store of scenic natural resources that make it a wonderful place to live and a popular destination spot for tourists. It has a high percentage of rivers, lakes and wetlands as well as towering forests and abundant wildlife which give it great potential for attracting additional visitors and residents. Planning for parks and recreation should take full advantage of these assets.

- Because of its location in relation to surrounding regional attractions many visitors drive through Pend Oreille County on their travels. This is another opportunity to attract tourist's attention and encourage them to stay for a few additional days or even eventually locate their residences to our County.

- The climate of Pend Oreille County provides beautiful four season opportunities for recreation. More winter recreation opportunities should be promoted.

- Soils of Pend Oreille County are extremely erodible and planning for outdoor recreation areas and activities should keep this in mind. Costs for erosion control and repairs for resource damage may be higher than average.

- There are rich historical and cultural resources in the County that also provide basis for interpretive and outdoor education opportunities. Non-consumptive wildlife viewing and wildlife photography are fast growing areas of interest.

- Another popular activity is visiting historical sites. This county, and more specifically, Pend Oreille County Park, with its old growth forest would be an excellent location for a turn of the century logging camp living history facility.

- Pend Oreille County is the 8th fastest growing county in the State of Washington and this population growth is predicted to continue. Planning efforts should be made to accommodate this increasing population. With growth come problems of traffic, over-crowding and resource damage and these need to be factored into maintenance and replacement costs.

- Spokane, Spokane Valley, Post Falls and Coeur d'Alene are also growing and as recreation areas to the south become more crowded people will be driving further north into Pend Oreille County for a more natural and uncrowded recreational experience.

- The average household income levels are relatively low and poverty levels of the county are relatively high. Proper parks and recreation planning will attract the tourism dollar, entice new residents, improve the regional economy and provide jobs for local residents.

- Sixty-five percent of the population of Pend Oreille County consists of people over 35. Many people are moving to the County to retire. Activities for seniors and facilities for disabled should play a big part in planning for parks and recreational opportunities in the County.

*(Pages 34-35, continued)*

- Population density in Pend Oreille County is low. Many people live in pristine, rural settings and have recreational opportunities on their own properties (hunting, fishing, hiking, etc.) Parks and Recreation planning must provide unique recreation opportunities and events that provide social interaction.

- The numbers of young people are low and student numbers in local schools are steadily declining. Most young people leave the county to find jobs as soon as they graduate from high school. As the economy of the county improves and more jobs are available, this part of the population will be able to stay within the county and not be forced to leave to follow the jobs.

- The crime rate in Pend Oreille County is on the rise. Planning should include adequate monies for enforcement, protection of facilities, maintenance and surveillance.

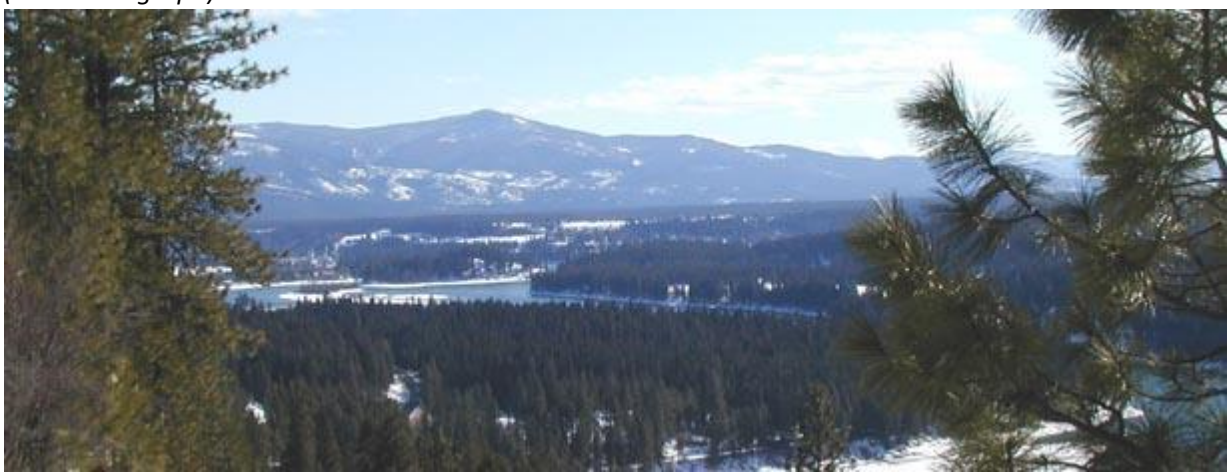
*(P 25-Photograph)*

PEND OREILLE RIVER AND USK BRIDGE

*(P33-Photograph)*

FAN LAKE

*(P35-Photograph)*



PEND OREILLE RIVER AND NEWPORT

## SECTION 1: NATURAL ENVIRONMENT

**(a) Earth** Forests, Wetlands, Soils, Agriculture, Topography, Geology, Unique physical features, Erosion / enlargement of land area (accretion). ***Note: underlined topics = PacWest "line-outs": we reject PacWest's Line-outs.***

### *Forest Ecosystems*

Most of Pend Oreille County takes the form of a long, forested river valley. This area, known as the Okanogan Highlands, is unique since it is the only area in the country where plant and animal species from both the Rocky Mountain Region and the Cascade Mountain region can be found *(1)(P18-p3).*

*Risks*

The health of Northeast Washington forests, including Pend Oreille County and also North Idaho are at serious risk. Climate Change is causing increasing drought conditions. Other environmental and management issues also contribute to a number of threats to our environment. Pine Bark Beetles are taking their toll on our Lodge Pole and Ponderosa Pines, Forest Fires are becoming more common and more intense, and other diseases and negative impacts on our forest ecosystems are becoming more common *(2) (3).* Douglas-fir is one of the most widespread tree species in Washington, the most important by far economically, and possibly one of the more climate-sensitive species regionally *(3).* The impacts of Climate change are affecting all aspects of our rural landscape.
Two initiatives from the Washington State DNR Commissioner of Lands to address the current threats to our environment are listed below:

***From the: "20-Year Forest Health Strategic Plan: Eastern Washington Summary" dnr.wa.gov/ForestHealthPlan,*** https://www.dnr.wa.gov/publications/rp_forest_health_summary.pdf

> *"The state of Washington has more than 22 million acres of forestland with approximately 10 million forested acres in eastern Washington. The forest health problem in eastern Washington is too large to solve overnight. As of 2015, 2.7 million acres— nearly 30 percent of all forestlands in eastern Washington— need treatment to become more resilient to insects, diseases and wildfire."*
> *"The health of our eastern Washington forests has declined significantly over the decades. Due to past fire and forest management practices, our forests are more prone to severe wildfire and less able to support ecosystem services and provide for communities as they have historically." (2)*

***From: "Smart Carbon Policy that Works for Washington", S Hilary. Franz Commissioner of Public Lands***

> *"Commissioner of Public Lands Hilary Franz is calling for a carbon policy that strengthens the resiliency of our lands and waters."*
>
> ***"CLIMATE RISK ASSESSMENT KEY THREAT FINDINGS***
> *More frequent large fires. More severe coastal flooding. More landslides. Summer water shortages. Decreases in shellfish populations. More invasive species"*
>
> *"The rural communities that surround Washington's forests, farms and waterways are on the frontlines of climate change. They endure the impacts of greater disease, drought and acidifying oceans first hand—and they must be part of the solution. Natural resource-based communities need to be part of a Smart Carbon Policy for wise and productive adaptation to a changing climate."*
>
> ***FOUR RESILIENCE PRINCIPLES***

***1*** *Tackle the root cause—carbon pollution—and invest in reduction efforts.*
***2*** *Strengthen the health and resilience of our lands, waters, and communities.*
***3*** *Accelerate carbon sequestration.*
***4*** *Invest in and incentivize solutions with multiple benefits.*

*"CLIMATE CHANGE THREATENS WASHINGTON'S FARMS, FORESTS AND FISHERIES. SMART CARBON POLICY INVESTS IN THOSE LANDSCAPES AND KEEPS THOSE COMMUNITIES PRODUCTIVE AND RESILIENT." (3)*

The forest ecosystems of Northeast Washington have been identified to be under serious threat to health and sustainability as a result of increasing temperatures, drought conditions, insect infestations, disease, and other elements of climate change.
It is obvious that the yearly estimated HiTest/PacWest smelter (phase 1, 2 furnaces) emissions of: 320 tons Greenhouse Gases, 760 tons Sulfur Dioxide, 700 tons Nitrogen Oxides, 601 tons Carbon Monoxide, and 111 tons Particulate Matter; plus Lead, Fluorides, Hydrogen Sulfide, arsenic, Polycyclic aromatic Hydrocarbons, and other toxins will negatively impact our already compromised forest health, and that this source of pollution contradicts the initiatives promoted by Land Commissioner Franz. If 2 additional furnaces are constructed (phase 2), the health and environmental damage will double.
**Since this smelter project is moving forward despite its contradiction of current knowledge and data that supports the current poor health concerns of our forests as described by Land commissioner Franz, it will be necessary to provide a further, more comprehensive and current assessment of our forests in order to scientifically evaluate the impact of the smelter's toxic emissions.**

**SQ #1**: *Please provide a current assessment of our forests in Pend Oreille county and other affected areas, and please adopt a monitoring plan. Please involve citizens in the design and sample forest plot locations of the assessment and monitoring plan. Sample plot evaluations should be performed a minimum of twice per year (early Spring and late Summer or Fall), and should use current best practices for timber stand inventory and environmental examination. Sample plot locations should include National Forest land, State land, County land, and privately-owned land. Please adopt a program of public involvement and public invitation of private land owners to volunteer their land as a sample plot site. It is requested that a minimum of 1 year's-worth of data for the current forest health status be collected and analyzed prior to approval of any permits.*

## ***Wetland Ecosystems***

Wetlands are extensive and relatively diverse in the county. Wetlands mapped as Priority Habitat in the county are near Calispell Lake and Calispell Flats. The designating criteria for wetlands include significant large concentrations of waterfowl; a waterfowl migration staging area; nesting waterfowl, including cavity-nesting species; winter bald eagle use and great blue Heron foraging areas. These are important habitats for migrating, wintering and breeding waterfowl. Large concentrations of waterfowl stop during spring and fall migrations on sloughs and the larger ponds and in wetlands adjacent to the river corridor, principally Calispell Lake and the Calispell Flats. Waterfowl productivity studies indicate that there are important waterfowl nesting areas near Cusick Sough, Tacoma-Trimble Slough, Everett Island and Indian Island *(1)(P19-p4).*

**SQ#2**: *In order to scientifically evaluate the impact of the smelter's toxic emissions on our wetland ecosystems, please provide a current assessment of the status of our wetlands, and please adopt a*

*monitoring plan for collecting data during the life of the smelter. Please involve public citizens in the design of the assessment and monitoring plan; including the selection of water bodies to be included in the study. Each water body should be assessed 4 times annually (spring, summer, fall, winter). It is requested that a minimum of 1 year's-worth of data for the current wetland health status be collected and analyzed prior to approval of any permits. As a minimum, assessments should include:*
**Stream habitat assessment**: (a) streambed substrate, (b) streambank condition, (c) canopy cover, (d) riparian zone composition (e) stream width, depth, clarity, flow velocity, (f) water temperature, (g) pH, (h) dissolved oxygen, (i) chloride, (j) Nitrate-N, (k) phosphorus, (l) benthic macroinvertebrates and microhabitats, (m) vertebrates: amphibians, reptiles, fish, birds, mammals (n) aquatic plants, (o) algae, (p) bacteria., (q) adjacent land use, (r) invasive plant species.
**Lakes, ponds, standing water**: (a) bank composition/condition, (b) water clarity, (c) water temperature, (d) water level/depth, (e) pH, (f) dissolved oxygen, (g) chloride, (h) Nitrate-N, (i) total phosphorus, (j) algae, (k) aquatic plants, (l) benthic macroinvertebrates, (m) vertebrates: amphibians, reptiles, fish, birds, mammals (n) adjacent land use (o) invasive plant species.

**SQ#3**. *Please identify all tributaries to the Pend Oreille River and the Little Spokane River. Since the Pend Oreille River and the Little Spokane River have 303 (d) listings for several pollutants, please provide scientific evidence to support the location of the Smelter that will be within a mile of the Little Spokane River and the Pend Oreille River.*

**SQ#4**. *Please provide existing case studies of wetland damage due to the impacts of smelter emissions and/or other coal-burning industrial emissions and pollutants.*

**SQ#5**. *Please provide justification for the smelter toxic emission damage to the wetlands of Pend Oreille County and Bonner county Idaho.*

*From:* **5-Year Plan (2017 to 2022) Pend Oreille Conservation District**
***Priority Natural Resource Geographic Area***
*High risk areas for fire – forest health*
*Small Landownerships – South County – Wildland Urban Interface (WUI)*
*Little Spokane River – water quality*
*Pend Oreille River - erosion*
*Farmland – Calispel Flat – water quality*
***Habitat***
*By 2018: re-establish the POCD native tree/shrubs sale to encourage volunteer efforts for creating habitat.*
*Encourage native fire-resistant landscaping and plantings.*
*Encourage the use of downed large woody debris material and standing snags to enhance habitat.*
*By June of 2018: develop a list of high priority reaches in the Little Spokane River to concentrate conservation activities and provide assistance to the landowners there.*
*By June of 2018: develop a list of high priority reaches in the Pend Oreille River to concentrate conservation activities and provide assistance to the landowners there.*
*By 2019: provide assistance to agricultural landowners to help protect a mile of riparian area and increase by 50 percent each year.*
*Investigate the existence of threatened and/or endangered species and develop a strategy to help address them*

The smelter project is contradictory to the POCD 5-year plan, and will severely impair or totally negate the positive initiatives of this plan.
**SQ#6**. *How will the smelter impact the POCD initiatives and 5-year plan? Please provide justification for severely impairing and/or fully negating the initiatives of the 5-year plan.*

*Risks*
Climate Change, Acid Rain, Disruption of waterfowl health and migration, eutrophication, overcrowding, Heavy industry pollution.

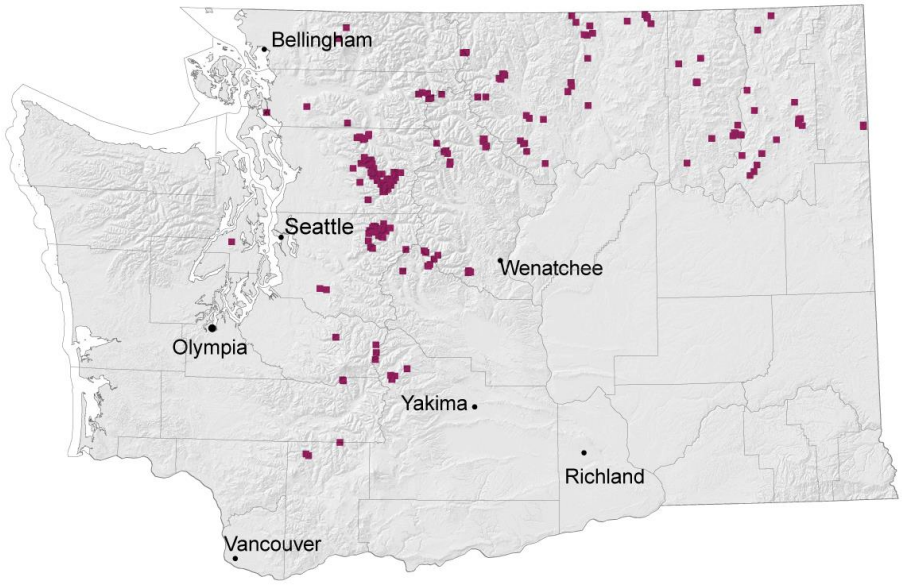
## ***Soils, Topography, Unique Physical Features, Erosion, Land Use***

### ***Soils (Composition, Agriculture, Forests)***
Soils of Pend Oreille County are extremely erodible and planning for outdoor recreation areas and activities should keep this in mind. Costs for erosion control and repairs for resource damage may be higher than average *(1)(P34-bp4)*

Areas historically covered in forest vegetation are currently at greater risk of aluminum toxicity, since these areas commonly have lower pH throughout the soil profile depth, lower base saturation, and higher concentrations of exchangeable aluminum. Recent field trials (Paulitz and Schroeder unpublished)

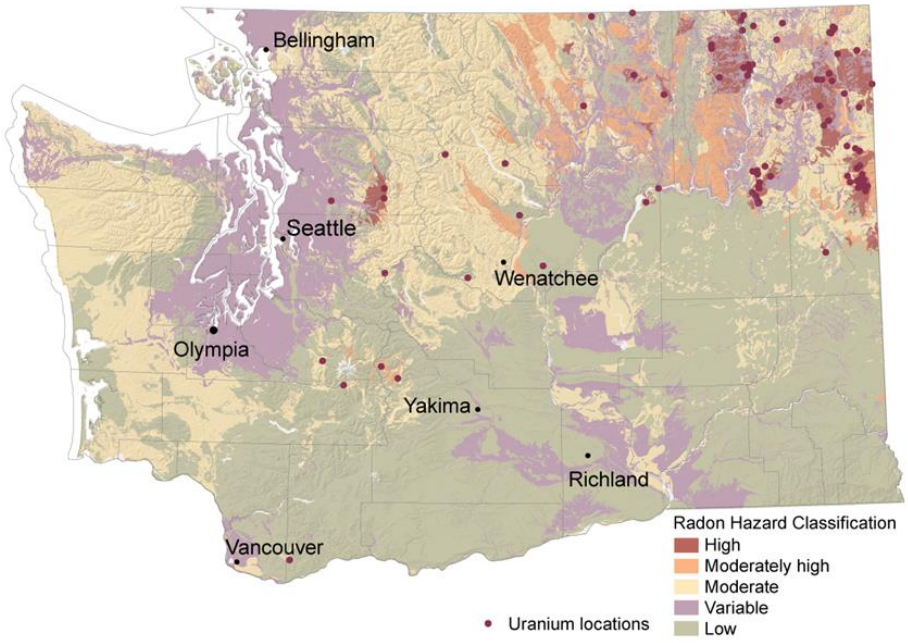
**Acidic soils, Aluminum toxicity are on the Rise in Eastern Washington, Northern Idaho.**
While pH has been dropping throughout the region, the acute symptoms of soil acidity and aluminum toxicity have begun to emerge in locations that were historically forested. That's because native soil in forested locations had a lower starting pH than prairie soil when active farming began on these sites. Forested soils also had lower organic matter when initially broken out, making them more vulnerable to shifts in soil pH.
Low soil pH not only frees up aluminum and leads to toxicity in plants, it also limits the availability of key plant nutrients (nitrogen, phosphorus, magnesium, molybdenum). *(#)*
If the pH is below 5.5 and the field is in a historically forested area, it is possible that aluminum toxicity is a problem. If the pH test includes exchangeable aluminum as a percentage of the cation exchange capacity, verify that it is under 60 percent. Exchangeable aluminum over 60 percent can result in aluminum toxicity. *(#)*

**Arsenic in Soils**
*From*: **Washington Stat Dept. of Natural Resources—Hazardous Minerals**
Arsenic is found in many rocks and minerals and is generally associated with sulfur. The most common arsenic minerals are arsenopyrite, and the sulfides, realgar and orpiment.
**Arsenic in Washington**
Arsenic minerals are widely distributed in mining districts throughout Washington. Gem-quality orpiment and realgar have been collected from deposits along the Green River in King County. The best known arsenic ores are in the Monte Cristo district in Snohomish County, where arsenopyrite was mined for gold and silver extraction. Many of the arsenic-bearing ores were shipped to the ASARCO Smelter in Tacoma, WA.




**Distribution of reported locations of arsenic-bearing ore.** From Washington State Dept. of Natural Resources *(map above)*
***NOTE:*** The above map shows that the Newport area is a reported location of arsenic-bearing ore.

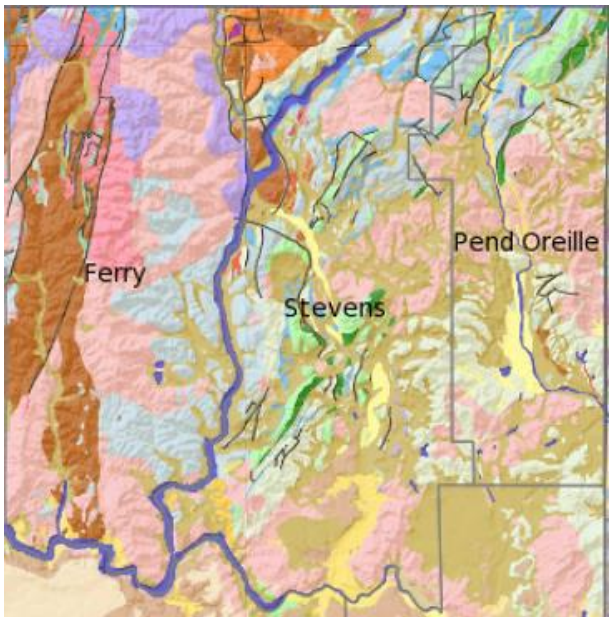
**Uranium and Radon in Washington Soils**
Uranium deposits have been observed in Washington State east of Puget Sound, and particularly in the northeast quadrant of the state.




Distribution of reported locations of uranium-bearing ore, and potential radon hazard classification inferred from geological mapping. *(map above)*
***NOTE:*** The above map shows that Pend Oreille County has numerous Uranium reported locations.

Certain rock types such as granite, phosphorous sedimentary rock, high grade metamorphic rocks, and dark shales, can contain elevated levels of uranium. Particularly, two-mica granite can contain large uranium deposits which often leaches into groundwater supplies. Two-mica granite is any granitic rock that most commonly contains biotite and muscovite, which are the black and white flecks that can be found in some igneous and metamorphic rocks. Two-mica granites often occur in conjunction with other plutonic (intrusive igneous) rocks, as well as high grade metamorphic rocks.

The most common rock types found in the northeast tri county area includes: Mesozoic granitic rock, mixed metamorphic rock, volcanic rock, and granitic-intrusive rocks (Fig. 1). Ferry County has the most Mesozoic granitic rock of the three counties.




*(map above)*

*Figure 1. Geologic Map of Ferry, Stevens, and Pend Oreille County.* Light pink indicates granitic rock. Retrieved from: https://mrdata.usgs.gov/geology/state/map.html?x=120.542628095141&y=47.4158509312795&z=7#

**SQ#7**. *Please perform Soil Assessments of Aluminum, Arsenic, Uranium, Lead, Mercury, Cadmium, and other heavy metals in Pend Oreille county to establish a baseline record of these toxic metals prior to approving any permits. Please also include Cation Exchange Capacity measurements, and pH measurements that include exchangeable Aluminum as a percentage of the cation exchange capacity. Please include the proposed smelter site, The Little Spokane River Watershed, the Pend Oreille River Valley, Colville National Forest Land, Pend Oreille County Public Land, and Private agricultural and forest land in the heavy metals baseline assessment.*

**SQ#8**. *Please also adopt a comprehensive "Soils Heavy Metals Monitoring Plan" for measuring and reporting the concentrations of these metals. Please involve Pend Oreille County citizens and affected Bonner County citizens in the design of this plan.*

**SQ#9**. *Please provide a "Washington State/Idaho Compensation Plan" for citizens in Pend Oreille County and Bonner County affected areas with regard to concentrations of the listed metals that exceed*

*acceptable levels determined during the Heavy Metals Monitoring Program. Please include citizen input in the design of this Compensation Plan.*

The soil on the proposed smelter site is known to be highly permeable, and is adjacent to private wells, Newport wells, the Newport Recharge Zone, and the Little Spokane River Watershed. Arsenic and heavy metals and radioactive uranium are known components of coal and will be released into the air, further contaminating soils, ground water, lakes, rivers, and streams.

**SQ#10**. *Do you agree that our soils are already at risk with regard to heavy metals and arsenic, and that the smelter will exacerbate this condition and will harm human health and our environment? If you disagree, please explain why.*

**SQ#11**. **Smelter site property**: *Please determine the Seasonal Water Table location and depth on the Smelter property, and also other areas within the estimated stack plume radius prior to any permits.*

**SQ#12**. *Please perform Perc tests on the smelter site property and other areas within the estimate stack plume radius prior to any permits.*

**SQ#13**. *Please perform pH analysis of the soil on the smelter site property and other areas within the estimate stack plume radius prior to any permits.*

Increasing temperatures due to climate change may result in exacerbating overall carbon dioxide levels in the air by affecting soil microbial activity. This affect is described in the article below:
*From**: Popular Science. Rising temperatures are causing soil to dump more carbon dioxide into the air.***
*Marlene Cimons:*
*"Climate change is nudging up the temperature under which soils and ecosystems operate, with effects that are both predictable — such as faster activity — and uncertain — that is, microbial and plant communities might change."*
*"The effect of this growing imbalance not only puts more heat-trapping carbon dioxide into the air, but it also dwindles the strength of the soil as a natural place to store carbon."(4)*

**SQ#14**. *Please include an assessment of current microbial activity in Pend Oreille County soils prior to approving any permits, and adopt a monitoring plan (including carbon storage capacity)*

**SQ#15**. *Pend Oreille county soils are susceptible to potential damage from hot wildland fires that may increase as a result of increasing hot and dry summers. Please assess the health status of the recent wildland fire soils in Pend Oreille County.*

*From:* **5-Year Plan (2017 to 2022) Pend Oreille Conservation District (POCD)**
***Agricultural land/soil preservation, enhancement, and management***

- *Continue to participate in local discussions on land use planning and VSP*
- *By 2019, provide assistance to agricultural landowners to help protect a mile of riparian area and increase by 50 percent each year.*
- *By 2018, become the lead agency implementing VSP.*
- *By 2019 utilize a certified conservation planner to work with agricultural landowners.*
- *By 2019 POCD will coordinate with the County Weed Board on management of noxious weeds.*

- *Continue to work with the county to develop a strategy to help landowners preserve their agricultural land.*
- *By 2020 provide at least one workshop per year on opportunities for reduced tillage practices.*
- *By 2020 develop an outreach program dealing with small acreage agricultural production and conservation opportunities.*

**SQ#16**. *How will the smelter impact the POCD 5-Year Plan listed above?*

## ***Unique Physical Features, Erosion, Land Use***

Pend Oreille County has an incredibly rich and diverse store of scenic natural resources that make it a wonderful place to live and a popular destination spot for tourists. It has a high percentage of rivers, lakes and wetlands as well as towering forests and abundant wildlife which give it great potential for attracting additional visitors and residents. Planning for parks and recreation should take full advantage of these assets. *(1)(P34-bp1)*

Current land use in Pend Oreille County is public, private, forest, agriculture, rural, residential or industrial. *(1)(P20-p3)*

*Risks*
Erosion, Climate Change, imbalance of microorganisms, Acidity/Aluminum Toxicity, heavy metal contamination, arsenic contamination, crop failure, Forest Health impacts, Forest Fires, Flooding.

## ***Topography***

There are fifty five lakes, 48 creeks and numerous wetlands dotting the natural meadows, the forested foothills and the mountains. There are seventy mountain peaks within our county borders, the highest of which is Gypsy Peak (7309'). Several of the peaks are the endpoints of interstate hiking trails and offer exceptional vistas into Idaho and Canada. Nestled within these forests and mountains are the Cusick Flats and other sections of the county with areas of specific agricultural land use. *(1) (P18-p3)*

This undulating topography consisting of the large Pend Oreille River valley; the Scotia Valley and the Spokane river watershed; and tributaries, sloughs, and wetlands that are flanked by mountains and hills promote the formation of **temperature inversions** that are prevalent from early fall through winter and into late spring.

Surface inversions are responsible for producing smog, trapping the pollutants produced by vehicles, fires and industrial activities. Furthermore, the hydrocarbons and nitrogen oxides present in these trapped pollutants are converted into harmful ozone by sunlight, which reduces air quality. The stratosphere's inversion traps pollutants within the stable layer, which is something that typically occurs when greenhouse gases are injected high into the atmosphere by volcanic eruptions. Without the vertical mixing provided by convection, these gases remain suspended within the inversion layer and result in a long-term impact on the global climate. *(5)*

Pollutant gases near the ground, such as CO, NO, NO2, SO2 and O3, significantly increase if a temperature inversion, **especially a morning time surface-based temperature inversion (SBI)**, is present

(Holzworth, 1972; Janhall et al., 2006). Aerosols, an important kind of air pollutant, affect human health, and fine particulate matter (PM2.5) mass loadings have been statistically correlated with morbidity and mortality (Pope et al., 1993). The increase in aerosol particle concentrations near the ground is also highly correlated with the presence of temperature inversions (Malek et al., 2006). Wallace et al. (2010) studied the effect of temperature inversions on ground-level NO2 and aerosols, and reported increases of 49% and 54% in NO2 and PM2.5, respectively, during nighttime inversion episodes. *(6)*

Please note that this critical topic was *"lined through"* by HiTest/PacWest as unimportant—we strongly disagree. The PSD Modeling Protocol performed by Ramboll uses weather monitoring data from Deer Park, Spokane county. The topography of Deer Park is significantly different than the topography in the Newport area and Pend Oreille county *(1) (5) (6)*.

**SQ#17***: It is common knowledge that topography has significant impacts on weather and climate; and the frequent occurrence of morning time surface-based temperature Inversions (SBIs) in the Newport area are not captured in the Deer Park data. Do you agree that the Deer Park weather data is not accurate and does not represent the Newport area? If not, please explain why.*

**SQ#18.** *Due to the inaccuracy of the Deer Park weather data used for the PSD Modeling, we request that Deer Park data be thrown out, and that a new scientifically accurate set of data be obtained in Newport near Newport schools. This data should be obtained over the course of 1 year (as a minimum). Other affected areas (e.g. Sandpoint, Idaho) should also have the opportunity to have weather data collected in their area. Do you agree that the Deer Park weather data should be thrown out? If not, please explain why.*

**SQ#19.** *Please locate a Weather Station near the Newport High, Middle School, or Elementary School as these areas of critical concern.*

*Risks*
Heavy Industry, Soil Erosion, Air quality, Uncontrolled Growth, Climate Change, Imbalance of Soil Microorganisms, Acidity/Aluminum Toxicity, Heavy Metal Contamination, Arsenic Contamination, Forest Fires, Flooding

## ***Agriculture***

*(P18-p4)*
The county is predominantly a hilly to mountainous terrain on both sides of the Pend Oreille River as it flows north through the entire county but for the very southern 10 miles of the county. This southern area is headwaters of the Little Spokane River with the watershed divide running roughly east-west from Newport to the Sacheen Lake area. The southerly regions of the county, along with the Pend Oreille River lowlands, have historically been the easily accessible, low elevation areas and are best suited for human settlement. All of the major towns in the county are located along the Pend Oreille River and virtually all agricultural land is part of the Pend Oreille River floodplain or along creek bottoms in the southern third of the county. *(1) (P18-p4)*

**SQ#20.** *The lowland areas support a significant amount of agriculture and wildlife habitat in Pend Oreille County. These low land areas also are prone to thermal inversion fog and smoke and particulate settling. Please monitor the frequency of thermal inversions in the Pend Oreille Valley, Scotia Valley, and other*

*representative areas to assess the impact of smelter emissions on these lowland agricultural, wetland, and forested areas. Please monitor for one year prior to approving any permits.*

Predominant field crops include Barley, Oats Hay, and Alfalfa. Livestock includes Cattle, Beef Cows, Sheep and Lambs, and Hogs and Pigs. The 1992 Livestock Inventory lists all cattle at 8,000 head, and Horses and Ponies at 464 head. Apples are the predominant Orchard Fruit. *(7)*

The Pend Oreille Valley Farmers Market includes a wide variety of locally grown organic vegetable and fruit crops, fresh herbs, dairy/eggs; and other locally crafted items: baked goods, bath / body, beeswax, bread, honey, soap, fibers (llama, wool), Specialty Items: plants (bedding, etc), seeds. *(8)*

*From*: "**Tainted Earth: Smelters, Public Health, and the Environment**" by Marianne Sullivan
A study of garden soils: "A July 1981 smoke stack fire and another accident in 1982 at the Tacoma smelter resulted in contaminated garden soils. The court concluded that the smelter emissions constituted "TOXIC TRESPASS." The gardeners did not receive compensation or the replacement of their soils because they were not able to prove damage to their land or their health."

Local Farmers and Farmers Markets depend on the clean air, water, and soils to provide fresh healthy, nutritious produce to local citizens. Farmers Markets in Newport, Sandpoint, and other nearby farmers markets are concerned

**SQ#21**. *How will the smelter emissions impact the special needs of organic farmers? How will farmers be compensated for loss of their livelihood due to soil and crop contamination from the smelter emissions? Please provide soil analysis of farmers soil prior to approving any permits to establish a baseline. Please construct an agricultural soil monitoring program for farmers in the affected smelter plume areas in Pend Oreille County and Bonner County in Idaho.*

Other cultural and woodland crops include Camas, Huckleberry, Service Berry… *(others?)*

**SQ#22**. *How will the smelter emissions impact native, cultural woodland crops and berries?*

**SQ#23**: *In order to scientifically evaluate the impact of the smelter's toxic emissions on our agricultural viability, please provide a current assessment of the status of our agricultural plant nutritional value and concentrations of toxic substances, and please adopt a monitoring plan.*

## ***Unique Physical Features, Erosion***

Pend Oreille County has an incredibly rich and diverse store of scenic natural resources that make it a wonderful place to live and a popular destination spot for tourists. It has a high percentage of rivers, lakes and wetlands as well as towering forests and abundant wildlife which give it great potential for attracting additional visitors and residents. Planning for parks and recreation should take full advantage of these assets. *(P34-bp1)*

Most of Pend Oreille County takes the form of a long, forested river valley. **This area, known as the Okanogan Highlands, is unique since it is the only area in the country where plant and animal species from both the Rocky Mountain Region and the Cascade Mountain region can be found** *(1)(P18-p3).*

The Pend Oreille River, The Little Spokane river, The Inland Rainforest, The Selkirk Caribou, The Selkirk Mountains, The "start of the Selkirk Loop", the Newport Museum are several examples of the unique features of Pend Oreille Count.

**SQ#24**. *Current erosion is a serious concern. Construction of the smelter will severely damage the Little Spokane Watershed and other areas. Runoff will be inevitable. Please describe all the steps that will be taken to prevent erosion, runoff, and damage of the sandy highly permeable soils and clay soils at the smelter site and surrounding areas. Who will be liable for the damage?*

*From:* **Selkirk Conservation Alliance**
The Inland Temperate Rainforest, which is part of the Purcell-Cabinet Mountain Corridor, stretches across northern extremes of Washington, Idaho, and Montana. It is the only place on earth where temperate rainforests are found so far from any ocean.
Here, weather systems from the Pacific collide with the Columbia Mountains and create lush interior forests, important habitat for many unique plants and animals including the endangered mountain caribou, a variety of woodland caribou found nowhere else in the world.
The Inland Temperate Rainforest of Idaho and northeastern Washington still retains almost all the plants and wildlife found here over 200 years ago when Lewis and Clark made their epic journey just to the south. It's our privilege to be able to experience and enjoy this unique area, and our responsibility to ensure that this wonderful biodiversity remains.

**SQ#25:** *Do you agree that the Inland Temperate Rainforest is worth protecting? If you agree, what will be done to protect this threatened, unique area? If you disagree, please explain why.*

**(b) Air.** Air Quality, Odor, Climate

Continental and maritime air masses influence the climate of northeastern Washington. Most of the weather systems affecting the northeastern part of the state are controlled by prevailing westerly winds; winters can be rather long and are affected by cold air from the Canadian arctic moving parallel to major north-south drainage systems. Air from the Pacific Ocean has a moderating effect throughout the year. Summers are generally warm and sunny with light rainfall, although localized thunderstorms occasionally cause heavier amounts of precipitation. Due to the continental effect, summers are warmer and winters are colder than in coastal areas. Daily average temperatures range from 15 degrees F to 30 degrees F in the winter and 46 degrees F to 76 degrees F in the summer. Annual precipitation varies from 15 to 25 inches in the valleys to 40 or more inches in the mountains. In the valleys, snow generally begins in November and remains on the ground through February. *(1) (P20-p5)*

In recent years, the summer seasons have become hotter and drier, and wild land fires are becoming more prevalent. The increasing number and intensity of wildland fires have resulted in significant air quality issues throughout the summer in the entire Inland Northwest Region.

Due to the topography in Pend Oreille County, the formation of **temperature inversions** is a prevalent phenomenon from early fall through winter and into late spring. These temperature inversions exacerbate poor air quality by concentrating pollutants and particulates *(2) (3) (5) (6)*

***Critical Loads***. Northeast Washington (including Pend Oreille County), the northern two thirds of Idaho, and areas in Northwest Montana have been identified as areas with Critical Loads for Acidity of Surface Water and Forest Ecosystems. The term "critical load" is used to describe the threshold of air pollution

deposition that causes change to sensitive resources in an ecosystem. A critical load is technically defined as "the quantitative estimate of an exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment are not expected to occur according to present knowledge" (Nilsson and Grennfelt 1988). *(9)*

***See: "Smart Carbon Policy that Works for Washington", S Hilary. Franz Commissioner of Public Lands***

**SQ#26***: Please include Critical Areas identified in* ***reference (9)*** *"2015 Summary of Critical Load Maps, National Atmospheric Deposition Program,* ***C****ritical* ***L****oads of* ***A****tmospheric* ***D****eposition Science committee" in sample plot locations in* ***Scoping Questions (?)****. (and SQ#19)*

**(c) Water.** Surface water movement/quantity/quality, Runoff/absorption, Floods, Groundwater movement/quantity/quality, Public water supplies. *Note: underlined topics = PacWest "line-outs"*

## *The Pend Oreille River*

The Pend Oreille River, the second largest in Washington State, flows through the county in a northerly direction for about 155 miles from its headwaters at Pend Oreille Lake in Idaho to the Columbia River in British Columbia, Canada. The northward-flowing river, fed by more than twenty-two tributaries, also supports a modest amount of farming as it courses through our rural county *(1) (P19-p1).* There are fifty five lakes, 48 creeks and numerous wetlands dotting the natural meadows, the forested foothills and the mountains. *(1) (P18-p3)*

***Pend Oreille River: 2004 303(d) list of impaired waters for total dissolved gas*** *(10)*
Monitoring of the Pend Oreille River from 2001 through 2004 at the Idaho state line near Newport, and in the forebays and tailraces of Box Canyon and Boundary Dams, shows that total dissolved gas (TDG) frequently exceeds water quality standards. As a result, the Washington State Department of Ecology (Ecology) listed the Pend Oreille River on its 2004 303(d) list of impaired waters and has determined the Total Maximum Daily Load (TMDL) for TDG in the Pend Oreille River. *(10)*

***Pend Oreille River: 1998 303(d) list of impaired waters for Temperature*** *(11)*
Water quality data from the Pend Oreille River shows that water temperatures exceed the site-specific criterion of 20°C from the state water quality standards. Therefore, the state of Washington has included the Pend Oreille River on Ecology's 1998 303(d) list. Because temperature levels have been observed above the water quality standards criterion of 20°C at multiple locations in the river and because the available information does not show temperature being reduced below the criterion between the monitoring points, the entire Pend Oreille River in Washington State must be considered impaired for temperature. This TMDL will evaluate tributaries at their mouths as inputs to the mainstem, but will not address impairments in the tributaries themselves.

Washington's Water Quality Standards establishes designated uses which are protected by numeric criteria and by narrative standards. The primary use affected by temperature is fisheries, and the most sensitive uses are protected by criteria for "char" (Bull Trout) in many of the tributaries and in the mainstem by criteria for "salmon and trout spawning, noncore rearing, and migration."

**Bull trout is listed as a threatened species under the Endangered Species Act.** The Bull Trout Draft Recovery Plan designates the Pend Oreille River and its tributaries as the core area of the Northeast Washington Recovery Unit (USFWS, 2002).

Bull Trout Habitat Limiting Factors Report (Andonaegui, 2003) provides a broad overview of Bull Trout current and historical conditions in the mainstem Pend Oreille River. **The decline in Bull Trout in the river**

**and its tributaries, compared to historical levels, can be attributed to a variety of factors, primarily migration barriers and competition from introduced species, but also including mainstem flows and temperatures.**

The principal factors that may increase water temperatures in the Pend Oreille River in Washington are:
*Changes in upstream water temperatures***.** The regulation of Lake Pend Oreille by Albeni Falls Dam and other human activities in the watershed may result in higher temperatures under certain conditions.
*Impoundment of the river by Box Canyon and Boundary Dams***.** Regulation of flow can result in deeper and slower water flow, greater surface area and volume, and reduced ground water inflows in the impounded reaches.
*Changes in tributary or groundwater inflows and temperatures***.** Human activities in the watershed have likely altered hydrology and heat balance, resulting in lower flows and higher water temperatures at times.
***Human point source inputs*.** Large cooling water discharges have the potential to increase the temperature of a river the size of the Pend Oreille. Ponderay Newsprint Company in Usk is currently the largest point source in the TMDL area that is likely to be of concern.
***Thermal variability in side-channels and vegetation beds*.** *(11)*

The Pend Oreille River has a candidate 2002/2004 Category 5 listing for aldrin in fish tissue and candidate Category 2 listings for dieldrin, endrin, DDT analogs, heptachlor, and heptachlor epoxide in the water column. All of these compounds are classed by EPA as probable human carcinogens. Total PCBs, though found at concentrations below the 30th percentile when compared to statewide levels, continued to exceed NTR human health criteria in most samples.
**It is recommended that both the Skagit and Pend Oreille rivers should be included in Category 5 of the 303(d) list for total PCBs in fish tissue.** *(12)*

**Pend Oreille River, Fish Consumption Advisory** of 2012 illustrates the current mercury contamination issues of the Pend Oreille River. *(13)*

**SQ#27**. *How does the smelter project fit with the Hirst Decision?*

**SQ#28**. *The Smelter will be emitting tons of toxic gasses into the atmosphere—some of these emissions will be absorbed into the Pend Oreille River, potentially exacerbating the TDG problem. How can the SEPA process even begin when the Pend Oreille River is on the 2004 303(d) list for impaired waters for TDG?*

**SQ#29**. *The massive amounts of Green House Gases emitted from the Smelter contribute to atmospheric warming which will raise air temperatures at the surface of our waters. The additional impacts of the Smelter emissions will only exacerbate the high temperature condition of the Pend Oreille River; why is has the SEPA process started when the Pend Oreille River has be on the 303(d) list for Temperature?*

**SQ#30**. *Is it accurate that the Pend Oreille River is 303(d) listed for Category 5 pollutants and therefore does not meet water quality standards for Water Temperature, PCBs, pH, and Mercury? Do any of these pollutants have an EPA-approved TMDL (Total Maximum Daily Load)?*
*If the Pend Oreille River does not have an approved TMDL for Water Temperature, PCBs, pH, and/or mercury, is it true that the Pend Oreille River currently has zero capacity for point or nonpoint sources of air or water pollution?*
*The smelter will definitely be pumping toxic pollutants into the atmosphere, land, and water. How can this project proceed with the current compromised Pend Oreille River water quality status?*

**SQ#31**. *Doesn't the 303(d) listing and lack of approved TMDL for the above-mentioned pollutants apply to all the Pend Oreille River tributaries and also ground water?*

## ***Little Spokane River***

**The HiTest/PacWest smelter is sited immediately adjacent to the Little Spokane River Recharge Area and Watershed.**

*From the Pend Oreille County Conservation District:*

***Priority Natural Resource Geographic Area***

*High risk areas for fire – forest health*

*Small Landownerships – South County – Wildland Urban Interface (WUI)*

***Little Spokane River – water quality***

*Pend Oreille River - erosion*

*Farmland – Calispel Flat – water quality*

***From:*** **Focus on Little Spokane Watershed, Dept. of Ecology, Eastern Regional Office, July 2009**

The Little Spokane River watershed, Water Resources Inventory Area (WRIA) 55, includes about 675 square miles located within Spokane, Stevens and Pend Oreille counties. It is part of the Spokane-Coeur d'Alene watershed which encompasses about 6,600 square miles in parts of northeastern Washington and Idaho.

The largest aquifers in the watershed are in the valley of the Little Spokane River. Smaller and localized aquifers occur within tributary valleys and in upland areas. The Spokane Valley/Rathdrum Prairie aquifer --a vast, regional ground water system -- occupies a small portion of the southern part of the watershed.

***Water availability***

WRIA 55 streams and lakes are closed to new consumptive uses (uses that reduce the amount of water in the water source). All available water in the basin is legally "spoken for" while at the same time flow levels in the river are declining.

In 1976, a water resources program for the Little Spokane River was adopted into rule (WAC 173-555). The rule set instream flows for the Little Spokane River, and closed its tributaries as well as all natural lakes to further uses. Instream flow rules establish a water right and priority date for the river to protect instream uses like fish habitat, water quality, recreation, and navigation. The rule only affects those who apply for new water rights *after* the rule was adopted. These "junior" water rights can be shut off when the flow in the river is below the required flows.

Instream flows on the Little Spokane River and its tributaries have not been met in 19 of the past 30 years. This is in part due to the rapid population growth in the watershed and the increasing number of single domestic ("permit-exempt") wells being constructed. Spokane County leads the state in the number of small wells drilled each year.

**SQ#32**. *The smelter site is adjacent to the Little Spokane river Recharge area and Water shed. How can this smelter project proceed given the knowledge that Instream flows on the Little Spokane River and its tributaries have not been met in 19 of the past 30 years?*

**Water Rights in Washington State**

Under state law, the waters of Washington collectively belong to the public and cannot be owned by any one individual or group. Instead, Ecology may grant individuals or groups the right to use the public waters of the state. Approval is given in the form of a water right permit.

You need a water right permit to use any surface water (water located above ground, such as lakes, rivers, streams and springs), or to use ground water (water located under the ground) at a rate of more

than 5,000 gallons a day or to irrigate more than ½ acre of lawn and non-commercial garden. (For small ground water uses exempt from the permitting process, see RCW 90.44.050.)
Much of the water in Washington State has already been appropriated, which means it is spoken for and being used. This is making it more difficult to find water supplies for new growth and development, while still leaving enough water in our lakes and rivers for fish and other protected instream resources and values (such as wildlife, navigation, aesthetics and water quality).
Ecology is working closely with communities to help them effectively manage their water so we can meet current needs and help ensure future water availability for people, fish and the natural environment.

**SQ#33**. *How Can the smelter obtain permits to use thousands of gallons of water per day given the information above? HiTest/PacWest keeps changes its water use estimates—how can the permitting process even begin without this information?*

***From: The Dept. of Ecology, Washington State, Little Spokane River:***
We're working to better understand and reduce pollution in the Little Spokane River and its tributaries. Pollution problems include high temperature, too much bacteria, and low dissolved oxygen. There are additional studies underway and several projects to help reduce pollution and improve water quality.
**Water quality problems**
The Little Spokane River and some of its tributaries, Dragoon Creek and Deadman Creek, have been identified as not meeting clean water requirements, according to our water quality assessments.
Pollution problems include:
High temperature, bacteria, and pH
Low dissolved oxygen
High levels of PCBs
Too much sediment in the water column (turbidity)
**What we are doing**
We partnered with the Spokane County Conservation District to develop a water quality improvement plan that addresses fecal coliform bacteria, temperature, and turbidity. The plan identifies sources of pollution.
We are currently working on a plan to address low dissolved oxygen and high pH in various streams in the watershed. This plan will also address the total phosphorus load that comes into Lake Spokane at the mouth of the Little Spokane River, which is required by the Spokane River and Lake Spokane Dissolved Oxygen water quality improvement plan.
Several studies were conducted to determine the nutrient, dissolved oxygen, and pH levels in the Little Spokane River watershed streams and lakes. **We are analyzing the results of these studies and will produce a draft water quality improvement report (TMDL) for these water quality problems at the end of 2017 or early 2018.**
Quality Assurance Project Plan: Little Spokane River Watershed Total Maximum Daily Load Study
Addendum to Quality Assurance Project Plan Little Spokane River Watershed Dissolved Oxygen and pH Total Maximum Daily Load Study: Water Quality Study Design
Data Summary Report: Little Spokane River Dissolved Oxygen and pH Total Maximum Daily Load Study and Little Spokane River Fish Hatchery Water Quality Monitoring for Nutrients
Once both plans for Little Spokane are complete, we'll develop a more detailed approach that outlines specific activities to improve water quality.

**SQ#34**. *Has the draft water quality improvement report (TMDL) described above been completed? Have all appropriate TMDLs been determined and approved? If not, how can the smelter project permitting process proceed without approved TMDLs? Please provide an update on the current 303(d) listings and TMDLs.*

*From:*

**Data Summary Report, Little Spokane River Dissolved Oxygen and pH Total Maximum Daily Load Study and Little Spokane River Fish Hatchery Water Quality Monitoring for Nutrients**

**Abstract**

This report summarizes field and laboratory water quality data and flow data collected by the Washington State Department of Ecology (Ecology) and the Spokane County Conservation District during 2010 for the Little Spokane River Dissolved Oxygen/pH TMDL study. This report also summarizes data collected by Ecology during 2009 for the Little Spokane Fish Hatchery water quality monitoring study. A final report will be published in the near future. A quality control and quality assurance analysis of the data is included.

Field data include pH, conductivity, dissolved oxygen, water and air temperature, dew point, and flow. Laboratory data include ash-free dry weight, alkalinity, ammonia-nitrogen, biochemical oxygen demand, chloride, chlorophyll a, dissolved organic carbon, nitrite-nitrate nitrogen, orthophosphate, total non-volatile suspended solids, total organic carbon, total phosphorus, total persulfate nitrogen, and total suspended solids.

**Introduction**

The Little Spokane River and its tributaries have low dissolved oxygen (DO) concentrations and high pH that may not protect fish and other aquatic life. Dragoon Creek, a tributary to the Little Spokane River, has been the subject of Total Maximum Daily Load (TMDL) evaluations for ammonia nitrogen, chlorine, and total phosphorus (Joy, 1981 and Jones 1993). Phosphorus loads from the Little Spokane watershed have also been evaluated to assess seasonal impacts for the Spokane River/Lake Spokane Dissolved Oxygen TMDL (Moore and Ross, 2010). However, the causes of low DO and high pH in the Little Spokane River have not been assessed because data were lacking.

This report describes data collected from TMDL investigations in 2009 and 2010 that will fill the data gaps necessary to complete the pH and DO TMDLs in the Little Spokane watershed. Data collection included synoptic surveys during the summer low-flow season in 2010, as well as continuous temperature monitoring at selected locations. Additional nutrient data were collected from four sites during 2009 at the Little Spokane Fish Hatchery operated by the Washington Department of Fish and Wildlife.

**Study Area**

The Little Spokane River consists of a West Branch and East Branch that converge upstream of Milan. The river then continues down to Lake Spokane. The focus of the TMDL was the Little Spokane River mainstem from below Eloika Lake on the West Branch and Chain Lake on the East Branch, through the area between Milan and Dartford, to the mouth where it enters Lake Spokane (Figure 1).

The study area lies entirely within the Spokane Valley Outwash Plain Ecoregion. The primary land uses are forestland, agricultural, and residential.

**Several 303(d) listings in the upper West and East Branches were not assessed (Table 1). Evaluation of the water quality of lakes and wetlands upstream of the affected reaches would have required more resources than are available at this time. A specialized set of studies is necessary to adequately address sources of DO and pH criteria violations other than those naturally caused by the presence of these upstream physical features.**

Major tributaries in the Little Spokane River watershed also have DO and pH 303(d) listings. To address the listings, additional data were collected during the critical low-flow season from the lower free-flowing reaches of Dragoon, Deadman, and Little Deep Creeks.

*"Several 303(d) listings in the upper West and East Branches were not assessed (Table 1). Evaluation of the water quality of lakes and wetlands upstream of the affected reaches would have required more resources than are available at this time. A specialized set of studies is necessary to adequately address*

*sources of DO and pH criteria violations other than those naturally caused by the presence of these upstream physical features."*

**SQ#35.** *The Smelter site will be proximal to the upper East and West Branches of the troubled Little Spokane River; but the 303(d) listings have not yet been addressed. How can the smelter project proceed as it will be located in this sensitive, crucial watershed proximal to the upper East and West Branches of the troubled Little Spokane?*

*Please perform the necessary assessments of the upper East and West Branches of the Little Spokane and establish TMDLs prior to approving any permits.*

*From:* Washington State Department of Ecology Publication No: 05-03-121, **Quality Assurance Project Plan: Little Spokane River Watershed Total Maximum Daily Load Study:**

**2.1 Problem Statement**

As illustrated in Figure 1, the Little Spokane River (LSR) drainage basin consists of a 700 square mile drainage area that includes regions located in north-central Spokane County, southern Pend Oreille County, and southeastern Stevens County in northeast Washington, as well as Bonner County in the state of Idaho. The watershed has been designated as Water Resource Inventory Area (WRIA) number 55. The majority of the watershed, approximately 417 square miles, is in Spokane County. Stevens and Pend Oreille Counties make up approximately 260 square miles of the watershed. Only 23 square miles is in Bonner County, Idaho. The river is one of the two major tributaries to the Spokane River (Latah/Hangman Creek being the other). The river discharges into the Spokane River at River Mile (RM) 56.3 downstream of Nine Mile Dam and upstream of Long Lake.

**Several streams and rivers in the LSR drainage basin are on the 1998 and proposed 2002/2004 303(d) list because of violations of one or more water quality criteria.** The Little Spokane Water Quality Assessment (POCD, 2000) was conducted in 2000 in accordance to the Quality Assurance and Water Quality Monitoring Program Plan developed by the Pend Oreille Conservation District (POCD). This plan was reviewed and approved by the Washington State Department of Ecology (Ecology) Watershed Assessment Section. The Ecology Water Quality Program further selected the basin for a total maximum daily load (TMDL) assessment. The State of Washington Water Research Center (SWWRC), in cooperation with the Ecology Environmental Assessment Program (EAP), has been asked to design and conduct the TMDL study for the basin. This document summarizes the findings from historical data and from discussions with local agencies pertaining to water quality problems in the basin. Based upon these findings, a TMDL study project design and quality assurance project plan is described.

**8.3 Project Deliverables**

In addition to routine progress meetings with Ecology and public information briefings, the completion of this project will result in the following items:

Updated Ecology water quality database,
Monitoring report and assessment,
TMDL modeling and report for temperature,
TMDL modeling and report for fecal coliform bacteria, and
TMDL modeling and report for phosphorus/TSS.

It is anticipated that the phosphorus/TSS TMDL modeling will include the impacts of traditional nutrient/DO cycles. As such, the theoretical impacts of phosphorus and nitrogen species on DO, pH, and algae growth will likely provide extremely valuable information for future assessments. <u>However, given the duration of this proposed project, insufficient time/resources will be spent on developing justifiable DO and pH TMDLs.</u>

**3.4 Surface Water Quality Issues**

Ecology has identified the Little Spokane River as a water body with water quality and water quantity issues. Since the wastewater treatment plant at Deer Park now uses land applications for treating its

summer discharge, no specific point sources have been identified that contribute to the water quality problems in the Little Spokane River (Ecology 1992). Nonpoint sources are the main contributors to pollution problems in the Little Spokane River. A majority of the land in the Little Spokane watershed is used for agricultural purposes. Runoff of pesticides and fertilizers from agriculture practices are potential nonpoint source pollutants. Dairies located around the basin also contribute to the water quality problems. There are about 14 dairies in Spokane County with a total animal number of 2,677. We did not find any specific references of dairies in Pend Oreille County. Grazing by cattle and cattle having access to the river have also exacerbated the problem. Temperature problems appear to be the result of both natural and anthropogenic causes. Increased ground water pumping has reduced base flow in certain sections of the watershed thus exasperating the stream temperature problem. Water discharge permits for the Little Spokane River are given in Table 7.

The lower portion of the watershed, especially in the Spokane area, has seen a lot of land use changes due to urbanization. Because of rapid economic growth in North Spokane, much of the rural land has been converted to urban and suburban environments (Dames and Moore 1995). Such increases in housing and commercial development have given rise to nonpoint source pollutants such as septic systems, urban/highway storm water, and agricultural runoff. Forest practices related to timber harvesting have also contributed to this problem.

Other potential problems that were seen in the Little Spokane River in 1992 when a statewide wide water quality assessment was carried out included (Ecology, 1995):

The Little Spokane River (48.6 miles) was not meeting swimmable and fishable goals of the federal Clean Water Act and water quality standards for priority pollutants. Causes included metals (cyanide and mercury), inorganics, and pathogens indicators such as fecal coliform. Sources included agriculture, landfills, hazardous waste disposal sites and inplace contaminants.

Diamond Lake was considered threatened for supported beneficial uses due to nutrient levels. Causes included land development, sludge, removal of riparian vegetation and natural sources.

Eloika Lake was considered as having impaired aesthetic enjoyment due to nutrients, siltation, and taste odor. The sources were unknown.

Sacheen Lake was considered impaired for aesthetic enjoyment due to eutrophication. No cases of sources were identified

Golder (2003) conducted the most recent survey of water quality in WRIA 55 in a comprehensive report to Spokane County and the local Planning Unit. Their report essentially supported earlier findings that dissolved oxygen, fecal coliform, pH, temperature, and PCBs are still the primary pollutants of concern. DO and temperature problems were most likely to occur during summer months coinciding with low flow periods. Fecal coliform concentrations were quite variable throughout the year with some dilution effects during the spring freshet. The pH values were also variable however, unlike the fecal coliform data, no significant correlation to flow was observed.

**As a result of these water quality problems, Ecology identified the Little Spokane River as an impaired Washington state waterway. The Little Spokane River was put on 303(d) list in 1998 and 2002/2004 for violation of state's water quality standards (Appendix A) for pH, temperature, dissolved oxygen, fecal coliform, and PCBs.**

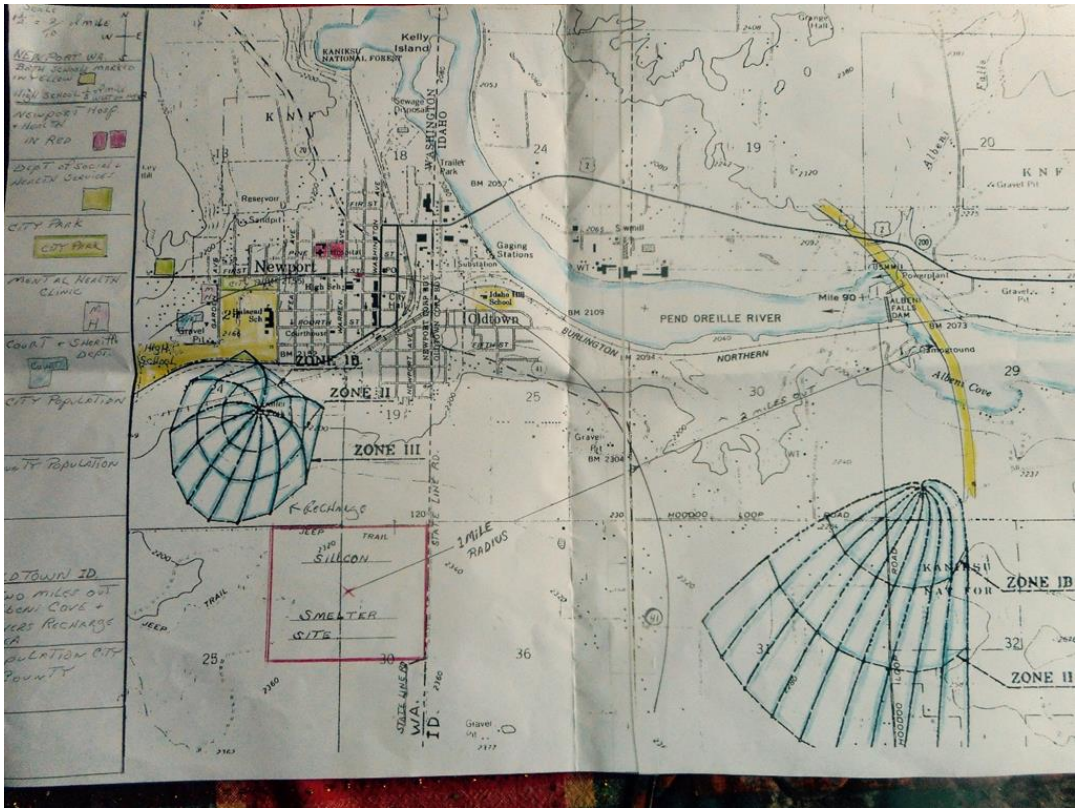
### 3.5 Ground Water Quantity/Quality Issues

**Ground water use in WRIA 55 exceeds surface water use, drawing heavily from aquifers which are hydraulically connected with the Little Spokane River and its tributaries. The excessive ground water**

**pumping has resulted in decrease in streamflow. This is especially the case in the western and southern portion of the watershed where ground water use is the greatest.**
Since 1980's Ecology has monitored water levels in the Green Bluff Area (northeast of Spokane in township 27N Range 44E). Ground water in this area discharges to Deadman Creek and Little Deep Creek. **Ground water level monitoring data from 1980-1990 indicates the ground water level has been declining due to excessive pumping of water for industrialization and irrigation purposes (Ecology, 1995).**
**A study carried out by the Spokane County Conservation District in 2001-2002 indicated that ground water has been contaminated with nitrate near the Deadman Creek and Little Deep Creek. The source of nitrogen was from housing development as well as from the springs that are located around the Deadman Creek**.

*From*: **CDC**, **Center for Disease Control and prevention**
**Arsenic and Drinking Water from Private Wells**
Arsenic is an element that occurs naturally in rocks and soil and is used for a variety of purposes within industry and agriculture. It is also a byproduct of copper smelting, mining, and coal burning. Arsenic can combine with other elements to make chemicals used to preserve wood and to kill insects on cotton and other agricultural crops.
**Where and how does arsenic get into drinking water?**
Arsenic can enter the water supply from natural deposits in the earth or from industrial and agricultural pollution. It is widely believed that naturally occurring arsenic dissolves out of certain rock formations when ground water levels drop significantly. Some industries in the United States release thousands of pounds of arsenic into the environment every year. Once released, arsenic remains in the environment for a long time. Arsenic is removed from the air by rain, snow, and gradual settling. Once on the ground or in surface water, arsenic can slowly enter ground water. High arsenic levels in private wells may come from certain arsenic containing fertilizers used in the past or industrial waste. It may also indicate improper well construction or overuse of chemical fertilizers or herbicides in the past.
In the ***Soils, Topography, Unique Physical Features, Erosion, Land Use*, Arsenic in Soils** section above, the **Distribution of reported locations of arsenic-bearing ore map** shows that the Newport area is a reported location of arsenic-bearing ore. This puts Newport area wells at an alarming risk for arsenic contamination due to declining ground water levels described above, and also from the added arsenic containing emissions from the proposed Smelter.

**SQ#36**. *The above excerpts from the reports above show that the Little Spokane River Watershed is at serious risk. The smelter will only exacerbate this condition. Please evaluate all of the water quality issues described in the excerpts in the "Little Spokane River" section above, including the alarming potential for increasing levels of arsenic in the Newport area wells. Also provide a current update on all of the water quality issues described in the "Little Spokane River" section. Based on the information above, please justify the location of the smelter on a site that is located at the headwaters of the troubled Little Spokane River watershed.*



Map showing the Recharge Zone that abuts the smelter site and the city of Newport; and is approximately 1 mile from the Little Spokane River headwaters.

***From: Visit Spokane: Little Spokane River***

Don't be fooled by the name—the Little Spokane River is a 35-mile long hidden treasure. A popular fly-fishing destination, the Little Spokane contains native rainbow trout, introduced brown trout, suckerfish, brook trout and mountain whitefish. If you're not an angler, the Little Spokane runs through Riverside State Park and offers miles of hiking trails. Try the loop beginning at Painted Rocks in the Little Spokane Natural Area where you can find views of Long Lake and the Spokane River.

**SQ#37**. *The Little Spokane River is an important natural area and a critical part of recreation and tourism in our region. Please explain how the smelter toxic emissions will fit with the fishing, hiking, canoeing, boating and other activities that are so important for health and welfare of our citizens and visitors.*

**(d) Plants and Animals.** Habitat for and numbers or diversity of species of plants, fish, or other wildlife, Unique species, Fish or wildlife migration routes, Public water supplies. ***Note:*** *underlined topics = PacWest "line-outs". We disagree with the Line outs.*

## ***Plants and Animals***

A partial list of major tree species found in the Okanogan Highland Forests:
Douglas fir (pseudotsuga menziesii), Ponderosa pine (pinus ponderosa), Western larch (larix occidentalis), Englemann spruce (picea englemanni), Quaking aspen (populus tremuloides), Black cottonwood (populus trichocarpa), Red alder (alnus rubra), Sub alpine fir, Lodge pole pine *(14)*

***Animals, fish, or other wildlife, Unique species, Fish or wildlife migration routes***

This lesser [Selkirk] range is home to bighorn sheep, elk, moose, deer, bear, cougar, bobcats, mountain caribou, and several large predatory birds such as bald eagles and osprey. *(1) (P18-p1)*

***The [Selkirk Caribou] population is currently listed as endangered under the Endangered Species Act with designated critical habitat.***

There are currently believed to be at least 50-60 grizzly bears in the Selkirk Recovery Zone with numbers approximately equally divided between the Canadian and U.S. portions of the ecosystems. Another 40 bears are estimated to reside in the Cabinet-Yaak Recovery Zone of northwest Montana and northeast Idaho. *(15)*

**Interagency Grizzly Bear Committee*Grizzly bears are listed as "threatened" in the continental United States by the U.S. Fish and Wildlife Service.*** *Today, grizzly bear distribution is primarily within but not limited to the areas identified as "Recovery Ecosystems." (REF)*

All of the amphibian species in the study area breed in aquatic habitats, particularly in seasonal or persistently flooded wetlands. ***Two Priority species, the Columbia spotted frog (Rana luteiventris) and northern leopard frog (Rana pipiens) thrive in our wetlands.*** *(1) (P20-p1)*

***From the Fish and Wildlife Service (endangered, threatened species in Pend Oreille county)*** *(16):*

**LISTED**
Bull trout *(Salvelinus confluentus)*
Canada lynx *(Lynx canadensis)*
Grizzly bear *(Ursus arctos horribilis)*
Woodland caribou *(Rangifer tarandus caribou)*
*Spiranthes diluvialis* (Ute ladies'-tresses)

**DESIGNATED**
Critical habitat for the bull trout
Critical habitat for woodland caribou

**PROPOSED**
North American wolverine *(Gulo gulo luteus)* – contiguous U.S. DPS

**CANDIDATE**
Yellow-billed cuckoo *(Coccyzus americanus)*
*Pinus albicaulis* (whitebark pine)

**SPECIES OF CONCERN**
Bald eagle *(Haliaeetus leucocephalus)*
Fisher *(Martes pennanti)*
Kincaid meadow vole *(Microtus pennsylvanicus kincaidi)*
Long-eared myotis *(Myotis evotis)*
Northern goshawk *(Accipiter gentilis)*
Northern leopard frog *(Rana pipiens)*
Olive-sided flycatcher *(Contopus cooperi)*
Pacific lamprey *(Lampetra tridentata)*
Pallid Townsend's big-eared bat *(Corynorhinus townsendii pallescens)*
Pygmy whitefish (*Prosopium coulteri*)
Redband trout *(Oncorhynchus mykiss)*
River lamprey *(Lampetra ayresi)*

Western brook lamprey *(Lampetra richardsoni)*
Westslope cutthroat trout *(Oncorhynchus clarki lewisi)*
*Botrychium ascendens* (triangular-lobed moonwort)
*Botrychium crenulatum* (crenulate moonwort)
*Botrychium paradoxum* (two-spiked moonwort)
*Botrychium pedunculosum* (stalked moonwort)

*From:* **Conservation Northwest**
The South Selkirks mountain caribou: endangered icons and the world's southernmost caribou herd
A unique ecotype of the woodland caribou subspecies (*rangifer tarandus caribou*), mountain caribou reside in limited numbers in interior British Columbia, western Alberta, northern Idaho and northeast Washington. Historically, they were also present in northwestern Montana and central Idaho.
The South Selkirk Mountains herd of mountain caribou, the world's southernmost remaining caribou and the only herd that still ranges into the lower 48 states, occupies a transboundary range from southeast British Columbia into northeast Washington and northwest Idaho.


A majestic caribou bull in the Selkirk Mountains. Photo: USFWS

**Conservation Northwest is a leading organization in the fight to save the critically endangered caribou of the Inland Northwest.**
Mountain caribou facts

- While barren-ground caribou migrate long distances seasonally, woodland caribou live within the same mountains and forests. To find food and escape predators, they climb high into the mountains in summer and descend into old growth forests during the chilly winter months.
- Amazingly, in winter woodland caribou depend absolutely upon arboreal, or tree, lichens as their main source of food. Barren-ground caribou eat lichens that grow on the open ground.
- Huge hooves keep woodland caribou "afloat" over deep snowpacks, giving them the "step-up" to browse tree lichens growing from the lowest branches of old-growth trees. Tree lichens thrive in the moist, internal air within the forest canopies of the Inland Temperate Rainforest.

**SQ#38**. *Please asses the current status of all the above challenged species and compile a report for public viewing before any permits are approved. Please also construct and implement a plan to protect all of our challenged and endangered species.*

**<u>Lichens</u>**

**Manual for Monitoring Air Quality Using Lichens on National Forests of the Pacific Northwest**
US Department of Agriculture-Forest Service, Pacific Northwest Region, Air Resource Management, Portland, Oregon, January 2004

**1.32 Sensitivity of lichens to air pollutants**.

Lichens have species-specific response patterns to increasing levels of atmospheric pollutants, ranging from relative resistance to high sensitivity. Sensitive species are damaged or killed by annual average levels of sulfur dioxide as low as 8-30 µg/ m3 (Johnson 1979, DeWit 1976, Hawksworth and Rose 1970, LeBlanc et al. 1972), by short term exposure to nitrogen oxides as low as 564 ug/m3 (Holopainen and Kärenlampi 1985) and by peak ozone concentrations as low as 20- 60 ug/m3 (Egger et al. 1994, Eversman and Sigal 1987). With regard to ozone, most reports of adverse effects on lichens have been in areas where peak ozone concentrations were at least 180-240 µg/m3 (Scheidegger and Schroeter 1995, Ross and Nash 1983, Sigal and Nash 1983, Zambrano and Nash 2000). Ruoss et al. (1995) found no adverse effects on lichens in areas of Switzerland with daily summer peaks of 180-200 µg/m3. They attributed lack of response to low lichen metabolic activity caused by low humidity at times of the day when ozone was highest; ozone concentrations never rose above 120 µg/m3 when the relative humidity was over 75%.

In addition to gaseous pollutants, lichens are sensitive to depositional compounds, particularly sulfuric and nitric acids, hydrogen ions, sulfites and bisulfites, and other fertilizing or alkalinizing pollutants such as NH3 and NH4+. While sulfites, nitrites, and bisulfites are toxic in themselves, acidic compounds affect lichens through direct toxicity of the H+ ion, fertilization by nitrate (NO3-), and acidification of bark substrates (Farmer et al. 1992). For example, in a study of northwest Britain, *Lobaria pulmonaria* was limited at nearly all sites to trees with bark pH >5 (Farmer et al. 1991). In the Netherlands, a number of studies have demonstrated that ammoniabased fertilizers alkalinize and enrich the nutritional composition of lichen substrates which in turn influences lichen community composition and element content (van Herk 1999, van Dobben et al. 2001, van Dobben and ter Braak 1999 and 1998). Finally, it is clear that pollutant mixes can have synergistic protective or adverse effects on lichens and that individual species differ in their sensitivity to these pollutants and their response to pollutant mixes (Hyvärinen et al. 1992, Gilbert 1986, Farmer et al. 1992).

The ability of lichens to absorb and concentrate sulfur from oxidized sulfur sources is well established, as is their sensitivity to SO2 gas. The first indications of air pollution damage from these sources are inhibition of nitrogen fixation, increased electrolyte leakage, decreased photosynthesis and respiration followed by discoloration and death of the algae (Fields 1988). More resistant species tolerate regions with higher concentrations of these pollutants, but may exhibit changes in internal and/or external morphology (Nash and Gries 1991, Will-Wolf 1980).

A preliminary air quality assessment can be made by studying the lichens present in an area with reference to their sensitivities to sulfur dioxide or other pollutants. If many or all of the more sensitive species are absent from an area where they would be expected to occur, there is a high probability that the air quality has been degraded. If all of the expected sensitive species are present, air pollution is unlikely to be adversely affecting other organisms. Denison (1987) cautions: 1) lichen community dynamics are complex and a missing species can also be due to gradual climatological and environmental changes during natural succession, and 2) variation in the skill and meticulousness of the individual researchers who measure and identify the lichens can affect results as much as pollution effects. The most accurate results from this method are achieved where historical records (Wetmore 1988) and good quality control and quality assurance programs to assess and minimize observer error are available (Stolte et al. 1993).

**Why Are Lichens Important in an Ecosystem?**

An Important Food Source

Lichens are an important part of the food web in several ecosystems. Since they take care of their own food production, they can be classified as producers and provide food for other organisms. Many small animals such as squirrels and birds eat lichens. Larger mammals such as deer, mountain goats and caribou also use lichens as a significant food source, especially in the winter when food is scarce. Some bears have even been known to graze on lichens.

Soil Formation

Soil is the foundation for most ecosystems and lichens are critical in creating soil. Many lichens are considered colonizing organisms. This means they are some of the first organisms that can live in an ecosystem that is either new or starting over. They can live on rocks and, as they grow, the acids they secrete break down the rocks. This makes a significant contribution in the formation of soil. Once soil is formed, other organisms are able to live in the area and the ecosystem can continue to develop.

Habitat for Other Organisms

Lichens provide important habitat for many other organisms. They are an excellent home for insects, arthropods, and other small invertebrates. Lichens are also used by organisms to help build and insulate their homes. Birds, for example, use various species of lichens (especially the fruticose types) to build their nests. Lichens are absorbent, flexible and soft and are therefore great additions to borrows and other small animal homes. Lichens also provide excellent camouflage for small insects and other invertebrates.

A Source of Nitrogen

Nitrogen is a nutrient that is essential for living things. However, not many organisms can add new nitrogen to an ecosystem. Many types of lichens are able to capture nitrogen from the atmosphere and then secrete it into the soil where it can be used by plants and passed on to other organisms

**Lichens are a critical food source of the endangered Mountain (Selkirk) Caribou** (see above)

**SQ#39**. *Please assess the current status of lichen health in Pend Oreille county forests and natural areas and also in the Selkirk Caribou range area near Sullivan Lake, and compile a report for public viewing before any permits are approved. Please adopt a monitoring program.*

***Insects***

**'Hyper-alarming' study reveals dramatic decline of insect population in rainforest**
**Researchers warn decrease could put food supply in jeopardy from loss of pollinating insects ,**Ben Guarino The Independent, October, 2018

Insects around the world are in a crisis, according to a small but growing number of long-term studies showing dramatic declines in invertebrate populations. A new report suggests that the problem is more widespread than scientists realised. Huge numbers of bugs have been lost in a pristine national forest in Puerto Rico, the study found, and the forest's insect-eating animals have gone missing, too.

In 2014, an international team of biologists estimated that, in the past 35 years, the abundance of invertebrates such as beetles and bees had decreased by 45 per cent. In places where long-term insect data is available, mainly in Europe, insect numbers are plummeting. A study last year showed a 76 per cent decrease in flying insects in the past few decades in German nature preserves.

The latest report, published on Monday in the *Proceedings of the National Academy of Sciences*, shows that this startling loss of insect abundance extends to the Americas. The study's authors implicate climate change in the loss of tropical invertebrates.

A recent analysis of climate change and insects, published in August in the journal *Science*, predicts a decrease in tropical insect populations, according to an author of that study, Scott Merrill, who studies crop pests at the University of Vermont. In temperate regions farther from the equator, where insects

can survive a wider range of temperatures, agricultural pests will devour more food as their metabolism increases, Mr Merrill and his co-authors warned. But after a certain thermal threshold, insects will no longer lay eggs, he said, and their internal chemistry breaks down.

The authors of a 2017 study of vanished flying insects in Germany suggested other possible culprits, including pesticides and habitat loss. Arthropods around the globe also have to contend with pathogens and invasive species.

"It's bewildering and I'm scared to death that it's actually death by a thousand cuts," Mr Wagner said. "One of the scariest parts about it is we don't have an obvious smoking gun here." A particular danger to these arthropods, in his view, was not temperature but droughts and lack of rainfall.

**Bees**

*From*: "**Tainted Earth: Smelters, Public Health, and the Environment**" by Marianne Sullivan
"Electrostatic charges help bees gather pollen and are thought to cause pollution particles to adhere to their bodies. Arsenic and other heavy metals can also accumulate inside the bees' bodies.
Early 80's research ... bees in Puget Sound were used to map the extent of the pollution from the Tacoma smelter. The researcher also used brood heath and survival as an additional indicator of environmental damage. The EPA funded his research. Arsenic concentrations in Tacoma bees were 60 times the background. More than 64% of colonies studied in the region showed low brood viability."

**SQ#40**. *Please provide an assessment of the current status of our insect population in Pend Oreille County to establish a baseline prior to approving any permits. Please construct a monitoring program tacking the health of our insect population; please involve Pend Oreille county citizens.*

**(e) Energy and Natural Resources.** Amount Required/rate of use/efficiency, Source/availability, Nonrenewable resources, Conservation and renewable resources, Scenic resources**.**

**Electrical power from the Pend Oreille County Public Utility district (PUD)**.
The proposed smelter will require 105 MegaWatts of electricity for the first proposed phase of 2 submerged arc furnaces (one stack) and 210 MegaWatts of electricity for the second proposed phase of 4 submerged arc furnaces (two stacks).
Blockchain mining and krypto-currency companies that can demand up to 250 MWatts are already moving in to Pend Oreille County.

*Excerpts From:*
**How Does an Electric ARC Furnace Work?** By Blake Flournoy **Arc Furnace Drawbacks**
Though arc furnaces are useful and can process large amounts of scrap metal in a relatively short amount of time, their traits give them a few downsides that must be considered before using them. More than anything else, arc furnaces use an incredibly large amount of electricity – to the point that industrial arc furnace use has been known to make power flicker in the area and use times are generally keyed to periods where electricity isn't being widely used. They also, like other furnace types, are loud and require a nearby steel mill or other metal processing plant to effectively utilize the products produced within.

*Excerpts From:*
**Electric arc furnace,** From Wikipedia, the free encyclopedia
**Environmental issues**
Although the modern electric arc furnace is a highly efficient recycler of steel scrap, operation of an arc furnace shop can have adverse environmental effects. Much of the capital cost of a new installation will be devoted to systems intended to reduce these effects, which include:

- Enclosures to reduce high sound levels
- Dust collector for furnace off-gas
- Slag production
- Cooling water demand
- Heavy truck traffic for scrap, materials handling, and product
- Environmental effects of electricity generation

Because of the very dynamic quality of the arc furnace load, **power systems may require technical measures to maintain the quality of power for other customers; flicker and harmonic distortion are common side-effects of arc furnace operation on a power system.** For this reason, the power station should be located as close to the EA furnaces as possible.

People are already noticing "flicker" of their electricity, and are concerned about quality, uniform supply of electricity to run their well pumps and households.

**SQ#41**. *Does the PUD have enough power to provide citizens or Pend Oreille County sufficient and quality electricity to run health and safe households? Doe the PUD guarantee and prioritize power to heavy industry, block-chain mining/krypto-currency groups, and other commercial industries above Pend Oreille citizens? Will there be electric power "flicker", disruptions, distortions, and surges that will damage well pumps and household electrical systems?*

## SECTION 2: BUILT ENVIRONMENT

**(a) Environmental Health.** Noise, Risk of Explosion, Releases or potential releases to the environment affecting public health, such as toxic or hazardous materials

We have not yet received a smelter building, furnace, stack/scrubbers, baghouse, storage structure(s), overall site layout, transportation infrastructure, water/sewage/waste source/ infrastructure, waste handling, and transportation infrastructure design.

**SQ42.** *Why was the scoping process started when we do not have the essential information to formulate scoping questions?*

**SQ43**. *Why was the SEPA Checklist omitted? For such a controversial, highly polluting heavy industrial project, please provide justification for skipping the SEPA Checklist. Has the SEPA Checklist been omitted for other industry applications? If so, how many? Please provide a list of instances where the SEPA checklist was omitted.*

**SQ44.** *The secretive nature of the HiTest/PacWest purchase of land from the PUD and Pend Oreille County was inappropriate and possibly illegal. The land is not zoned for heavy industrial use; is this the reason the Ecology chose to skip the SEPA Checklist?*

HiTest/PacWest continues to misrepresent and misinform. For example, From HiTest/PacWest's website: "**Production process does not require or produce any heavy metals or hazardous chemicals as by-products – All materials required during production process and consumed leave the plant as a saleable product"**. But, yearly estimated HiTest smelter emissions include: 320 tons Greenhouse Gases, 760 tons Sulfur Dioxide, 700 tons Nitrogen Oxides, 601 tons Carbon Monoxide, and 111 tons Particulate Matter; plus Lead, Fluorides, Hydrogen Sulfide, Polyaromatic Hydrocarbons, and other toxins.

**This is clearly a false statement**. All smelters produce tons of toxic and hazardous emissions that are released into the environment. These toxic emissions DO LEAVE the plant via the plume from the stack and also within the plant (fugitive emissions).

HiTest/PacWest has shown a tendency of untruthful behavior, and has created significant distrust of both HiTest/PacWest; and our state, county, and local government officials. This has caused significant

anxiety, and contempt of this process. That citizens voices have been shutdown by our government officials and the damage it has already caused needs to be addressed and included in the Environmental Impact Statement.

**PSD Modelling Protocol**

10/9. The PSD Modelling Protocol is based on inaccurate information obtained from Deer Park, Spokane county. The topography of Deer is dramatically different than the topography of the Newport area. In the Pend Oreille River Valley, temperature inversions begin in October and persist into Spring. These fog inversions significantly exacerbate the negative impacts of pollutants on health and also exacerbate the effects of acid rain on plant foliage.

Ramboll Comments regarding snow cover in the Newport area are inaccurate.

HiTest/PacWest continues to dismiss the threat of Silicosis, when other sources refute this claim

Dust and particulates during transport to and from the plant and transfer of materials at the site.

At the smelter

**#SQ45**. *Do you concur that HiTest/PacWest has made inaccurate statements? Please investigate all sources of silica dust in all areas and processes of the smelter (including transport) and the risk of silicosis. Do you conclude that Silicosis is a risk?*

## ***Releases or potential releases to the environment affecting public health, such as toxic or hazardous materials***

## ***Coal***

**SQ#46**. Where will the coal come from? How will the coal be transported? Will the coal be covered during transport? Will the coal be crushed prior to transport? Will the coal be cleaned prior to shipment to the smelter?

**SQ#47**. How and where will the coal be stored? Will it be sealed from the soil, or will it be in contact with the soil?

**SQ#48**. Will the coal be sealed and enclosed from the outdoor natural environment at all times?

**SQ#49**. Will the coal be crushed or broken on site? If so, how and where?

**SQ#50**. Will the coal be further processed on site? If so, how and where?

**SQ#51**. How much of the coal will be considered waste, and how will it be handled and disposed?

**SQ#52**. What is the estimated tonnage of coal that will be stored on site at any one time?

**SQ#53** How will the coal be loaded into the furnace?

**SQ#54**. Will Fly Ash be a by-product of the smelter? If so, how will the fly as be handled and stored? Will fly ash be further processed? Will any fly ash components be sold?

### ***Quartz***

**SQ#55**. Where will the quartz come from? How will the quartz be transported? Will the quartz be covered during transport? Will the quartz be crushed prior to transport? Will the quartz be cleaned prior to shipment to the smelter?

**SQ#56**. How and where will the quartz be stored? Will it be sealed from the soil, or will it be in contact with the soil?

**SQ#57**. Will the quartz be covered and enclosed from the outdoor, natural environment at all times?

**SQ#58**. Will the quartz be crushed or broken on site? If so, how and where?

**SQ#59**. Will the quartz be further processed on site? If so, how and where?

**SQ#60**. How much of the quartz will be considered waste, and how will it be handled and disposed?

**SQ#61**. What is the estimated tonnage of quartz that will be stored on site at any one time?

## How will the quartz be loaded into the furnace?

***Charcoal***

**SQ#62**. Where will the charcoal come from? How will the charcoal be transported? Will the charcoal be covered during transport? Will the charcoal be crushed prior to transport? Will the charcoal be cleaned prior to shipment to the smelter?

**SQ#63**. Will charcoal be prepared on site? If so, how and where? What would be the estimated composition of the emissions from on site preparation? What would be the design of the kiln or furnace? What would be the waste products, and how would they be handled? How would this fit in with the initial emissions estimation for PSD?

**SQ#64**. How and where will the charcoal be stored? Will it be sealed from the soil, or will it be in contact with the soil?

**SQ#65**. Will the charcoal be sealed and enclosed from the outdoor natural environment at all times?

**SQ#66**. Will the charcoal be crushed or broken on site? If so, how and where?

**SQ#67**. Will the charcoal be further processed on site? If so, how and where?

**SQ#68**. How much of the charcoal will be considered waste, and how will it be handled and disposed?

**SQ#69**. What is the estimated tonnage of charcoal that will be stored on site at any one time?

**SQ#70** How will the charcoal be loaded into the furnace?

***Wood Chips***

**SQ#71**. Where will the wood chips come from? How will the wood chips be transported? Will the wood chips be covered during transport? Will the wood chips be cut to size prior to transport? What is the estimated size/dimension of the wood chips? Will the chips be cleaned or processed prior to shipment to the smelter?

**SQ#72**. How and where will the wood chips be stored? Will it they sealed from the soil, or will they be in contact with the soil?

**SQ#73**. Will the wood chips be sealed and enclosed from the outdoor natural environment at all times?

**SQ#74**. Will the wood chips be further processed on site before use? If so, how and where?

**SQ#75**. How much of the wood chips will be considered waste, and how will they be handled and disposed?

**SQ#76**. What is the estimated tonnage of wood chips that will be stored on site at any one time?

**SQ#77** How will the coal be loaded into the furnace?

***Flue***

**SQ#78**. How will the flue be collected? Please provide design details and describe the health hzards.

**SQ#79**. How and where will the flue be stored? Will it be sealed from the soil, or will it be in contact with the soil?

**SQ#80**. Will the flue be covered and enclosed from the outdoor natural environment at all times?

**SQ#81**. Will the flue be further processed on site? If so, how and where?

**SQ#82**. How much flue will be considered waste, and how will it be handled and disposed?

**SQ#83**. How and where will the flue be packaged?

**SQ#84**. Will the flue be sold? Who are the customers and how will it be used?

**SQ#85**. How will the flue be loaded for transport, and how will it be transported?

**SQ#86**. What is the estimated tonnage of flue that will be stored on site at any one time?

***Slag***

**SQ#87**. How and where will the slag be stored? Will it be sealed from the soil, or will it be in contact with the soil?

**SQ#88**. Will the slag be covered and enclosed from the outdoor natural environment at all times?

**SQ#89**. Will the slag be crushed or broken on site? If so, how and where?

**SQ#90**. Will the slag be further processed on site? I f so, how and where?

**SQ#91**. How much slag will be considered waste, and how will it be handled and disposed?
**SQ#92**. How will the slag be packaged?
**SQ#93**. Will the slag be sold? Who are the customers and how will it be used?
**SQ#94**. How will the slag be loaded for transport, and how will it be transported?
**SQ#95**. What is the estimated tonnage of slag that will be stored at any one time?

***Final Silicon Product***
**SQ#96**. How and where will the silicon be stored? Will it be sealed from the soil, or will it be in contact with the soil?
**SQ#97**. Will the silicon be covered and enclosed from the outdoor natural environment at all times?
**SQ#98**. Will the silicon be crushed or broken on site? If so, how and where?
**SQ#99**. Will the silicon be further processed on site? I f so, how and where?
**SQ#100**. How much silicon will be considered waste, and how will it be handled and disposed?
**SQ#101**. How will the silicon be packaged?
**SQ#102**. How will the silicon be sold? Who are the customers and how will it be used?
**SQ#103**. How will the silicon be loaded for transport, and how will it be transported?
**SQ#104**. What is the estimated tonnage of silicon that will be stored at any one time?

***Other Questions***
**SQ#105**. Will the smelter be used for any other products besides silicon?
**SQ#106**. Will any radioactive products or by-products (such as uranium, etc.) be generated during the smelting process?
**SQ#107**. If radioactive products are generated, how will they be disposed?
**SQ#108**. If radioactive products are generated, will they be sold?
**SQ#109**. Will any toxic or potentially toxic products or by-products (such as arsenic, lead, mercury, cadmium or other metals or compounds, etc.) be generated during the smelting process?
**SQ#110**. If any of the above products are generated, how will they be disposed?
**SQ#111**. If any of the above products are generated, will they be sold?

**SQ#112**. *Please describe what he composition of the flue will be, and assess the risk of silicosis and other health risks.*

## ***Coal: Pollution, Smelter Emissions Impacts on Health and Environment***

Air pollution from coal-fired power plants is linked with asthma, cancer, heart and lung ailments, neurological problems, acid rain, global warming, and other severe environmental and public health impacts. *(17)*

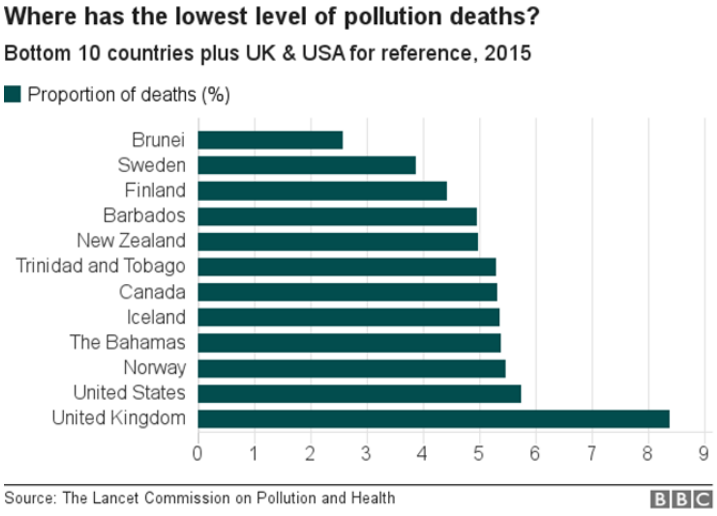
***From: Coal's Assault on Human Health, Physicians for Social Responsibility:***
**Coal**: Coal pollutants affect all major body organ systems and contribute to four of the five leading causes of mortality in the U.S.: heart disease, cancer, stroke, and chronic lower respiratory diseases. This conclusion emerges from our reassessment of the widely recognized health threats from coal. Each step of the coal lifecycle—mining, transportation, washing, combustion, and disposing of post-combustion wastes—impacts human health. Coal combustion in particular contributes to diseases affecting large portions of the U.S. population, including asthma, lung cancer, heart disease, and stroke, compounding the major public health challenges of our time. It interferes with lung development, increases the risk of heart attacks, and compromises intellectual capacity. Oxidative stress and inflammation are indicated as possible mechanisms in the exacerbation and development of many of the diseases under review. In addition, the report addresses another, less widely recognized health threat from coal: the contribution

of coal combustion to global warming, and the current and predicted health effects of global warming. *(18)*

**Pollution linked to one in six deaths,** By Katie Silver Health reporter, BBC News, 20 October 2017

Pollution has been linked to nine million deaths worldwide in 2015, a report in The Lancet has found**.**
Almost all of these deaths occurred in low- and middle-income countries, where pollution could account for up to a quarter of deaths. Bangladesh and Somalia were the worst affected.
Air pollution had the biggest impact, accounting for two-thirds of deaths from pollution.
Brunei and Sweden had the lowest numbers of pollution-related deaths.
Most of these deaths were caused by non-infectious diseases linked to pollution, such as heart disease, stroke and lung cancer.

"Pollution is much more than an environmental challenge - it is a profound and pervasive threat that affects many aspects of human health and wellbeing," said the study's author, Prof Philip Landrigan, of the Icahn School of Medicine, at Mount Sinai in New York.
The biggest risk factor, air pollution, contributed to 6.5 million premature deaths. This included pollution from outdoor sources, such as gases and particulate matter in the air, and in households, from burning wood or charcoal indoors.
The next largest risk factor, water pollution, accounted for 1.8 million deaths, while pollution in the workplace was linked to 800,000 deaths globally.
About 92% of these deaths occurred in poorer countries, with the greatest impact felt in places undergoing rapid economic development such as India, which had the fifth highest level of pollution deaths, and China, which had the 16th.




In the United States, more than 5.8% - or 155,000 - deaths could be linked to pollution.
The authors said air pollution affected the poor disproportionately, including those in poor countries as well as poor people in wealthy countries.
Study author Karti Sandilya, from Pure Earth, a non-governmental organisation, said: "Pollution, poverty, poor health, and social injustice are deeply intertwined.
"Pollution threatens fundamental human rights, such as the right to life, health, wellbeing, safe work, as well as protections of children and the most vulnerable."
The results were the product of a two-year project. The authors have published an **interactive map** illustrating their data.

All coals contain some arsenic. The U.S. Geological Survey (USGS) maintains an extensive database of over 7,000 analyses of U.S. coals. Data from this compilation indicate that the average arsenic concentration for U.S. coal is about 24 parts per million

**Bituminous Coal Characteristics and Applications in Energy: A Common Type of Hard Coal with Thermal and Metallurgical Uses**, By Wendy Lyons Sunshine Updated November 20, 2017 US Economy World Economy

**Types of Bituminous Coal**

**Thermal coal**, sometimes called steaming coal, is used to power plants that produce steam for electricity and industrial uses.

Trains that run on steam sometimes are fueled with "bit coal," a nickname for bituminous coal.

**Metallurgical coal**, sometimes referred to as coking coal, is used in the process of creating coke necessary for iron and steel production. Coke is a rock of concentrated carbon created by heating bituminous coal to extremely high temperatures without air. This process of melting the coal in the absence of oxygen to remove impurities is called pyrolysis.

**Environmental Concerns**

Bituminous coal lights on fire easily and can produce excessive smoke and soot -- particulate matter -- if burned improperly. Its high sulfur content contributes to acid rain.

Bituminous coal contains the mineral pyrite, which serves as a host for impurities such as **arsenic** and **mercury**. Burning the coal releases trace mineral impurities into the air as pollution. During combustion, approximately 95 percent of bituminous coal's sulfur content gets oxidized and released as gaseous sulfur oxides.

Hazardous emissions from bituminous coal combustion include particulate matter (PM), sulfur oxides (SOx), nitrogen oxides (NOx), trace metals such as lead (Pb) and mercury (Hg), vapor-phase hydrocarbons such as methane, alkanes, alkenes and benzenes, and polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans, commonly known as dioxins and furans. When burned, bituminous coal also releases hazardous gasses such as hydrogen chloride (HCl), hydrogen fluoride (HF) and polycyclic aromatic hydrocarbons (PAHs).

**Mercury and Halogens in Coal—Their Role in Determining Mercury Emissions From Coal Combustion, USGS**, By Allan Kolker,1 Jeffrey C. Quick,2 Connie L. Senior,3 and Harvey E. Belkin1

**Introduction**

Mercury (Hg) is a toxic pollutant. In its elemental form, gaseous mercury has a long residence time in the atmosphere, up to a year, allowing it to be transported long distances from emission sources. Mercury can be emitted from natural sources such as volcanoes, or from anthropogenic sources, such as coal-fired powerplants. In addition, all sources of Hg on the Earth's surface can re-emit it from land and sea back to the atmosphere, from which it is then redeposited.

Mercury in the atmosphere is present in such low concentrations that it is not considered harmful. Once Hg enters the aquatic environment, however, it can undergo a series of biochemical transformations that convert a portion of the Hg originally present to methylmercury, a highly toxic organic form of mercury that accumulates in fish and birds. Many factors contribute to creation of methylmercury in aquatic ecosystems, including Hg availability, sediment and nutrient load, bacterial influence, and chemical conditions. In the United States, consumption of fish with high levels of methylmercury is the most common pathway for human exposure to Hg, leading the U.S. Environmental Protection Agency (EPA) to issue fish consumption advisories in every State (fig. 1).

The EPA estimates that 50 percent of the Hg entering the atmosphere in the United States is emitted from coal-burning utility powerplants (U.S. Environmental Protection Agency, 2011a). An EPA rule, known as MATS (for Mercury and Air Toxics Standards), to reduce emissions of Hg and other toxic

pollutants from powerplants, was signed in December 2011 (U.S. Environmental Protection Agency, 2012). The rule, which is currently under review, specifies limits for Hg and other toxic elements, such as arsenic (As), chromium (Cr), and nickel (Ni). MATS also places limits on emission of harmful acid gases, such as hydrochloric acid (HCl) and hydrofluoric acid (HF). These standards are the result of a 2010 detailed nationwide program by the EPA to sample stack emissions and thousands of shipments of coal to coal-burning powerplants (U.S. Environmental Protection Agency, 2011b,c). The United States is the only nation to have collected such detailed information for Hg in both its coal and its utility emissions.

**Halogens in Coal and Their Influence on Mercury Capture**

Halogens are elements in a group that includes fluorine (F), chlorine (Cl), bromine (Br), and iodine (I); they have similar chemical properties, and they form negatively charged ionic species. At high temperatures in the boilers of coal-fired powerplants, Hg from coal exists primarily in the form of gaseous elemental mercury (Hg0). Air-pollution control devices (APCDs) present in modern coal-fired powerplants have little capacity to capture Hg0 because it is extremely nonreactive and insoluble. Halogens are important because they can convert Hg0 to oxidized forms of Hg at temperatures present in the flue gas of powerplants (fig. 4). This oxidized Hg combines with halogens, rendering these Hg-halogen complexes much more readily captured by APCDs than is Hg0 by itself. Chlorine is the most abundant halogen in coal, and it has the largest influence on Hg oxidation and capture. Bromine, which is heavier than Cl, is much less abundant in most coals than Cl (fig. 5), but heavy halogens such as Br are proportionally more effective as Hg oxidants than lighter halogens such as Cl. The actual proportion of Hg that conventional APCDs capture depends on the type of coal that is burned, the type and set-up of APCDs, the halogen content of that coal, and the flue gas temperature. Mercury-specific approaches, such as adding sorbents (materials that have the capacity to adsorb) containing halogens to the boiler, may be used to achieve greater reductions of Hg under MATS (Granite and others, in press).

**Trace Elements in Coal Ash, USGS**, *By Amrika Deonarine, Allan Kolker, and Michael Doughten*

**Overview**

According to the U.S. Energy Information Association (EIA), approximately 37 percent of the electricity currently produced in the United States is generated using coal (U.S. Energy Information Administration, 2013). **Coal ash (also known as coal combustion products) includes bottom ash, fly ash, and flue gas desulfurization products** (fig. 1), which are generated in amounts averaging 130 million tons per year. In 2013, 14.5 million tons of bottom ash, 53.4 million tons of fly ash, and 35.1 million tons of flue gas desulfurization products were produced (American Coal Ash Association, 2013). The EIA predicts that coal use and coal ash generation in the United States will remain at current levels over the next few decades (U.S. Energy Information Administration, 2013).

**Coal fly ash** consists of fine particles, which contain a mixture of minerals such as clays, quartz, iron oxides, aluminosilicate glass formed by melting of mineral matter at the high temperatures of combustion, and unburned carbon remaining after the combustion process. **Major chemical constituents of coal fly ash typically include** silicon (Si), aluminum (Al), and iron (Fe), listed in order of decreasing abundance when expressed as oxides (elements in combination with oxygen), with lesser amounts of oxides of calcium (Ca), magnesium (Mg), potassium (K), sulfur (S), titanium (Ti), and phosphorus (P) whose proportions tend to be more variable. Coal ash also contains minor amounts of trace elements, including chromium (Cr), nickel (Ni), zinc (Zn), arsenic (As), selenium (Se), cadmium (Cd), antimony (Sb), mercury (Hg), and lead (Pb). In addition, uranium (U) is commonly present at concentrations ranging from 10 to 30 ppm, which is near the upper limit of concentrations found in naturally formed rocks such as granite and black shale (Zielinski and others, 2007).

In the United States, coal ash is currently disposed of in ash impoundments or landfills (fig. 2). Storage or disposal of large volumes of coal ash in suitably engineered and monitored impoundments or landfills is costly and may be limited by near-site storage capacities. Long-term storage of coal ash can be problematic because water infiltration (from rain or snow) combined with leaky storage sites may result

in the transport of coal ash and its constituent elements into the local environment. **If ash impoundments fail, there is potential for widespread and prolonged impacts such as impairment of ecosystem functions and the loss of plant and animal life and habitat.** Recent examples of ash releases include the Tennessee Valley Authority Kingston, Tennessee, coal ash spill in December 2008, which released approximately 5.4 million cubic yards of ash into the Emory and Clinch Rivers in Tennessee (U.S. Environmental Protection Agency, 2012a), and the Eden, North Carolina, spill in February 2014, which released up to 39,000 tons of coal ash into the Dan River in North Carolina (U.S. Environmental Protection Agency, 2015a). Additionally, a number of other ash impoundments across the United States have been identified by the U.S. Environmental Protection Agency (EPA) as having the potential for significant hazardous impacts in the event of an ash spill (U.S. Environmental Protection Agency, 2014a).

**Health Effects of Energy Resources, USGS,** By William Orem,1 Calin Tatu,2 Nikola Pavlovic,3 Joseph Bunnell,1 Allan Kolker,1 Mark Engle,1 and Ben Stout4

**Coal Slurry**—Coal slurry is a black suspension produced from the washing of coal (with water and chemicals) after mining. Washing is intended to remove sulfur, mineral matter, and fine particles from the coal prior to shipment to the end user. Coal slurry is usually pumped to surface impoundments or into abandoned underground mines for long-term storage. Approximately 1,000 slurry impoundments are located in the coal-mining areas of the Appalachian Basin (fig. 5), each containing from tens of thousands to billions of gallons of coal slurry.

A potential concern with coal-slurry impoundments is contamination of surface and groundwater with toxic organic and inorganic substances from the coal slurry. Toxic substances could originate from the coal and coal matrix, from chemicals added in the coal-washing process (kerosene and fuel oil) or chemicals added to promote coagulation of coal slurry (polyacrylamide). Little is known about the chemistry of coal slurry, contamination of surface and groundwater by chemical substances from coal slurry, or human health and environmental issues linked to coal slurry. Citizen groups are becoming increasingly concerned about potential health hazards from coal-slurry impoundments. USGS scientists are participating with universities, State, and other Federal agencies in initiating studies of the chemistry and of potential human health and environmental impacts of coal slurry.

**SQ#113**. *Do you agree with all statements in the above articles and excerpts from the* ***Coal: Pollution, Smelter Emissions Impacts on Health and Environment*** *section above? If not, please describe what you do not agree with.*

HiTest/PacWest has changed its story several times as to the source of the coal they plan to use. Blue Gem coal from Kentucky, Coal from Colombia South America, Coal from Indonesia.

**SQ#114**. *Which source/type of Coal will HiTest Sands/PacWest will be permitted to use?*
**SQ#115**. *Will HiTest/PacWest be permitted to use coal from sources other than the originally stated "Blue Gem Coal" from Kentucky?*
**SQ#116**. *How will Air Emissions be estimated for other sources of Coal?*

## ***Emissions and Impacts***

**$NO_2$ and $NO_x$: Human Health Impacts**

Nitrogen dioxide, or NO2, is a gaseous air pollutant composed of nitrogen and oxygen and is one of a group of related gases called nitrogen oxides, or NOx. NO2 forms when fossil fuels such as coal, oil, gas or diesel are burned at high temperatures. NO2 and other nitrogen oxides in the outdoor air contribute to particle pollution and to the chemical reactions that make ozone.

Nitrogen Oxides Health Effects. Nitrogen dioxide causes a range of harmful effects on the lungs, including:

- Increased inflammation of the airways;
- Worsened cough and wheezing;
- Reduced lung function;
- Increased asthma attacks; and
- Greater likelihood of emergency department and hospital admissions.[1]

New research warns that $NO_2$ is likely to be a cause of asthma in children.[2]
A large new study found evidence that people with lung cancer faced greater risk from NO2, ozone, and other outdoor air pollutants. The 2016 study tracked the air pollution levels from 1988 to 2011 experienced by more than 350,000 cancer patients in California. The researchers found that exposure to these air pollutants shortened their survival.[3]
Looking beyond the lungs, newer research has linked $NO_2$ to cardiovascular harm, lower birth weight in newborns and increased risk of premature death.[4] *(19)*

**$SO_2$ and $SO_x$: Human Health Impacts.**
Sulfur dioxide causes a range of harmful effects on the lungs, as the EPA's most recent review of the science concluded:

- Wheezing, shortness of breath and chest tightness and other problems, especially during exercise or physical activity.
- Continued exposure at high levels increases respiratory symptoms and reduces the ability of the lungs to function.
- Short exposures to peak levels of $SO_2$ in the air can make it difficult for people with asthma to breathe when they are active outdoors.
- Rapid breathing during exercise helps $SO_2$ reach the lower respiratory tract, as does breathing through the mouth.
- Increased risk of hospital admissions or emergency room visits, especially among children, older adults and people with asthma.[2] *(20)*

**<u>Acid Rain</u>**

***From the EPA: "Acid Rain, effects of Acid Rain":***
**Effects of Acid Rain on Fish and Wildlife**
The ecological effects of acid rain are most clearly seen in aquatic environments, such as streams, lakes, and marshes where it can be harmful to fish and other wildlife. As it flows through the soil, acidic rain water can leach aluminum from soil clay particles and then flow into streams and lakes. The more acid that is introduced to the ecosystem, the more aluminum is released.
Some types of plants and animals are able to tolerate acidic waters and moderate amounts of aluminum. Others, however, are acid-sensitive and will be lost as the pH declines. Generally, the young of most species are more sensitive to environmental conditions than adults. At pH 5, most fish eggs cannot hatch. At lower pH levels, some adult fish die. Some acidic lakes have no fish. Even if a species of fish or animal can tolerate moderately acidic water, the animals or plants it eats might not. For example, frogs have a critical pH around 4, but the mayflies they eat are more sensitive and may not survive pH below 5.5.

**Effects of Acid Rain on Plants and Trees**
Dead or dying trees are a common sight in areas effected by acid rain. Acid rain leaches aluminum from the soil. That aluminum may be harmful to plants as well as animals. Acid rain also removes minerals and nutrients from the soil that trees need to grow.
At high elevations, acidic fog and clouds might strip nutrients from trees' foliage, leaving them with brown or dead leaves and needles. The trees are then less able to absorb sunlight, which makes them weak and less able to withstand freezing temperatures.

**Buffering Capacity**
[Buffering] capacity depends on the thickness and composition of the soil and the type of bedrock underneath it. In areas such as mountainous parts of the Northeast United States, the soil is thin and lacks the ability to adequately neutralize the acid in the rain water. As a result, these areas are particularly vulnerable and the acid and aluminum can accumulate in the soil, streams, or lakes. *(21)*

**SQ#117**. *Do you agree with all statements in the above articles and excerpts from the* ***Emissions and Impacts*** *section above? If not, please describe what you do not agree with.*

***Emissions Stack-Scrubbers***

## *Scrubber*

*From Wikipedia, the free encyclopedia*

**Scrubber** systems (e.g. chemical scrubbers, gas scrubbers) are a diverse group of air pollution control devices that can be used to remove some particulates and/or gases from industrial exhaust streams. The first air scrubber was designed to remove carbon dioxide from the air of an early submarine, the Ictineo I, a role for which they continue to be used today.[1] Traditionally, the term "scrubber" has referred to pollution control devices that use liquid to wash unwanted pollutants from a gas stream. Recently, the term has also been used to describe systems that inject a dry reagent or slurry into a dirty exhaust stream to "wash out" acid gases. Scrubbers are one of the primary devices that control gaseous emissions, especially acid gases. Scrubbers can also be used for heat recovery from hot gases by flue-gas condensation.[2] They are also used for the high flows in solar, PV, or LED processes.[3]
There are several methods to remove toxic or corrosive compounds from exhaust gas and neutralize it.

**Combustion**
Combustion is sometimes the cause of harmful exhausts, but, in many cases, combustion may also be used for exhaust gas cleaning if the temperature is high enough and enough oxygen is available.[4]

**Wet scrubbing**
The exhaust gases of combustion may contain substances considered harmful to the environment, and the scrubber may remove or neutralize those. A wet scrubber is used for cleaning air, fuel gas or other gases of various pollutants and dust particles. Wet scrubbing works via the contact of target compounds or particulate matter with the scrubbing solution. Solutions may simply be water (for dust) or solutions of reagents that specifically target certain compounds.
Process exhaust gas can also contain water-soluble toxic and/or corrosive gases like hydrochloric acid (HCl) or ammonia ($NH_3$). These can be removed very well by a wet scrubber.[5]
Removal efficiency of pollutants is improved by increasing residence time in the scrubber or by the increase of surface area of the scrubber solution by the use of a spray nozzle, packed towers or an aspirator. Wet scrubbers may increase the proportion of water in the gas, resulting in a visible stack plume, if the gas is sent to a stack.
Wet scrubbers can also be used for heat recovery from hot gases by flue-gas condensation.[2] In this mode, termed a condensing scrubber, water from the scrubber drain is circulated through a cooler to the nozzles at the top of the scrubber. The hot gas enters the scrubber at the bottom. If the gas temperature is above the water dew point, it is initially cooled by evaporation of water drops. Further cooling cause water vapors to condense, adding to the amount of circulating water.
The condensation of water releases significant amounts of low temperature heat (more than 2 gigajoules (560 kWh) per ton of water[*citation needed*]), that can be recovered by the cooler for e.g. district heating purposes.
Excess condensed water must continuously be removed from the circulating water.
The gas leaves the scrubber at its dew point, so even though significant amounts of water may have been removed from the cooled gas, it is likely to leave a visible stack plume of water vapor.

**Dry scrubbing**

A dry or semi-dry scrubbing system, unlike the wet scrubber, does not saturate the flue gas stream that is being treated with moisture. In some cases no moisture is added, while in others only the amount of moisture that can be evaporated in the flue gas without condensing is added. Therefore, dry scrubbers generally do not have a stack steam plume or wastewater handling/disposal requirements. Dry scrubbing systems are used to remove acid gases (such as $SO_2$ and HCl) primarily from combustion sources.

There are a number of dry type scrubbing system designs. However, all consist of two main sections or devices: a device to introduce the acid gas sorbent material into the gas stream and a particulate matter control device to remove reaction products, excess sorbent material as well as any particulate matter already in the flue gas.

Dry scrubbing systems can be categorized as dry sorbent injectors (DSIs) or as spray dryer absorbers (SDAs). Spray dryer absorbers are also called semi-dry scrubbers or spray dryers.

Dry scrubbing systems are often used for the removal of odorous and corrosive gases from wastewater treatment plant operations. The medium used is typically an activated alumina compound impregnated with materials to handle specific gases such as hydrogen sulfide. Media used can be mixed together to offer a wide range of removal for other odorous compounds such as methyl mercaptans, aldehydes, volatile organic compounds, dimethyl sulfide, and dimethyl disulfide.

**Dry sorbent injection** involves the addition of an alkaline material (usually hydrated lime, soda ash, or sodium bicarbonate) into the gas stream to react with the acid gases. The sorbent can be injected directly into several different locations: the combustion process, the flue gas duct (ahead of the particulate control device), or an open reaction chamber (if one exists). The acid gases react with the alkaline sorbents to form solid salts which are removed in the particulate control device. These simple systems can achieve only limited acid gas ($SO_2$ and HCl) removal efficiencies. Higher collection efficiencies can be achieved by increasing the flue gas humidity (i.e., cooling using water spray). These devices have been used on medical waste incinerators and a few municipal waste combustors.

In **spray dryer absorbers**, the flue gases are introduced into an absorbing tower (dryer) where the gases are contacted with a finely atomized alkaline slurry. Acid gases are absorbed by the slurry mixture and react to form solid salts which are removed by the particulate control device. The heat of the flue gas is used to evaporate all the water droplets, leaving a non-saturated flue gas to exit the absorber tower. Spray dryers are capable of achieving high (80+%) acid gas removal efficiencies. These devices have been used on industrial and utility boilers and municipal waste incinerators.

**Adsorber**

Many chemicals can be removed from exhaust gas also by using adsorber material. The flue gas is passed through a cartridge which is filled with one or several adsorber materials and has been adapted to the chemical properties of the components to be removed.[6] This type of scrubber is sometimes also called dry scrubber. The adsorber material has to be replaced after its surface is saturated. Note: adsorption is a surface phenomena, absorption involves the entire material. Ex: Activated carbon an adsorbent, used for the adsorption of odorous compounds.

**Mercury removal**

Mercury is a highly toxic element commonly found in coal and municipal waste. Wet scrubbers are only effective for removal of soluble mercury species, such as oxidized mercury, $Hg^{2+}$. Mercury vapor in its elemental form, $Hg^0$, is insoluble in the scrubber slurry and not removed. Therefore, an additional process of $Hg^0$ conversion is required to complete mercury capture. Usually halogens are added to the flue gas for this purpose. The type of coal burned as well as the presence of a selective catalytic reduction unit both affect the ratio of elemental to oxidized mercury in the flue gas and thus the degree to which the mercury is removed.

*In July 2015, one study found that some mercury scrubbers installed on coal power plants inadvertently capture PAH (polycyclic aromatic hydrocarbons) emissions as well*.[7][8]

**Scrubber waste products**

One side effect of scrubbing is that the process only moves the unwanted substance from the exhaust gases into a liquid solution, solid paste or powder form. This must be disposed of safely, if it can not be reused.
For example, mercury removal results in a waste product that either needs further processing to extract the raw mercury, or must be buried in a special hazardous wastes landfill that prevents the mercury from seeping out into the environment.
As an example of reuse, limestone-based scrubbers in coal-fired power plants can produce a synthetic gypsum of sufficient quality that can be used to manufacture drywall and other industrial products.[9]

**Bacteria spread**

Poorly maintained scrubbers have the potential to spread disease-causing bacteria. The problem is a result of inadequate cleaning. For example, the cause of a 2005 outbreak of Legionnaires' disease in Norway was just a few infected scrubbers. The outbreak caused 10 deaths and more than 50 cases of infection.[10]

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## ***Flue-gas desulfurization***

From Wikipedia, the free encyclopedia

Before flue gas desulfurization was installed, the emissions from this power plant in New Mexico contained a significant amount of sulfur dioxide.


The G. G. Allen Steam Station scrubber

**Flue-gas desulfurization** (**FGD**) is a set of technologies used to remove sulfur dioxide ($SO_2$) from exhaust flue gases of fossil-fuel power plants, and from the emissions of other sulfur oxide emitting processes (e.g trash incineration)

**Methods**

As stringent environmental regulations regarding $SO_2$ emissions have been enacted in many countries, $SO_2$ is now being removed from flue gases by a variety of methods. Below are common methods used:

- Wet scrubbing using a slurry of alkaline sorbent, usually limestone or lime, or seawater to scrub gases;
- Spray-dry scrubbing using similar sorbent slurries;
- Wet sulfuric acid process recovering sulfur in the form of commercial quality sulfuric acid;
- SNOX Flue gas desulfurization removes sulfur dioxide, nitrogen oxides and particulates from flue gases;
- Dry sorbent injection systems that introduce powdered hydrated lime (or other sorbent material) into exhaust ducts to eliminate SO2 and SO3 from process emissions.[1]

For a typical coal-fired power station, flue-gas desulfurization (FGD) may remove 90 percent or more of the $SO_2$ in the flue gases.[2]

**History**

Methods of removing sulfur dioxide from boiler and furnace exhaust gases have been studied for over 150 years. Early ideas for flue gas desulfurization were established in England around 1850.

With the construction of large-scale power plants in England in the 1920s, the problems associated with large volumes of $SO_2$ from a single site began to concern the public. The $SO_2$ emissions problem did not receive much attention until 1929, when the House of Lords upheld the claim of a landowner against the Barton Electricity Works of the Manchester Corporation for damages to his land resulting from $SO_2$ emissions. Shortly thereafter, a press campaign was launched against the erection of power plants within the confines of London. This outcry led to the imposition of $SO_2$ controls on all such power plants.[3]

The first major FGD unit at a utility was installed in 1931 at Battersea Power Station, owned by London Power Company. In 1935, an FGD system similar to that installed at Battersea went into service at Swansea Power Station. The third major FGD system was installed in 1938 at Fulham Power Station. These three early large-scale FGD installations were abandoned during World War II. Large-scale FGD units did not reappear at utilities until the 1970s, where most of the installations occurred in the United States and Japan.[3]

As of June 1973, there were 42 FGD units in operation, 36 in Japan and 6 in the United States, ranging in capacity from 5 MW to 250 MW.[4] As of around 1999 and 2000, FGD units were being used in 27 countries, and there were 678 FGD units operating at a total power plant capacity of about 229 gigawatts. About 45% of the FGD capacity was in the U.S., 24% in Germany, 11% in Japan, and 20% in

various other countries. Approximately 79% of the units, representing about 199 gigawatts of capacity, were using lime or limestone wet scrubbing. About 18% (or 25 gigawatts) utilized spray-dry scrubbers or sorbent injection systems.[5][6][7]

**Sulfuric acid mist formation**

Fossil fuels such as coal and oil can contain a significant amount of sulfur. When fossil fuels are burned, about 95 percent or more of the sulfur is generally converted to sulfur dioxide ($SO_2$). Such conversion happens under normal conditions of temperature and of oxygen present in the flue gas. However, there are circumstances under which such reaction may not occur.

When flue gas has too much oxygen, the $SO_2$ further oxidizes into sulfur trioxide ($SO_3$). Too much oxygen is only one of the ways that $SO_3$ is formed. Gas temperature is also an important factor. At about 800 °C, formation of $SO_3$ is favored. Another way that $SO_3$ can be formed is through catalysis by metals in the fuel. Such reaction is particularly true for heavy fuel oil, where a significant amount of vanadium is present. In whatever way $SO_3$ is formed, it does not behave like $SO_2$ in that it forms a liquid aerosol known as sulfuric acid ($H_2SO_4$) mist that is very difficult to remove. Generally, about 1% of the sulfur dioxide will be converted to $SO_3$. Sulfuric acid mist is often the cause of the blue haze that often appears as the flue gas plume dissipates. Increasingly, this problem is being addressed by the use of wet electrostatic precipitators.

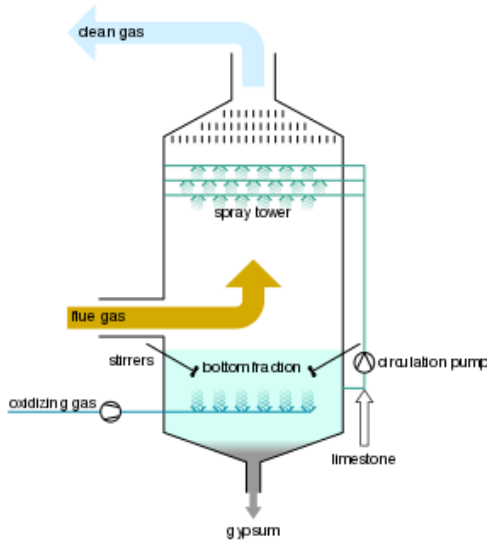
**FGD chemistry**

**Basic principles**

Most FGD systems employ two stages: one for fly ash removal and the other for $SO_2$ removal. Attempts have been made to remove both the fly ash and $SO_2$ in one scrubbing vessel. However, these systems experienced severe maintenance problems and low removal efficiency. In wet scrubbing systems, the flue gas normally passes first through a fly ash removal device, either an electrostatic precipitator or a baghouse, and then into the $SO_2$-absorber. However, in dry injection or spray drying operations, the $SO_2$ is first reacted with the lime, and then the flue gas passes through a particulate control device.

Another important design consideration associated with wet FGD systems is that the flue gas exiting the absorber is saturated with water and still contains some $SO_2$. These gases are highly corrosive to any downstream equipment such as fans, ducts, and stacks. Two methods that may minimize corrosion are: (1) reheating the gases to above their dew point, or (2) using materials of construction and designs that allow equipment to withstand the corrosive conditions. Both alternatives are expensive. Engineers determine which method to use on a site-by-site basis.

**Scrubbing with an alkali solid or solution**



Schematic design of the absorber of an FGD

$SO_2$ is an acid gas, and, therefore, the typical sorbent slurries or other materials used to remove the $SO_2$ from the flue gases are alkaline. The reaction taking place in wet scrubbing using a $CaCO_3$ (limestone) slurry produces calcium sulfite ($CaSO_3$) and may be expressed in the simplified dry form as:
$CaCO_{3(s)} + SO_{2(g)} \rightarrow CaSO_{3(s)} + CO_{2(g)}$
When wet scrubbing with a $Ca(OH)_2$ (hydrated lime) slurry, the reaction also produces $CaSO_3$ (calcium sulfite) and may be expressed in the simplified dry form as:
$Ca(OH)_{2(s)} + SO_{2(g)} \rightarrow CaSO_{3(s)} + H_2O_{(l)}$
When wet scrubbing with a $Mg(OH)_2$ (magnesium hydroxide) slurry, the reaction produces $MgSO_3$ (magnesium sulfite) and may be expressed in the simplified dry form as:
$Mg(OH)_{2(s)} + SO_{2(g)} \rightarrow MgSO_{3(s)} + H_2O_{(l)}$
To partially offset the cost of the FGD installation, some designs, particularly dry sorbent injection systems, further oxidize the $CaSO_3$ (calcium sulfite) to produce marketable $CaSO_4$-$2H_2O$ (gypsum) that can be of high enough quality to use in wallboard and other products. The process by which this synthetic gypsum is created is also known as forced oxidation:
$CaSO_{3(aq)} + 2H_2O_{(l)} + ½O_{2(g)} \rightarrow CaSO_4 \cdot 2H_2O_{(s)}$
A natural alkaline usable to absorb $SO_2$ is seawater. The $SO_2$ is absorbed in the water, and when oxygen is added reacts to form sulfate ions $SO_4$- and free $H^+$. The surplus of $H^+$ is offset by the carbonates in seawater pushing the carbonate equilibrium to release $CO_2$ gas:
$SO_{2(g)} + H_2O_{(l)} + ½O_{2(g)} \rightarrow SO_4^{2-}{}_{(aq)} + 2H^+$
$HCO_3^- + H^+ \rightarrow H_2O_{(l)} + CO_{2(g)}$
In industry caustic (NaOH) is often used to scrub $SO_2$, producing sodium sulfite:
$2NaOH_{(aq)} + SO_{2(g)} \rightarrow Na_2SO_{3(aq)} + H_2O_{(l)}$[8]

**Types of wet scrubbers used in FGD**
To promote maximum gas–liquid surface area and residence time, a number of wet scrubber designs have been used, including spray towers, venturis, plate towers, and mobile packed beds. Because of scale buildup, plugging, or erosion, which affect FGD dependability and absorber efficiency, the trend is to use simple scrubbers such as spray towers instead of more complicated ones. The configuration of the tower may be vertical or horizontal, and flue gas can flow cocurrently, countercurrently, or crosscurrently with respect to the liquid. The chief drawback of spray towers is that they require a higher liquid-to-gas ratio requirement for equivalent SO
$_2$ removal than other absorber designs.

FGD scrubbers produce a scaling wastewater that requires treatment to meet discharge regulations.[9] However, technological advancements in ion exchange membranes and electrodialysis systems has enabled high-efficiency treatment of FGD wastewater to meet recent EPA discharge limits.[10] The treatment approach is similar for other highly scaling industrial wastewaters.

**Venturi-rod scrubbers**

A venturi scrubber is a converging/diverging section of duct. The converging section accelerates the gas stream to high velocity. When the liquid stream is injected at the throat, which is the point of maximum velocity, the turbulence caused by the high gas velocity atomizes the liquid into small droplets, which creates the surface area necessary for mass transfer to take place. The higher the pressure drop in the venturi, the smaller the droplets and the higher the surface area. The penalty is in power consumption. For simultaneous removal of $SO_2$ and fly ash, venturi scrubbers can be used. In fact, many of the industrial sodium-based throwaway systems are venturi scrubbers originally designed to remove particulate matter. These units were slightly modified to inject a sodium-based scrubbing liquor. Although removal of both particles and $SO_2$ in one vessel can be economic, the problems of high pressure drops and finding a scrubbing medium to remove heavy loadings of fly ash must be considered. However, in cases where the particle concentration is low, such as from oil-fired units, it can be more effective to remove particulate and $SO_2$ simultaneously.

**Packed bed scrubbers**

A packed scrubber consists of a tower with packing material inside. This packing material can be in the shape of saddles, rings, or some highly specialized shapes designed to maximize the contact area between the dirty gas and liquid. Packed towers typically operate at much lower pressure drops than venturi scrubbers and are therefore cheaper to operate. They also typically offer higher $SO_2$ removal efficiency. The drawback is that they have a greater tendency to plug up if particles are present in excess in the exhaust air stream.

**Spray towers**

A spray tower is the simplest type of scrubber. It consists of a tower with spray nozzles, which generate the droplets for surface contact. Spray towers are typically used when circulating a slurry (see below). The high speed of a venturi would cause erosion problems, while a packed tower would plug up if it tried to circulate a slurry.

Counter-current packed towers are infrequently used because they have a tendency to become plugged by collected particles or to scale when lime or limestone scrubbing slurries are used.

**Scrubbing reagent**

As explained above, alkaline sorbents are used for scrubbing flue gases to remove $SO_2$. Depending on the application, the two most important are lime and sodium hydroxide (also known as caustic soda). Lime is typically used on large coal- or oil-fired boilers as found in power plants, as it is very much less expensive than caustic soda. The problem is that it results in a slurry being circulated through the scrubber instead of a solution. This makes it harder on the equipment. A spray tower is typically used for this application. The use of lime results in a slurry of calcium sulfite ($CaSO_3$) that must be disposed of. Fortunately, calcium sulfite can be oxidized to produce by-product gypsum ($CaSO_4 \cdot 2H_2O$) which is marketable for use in the building products industry.

Caustic soda is limited to smaller combustion units because it is more expensive than lime, but it has the advantage that it forms a solution rather than a slurry. This makes it easier to operate. It produces a "spent caustic" solution of sodium sulfite/bisulfite (depending on the pH), or sodium sulfate that must be disposed of. This is not a problem in a kraft pulp mill for example, where this can be a source of makeup chemicals to the recovery cycle.

**Scrubbing with sodium sulfite solution**

It is possible to scrub sulfur dioxide by using a cold solution of sodium sulfite; this forms a sodium hydrogen sulfite solution. By heating this solution it is possible to reverse the reaction to form sulfur dioxide and the sodium sulfite solution. Since the sodium sulfite solution is not consumed, it is called a regenerative treatment. The application of this reaction is also known as the Wellman–Lord process.
In some ways this can be thought of as being similar to the reversible liquid–liquid extraction of an inert gas such as xenon or radon (or some other solute which does not undergo a chemical change during the extraction) from water to another phase. While a chemical change does occur during the extraction of the sulfur dioxide from the gas mixture, it is the case that the extraction equilibrium is shifted by changing the temperature rather than by the use of a chemical reagent.

**Gas phase oxidation followed by reaction with ammonia**

A new, emerging flue gas desulfurization technology has been described by the IAEA.[11] It is a radiation technology where an intense beam of electrons is fired into the flue gas at the same time as ammonia is added to the gas. The Chendu power plant in China started up such a flue gas desulfurization unit on a 100 MW scale in 1998. The Pomorzany power plant in Poland also started up a similar sized unit in 2003 and that plant removes both sulfur and nitrogen oxides. Both plants are reported to be operating successfully.[12][13] However, the accelerator design principles and manufacturing quality need further improvement for continuous operation in industrial conditions.[14]
No radioactivity is required or created in the process. The electron beam is generated by a device similar to the electron gun in a TV set. This device is called an accelerator. This is an example of a radiation chemistry process[13] where the physical effects of radiation are used to process a substance.
The action of the electron beam is to promote the oxidation of sulfur dioxide to sulfur(VI) compounds. The ammonia reacts with the sulfur compounds thus formed to produce ammonium sulfate, which can be used as a nitrogenous fertilizer. In addition, it can be used to lower the nitrogen oxide content of the flue gas. This method has attained industrial plant scale.[12][15]

**Facts and statistics**

*The information in this section was obtained from a US EPA published fact sheet.*[16]
Flue gas desulfurization scrubbers have been applied to combustion units firing coal and oil that range in size from 5 MW to 1500 MW. Scottish Power are spending £400 million installing FGD at Longannet power station, which has a capacity of over 2 GW. Dry scrubbers and spray scrubbers have generally been applied to units smaller than 300 MW.
FGD has been fitted by RWE npower at Aberthaw Power Station in south Wales using the seawater process and works successfully on the 1580MW plant.
Approximately 85% of the flue gas desulfurization units installed in the US are wet scrubbers, 12% are spray dry systems, and 3% are dry injection systems.
The highest $SO_2$ removal efficiencies (greater than 90%) are achieved by wet scrubbers and the lowest (less than 80%) by dry scrubbers. However, the newer designs for dry scrubbers are capable of achieving efficiencies in the order of 90%.
In spray drying and dry injection systems, the flue gas must first be cooled to about 10–20 °C above adiabatic saturation to avoid wet solids deposition on downstream equipment and plugging of baghouses.
The capital, operating and maintenance costs per short ton of $SO_2$ removed (in 2001 US dollars) are:

- For wet scrubbers larger than 400 MW, the cost is $200 to $500 per ton
- For wet scrubbers smaller than 400 MW, the cost is $500 to $5,000 per ton
- For spray dry scrubbers larger than 200 MW, the cost is $150 to $300 per ton
- For spray dry scrubbers smaller than 200 MW, the cost is $500 to $4,000 per ton

**Alternative methods of reducing sulfur dioxide emissions**

An alternative to removing sulfur from the flue gases after burning is to remove the sulfur from the fuel before or during combustion. Hydrodesulfurization of fuel has been used for treating fuel oils before use. Fluidized bed combustion adds lime to the fuel during combustion. The lime reacts with the $SO_2$ to form sulfates which become part of the ash. This elemental sulfur is then separated and finally recovered at the end of the process for further usage in, for example, agricultural products. Safety is one of the greatest benefits of this method, as the whole process takes place at atmospheric pressure and ambient temperature. This method has been developed by Paqell, a joint venture between Shell Global Solutions and Paques.[17]

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## ***Venturi scrubber***

From Wikipedia, the free encyclopedia

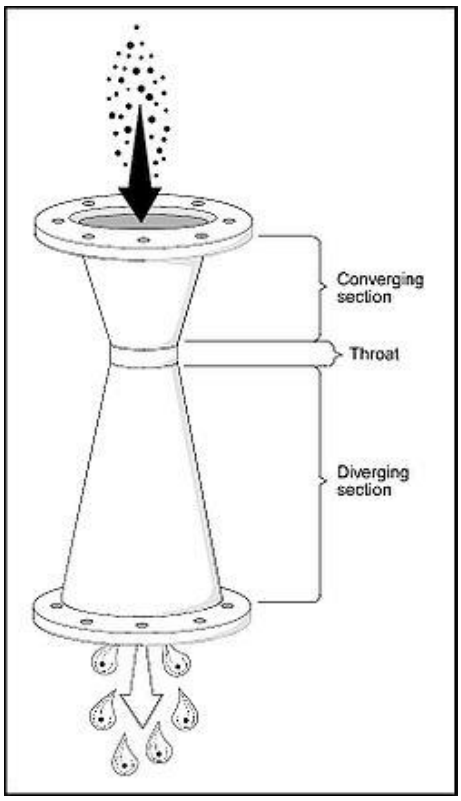


**Figure 1** - Venturi scrubber

A **venturi scrubber** is designed to effectively use the energy from the inlet gas stream to atomize the liquid being used to scrub the gas stream. This type of technology is a part of the group of air pollution controls collectively referred to as wet scrubbers.

Venturi devices have also been used for over 100 years to measure fluid flow (Venturi tubes derived their name from Giovanni Battista Venturi, an Italian physicist).

In the late 1940s, H.F. Johnstone[1], William Jones,[2] and other researchers found that they could effectively use the venturi configuration to remove particles from gas streams. **Figure 1** illustrates the classic venturi configuration.[3]

A venturi scrubber consists of three sections: a converging section, a throat section, and a diverging section. The inlet gas stream enters the converging section and, as the area decreases, gas velocity increases. Liquid is introduced either at the throat or at the entrance to the converging section.

The inlet gas, forced to move at extremely high velocities in the small throat section, shears the liquid from its walls, producing an enormous number of very tiny droplets.

Particle and gas removal occur in the diverging section as the inlet gas stream mixes with the fog of tiny liquid droplets. The inlet stream then exits through the diverging section, where it is forced to slow down.

Venturis can be used to collect both particulate and gaseous pollutants, but they are more effective in removing particles than gaseous pollutants.

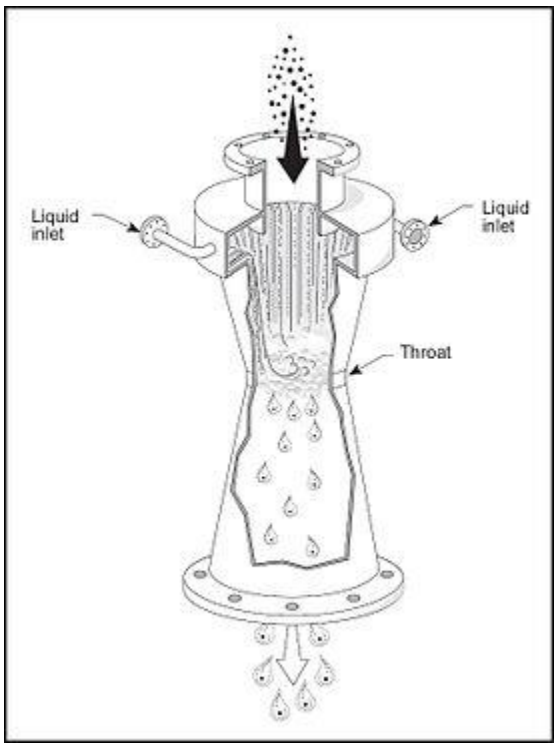


**Figure 2** - Wetted throat venturi scrubber

Liquid can be injected at the converging section or at the throat. **Figure 2** shows liquid injected at the converging section.[3] Thus, the liquid coats the venturi throat making it very effective for handling hot, dry inlet gas that contains dust. Otherwise, the dust would have a tendency to cake on or abrade a dry throat. These venturis are sometimes referred to as having a wetted approach.

**Figure 3** shows liquid injected at the venturi throat.[3] Since it is sprayed at or just before the throat, it does not actually coat the throat surface. These throats are susceptible to solids buildup when the throat is dry. They are also susceptible to abrasion by dust particles. These venturis are best used when the inlet stream is cool and moist. These venturis are referred to as having a non-wetted approach.

Venturis with round throats (**Figures 2** and **3**) can handle inlet flows as large as 88,000 $m^3/h$ (40,000 cfm) (*Brady and Legatski 1977*). At inlet flow rates greater than this, achieving uniform liquid distribution is difficult, unless additional weirs or baffles are used. To handle large inlet flows, scrubbers designed with long, narrow, rectangular throats (**Figure 4**) have been used.[3]

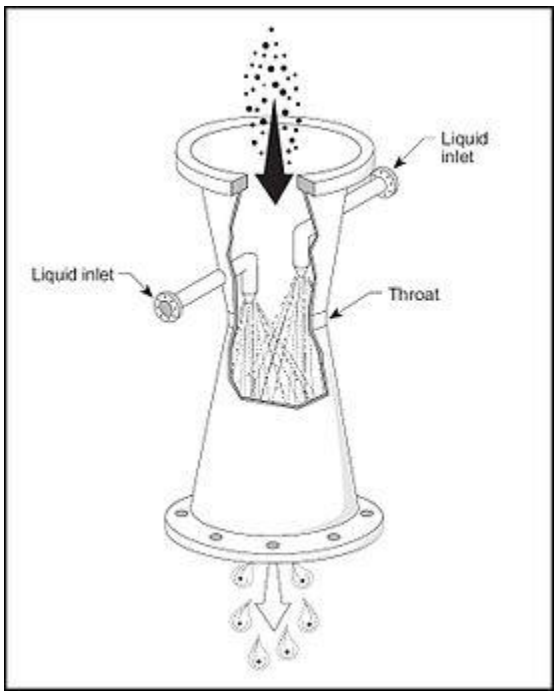


**Figure 3** - Non-wetted throat venturi scrubber

Simple venturis have fixed throat areas and cannot be used over a wide range of gas flow rates. Manufacturers have developed other modifications to the basic venturi design to maintain scrubber efficiency by changing the throat area for varying inlet gas rates.

Certain types of orifices (throat areas) that create more turbulence than a true venturi were found to be equally efficient for a given unit of energy consumed (*McIlvaine Company 1974*).

Results of these findings led to the development of the annular-orifice, or adjustable-throat, venturi scrubber (**Figure 5**).[3] The size of the throat area is varied by moving a plunger, or adjustable disk, up or down in the throat, thereby decreasing or increasing the annular opening. Gas flows through the annular opening and atomizes liquid that is sprayed onto the plunger or swirled in from the top.

Another adjustable-throat venturi is shown in **Figure 6**.[3] In this scrubber, the throat area is varied by using a movable plate. A water-wash spray is used to continually wash collected material from the plate.

Another modification can be seen in the venturi-rod or rod deck scrubber. By placing a number of pipes parallel to each other, a series of longitudinal venturi openings can be created as shown in **Figure 7**.[3] The area between adjacent rods is a small venturi throat.

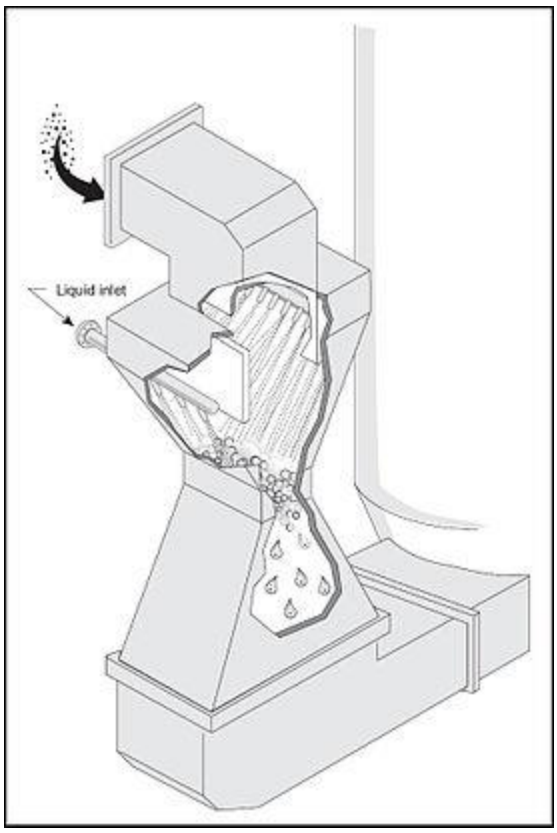


**Figure 4** - Rectangular throat venturi scrubber

Water sprays help prevent solids buildup. The principal atomization of the liquid occurs at the rods, where the high-velocity gas moving through spacings creates the small droplets necessary for fine particle collection. These rods must be made of abrasion-resistant material due to the high velocities present.

All venturi scrubbers require an entrainment separator because the high velocity of gas through the scrubber will have a tendency to entrain the droplets with the outlet clean gas stream.

Cyclonic, mesh-pad, and blade separators are all used to remove liquid droplets from the flue gas and return the liquid to the scrubber water. Cyclonic separators, the most popular for use with venturi scrubbers, are connected to the venturi vessel by a flooded elbow (**Figure 8**).[3] The liquid reduces abrasion of the elbow as the outlet gas flows at high velocities from the venturi into the separator.

**Particle collection**

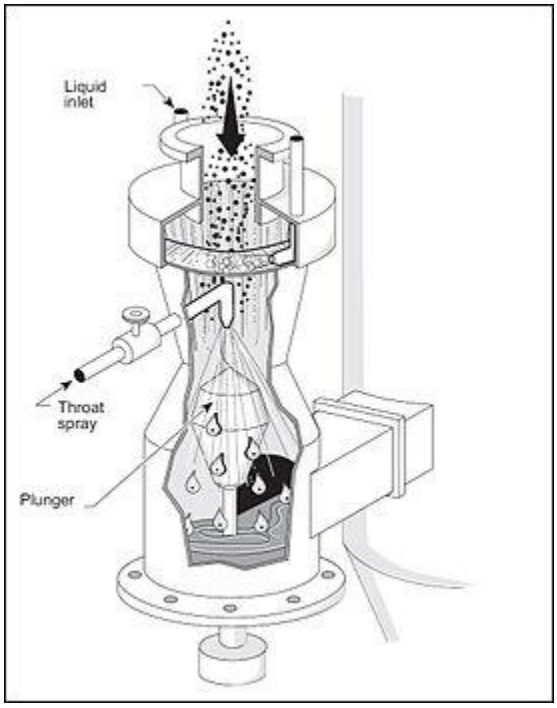


**Figure 5** - Adjustable-throat venturi scrubber with plunger

Venturis are the most commonly used scrubber for particle collection and are capable of achieving the highest particle collection efficiency of any wet scrubbing system. As the inlet stream enters the throat, its velocity increases greatly, atomizing and turbulently mixing with any liquid present.

The atomized liquid provides an enormous number of tiny droplets for the dust particles to impact on. These liquid droplets incorporating the particles must be removed from the scrubber outlet stream, generally by cyclonic separators.

Particle removal efficiency increases with increasing pressure drop because of increased turbulence due to high gas velocity in the throat. Venturis can be operated with pressure drops ranging from 12 to 250 cm (5 to 100 in) of water.

Most venturis normally operate with pressure drops in the range of 50 to 150 cm (20 to 60 in) of water. At these pressure drops, the gas velocity in the throat section is usually between 30 and 120 m/s (100 to 400 ft/s), or approximately 270 mph at the high end. These high pressure drops result in high operating costs.

The liquid-injection rate, or liquid-to-gas ratio (L/G), also affects particle collection. The proper amount of liquid must be injected to provide adequate liquid coverage over the throat area and make up for any evaporation losses. If there is insufficient liquid, then there will not be enough liquid targets to provide the required capture efficiency.

Most venturi systems operate with an L/G ratio of 0.4 to 1.3 $l/m^3$ (3 to 10 $gal/1000\ ft^3$) (*Brady and Legatski 1977*). L/G ratios less than 0.4 $l/m^3$ (3 $gal/1000\ ft^3$) are usually not sufficient to cover the throat, and adding more than 1.3 $l/m^3$ (10 $gal/1000\ ft^3$) does not usually significantly improve particle collection efficiency.

**Gas collection**

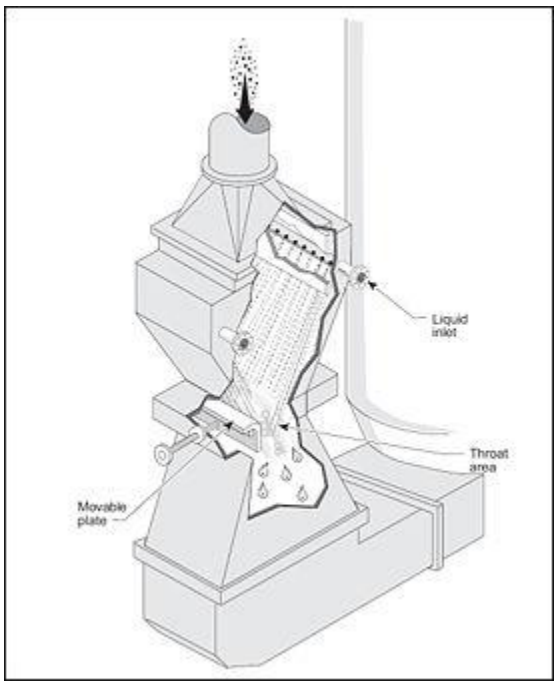


**Figure 6** - Adjustable-throat venturi scrubber with movable plate

Venturi scrubbers can be used for removing gaseous pollutants; however, they are not used when removal of gaseous pollutants is the only concern.

The high inlet gas velocities in a venturi scrubber result in a very short contact time between the liquid and gas phases. This short contact time limits gas absorption. However, because venturis have a relatively open design compared to other scrubbers, they are very useful for simultaneous gaseous and particulate pollutant removal, especially when:

- Scaling could be a problem
- A high concentration of dust is in the inlet stream
- The dust is sticky or has a tendency to plug openings
- The gaseous contaminant is very soluble or chemically reactive with the liquid

To maximize the absorption of gases, venturis are designed to operate at a different set of conditions from those used to collect particles. The gas velocities are lower and the liquid-to-gas ratios are higher for absorption.

For a given venturi design, if the gas velocity is decreased, then the pressure drop (resistance to flow) will also decrease and vice versa. Therefore, by reducing pressure drop, the gas velocity is decreased and the corresponding residence time is increased. Liquid-to-gas ratios for these gas absorption applications are approximately 2.7 to 5.3 l/m$^3$ (20 to 40 gal/1000 ft$^3$). The reduction in gas velocity allows for a longer contact time between phases and better absorption.

Increasing the liquid-to-gas ratio will increase the potential solubility of the pollutant in the liquid. Though capable of some incidental control of volatile organic compounds (VOC), generally venturi scrubbers are limited to control PM (particulate matter) and high solubility gases (*EPA, 1992; EPA, 1996*). [4]

**Maintenance problems**

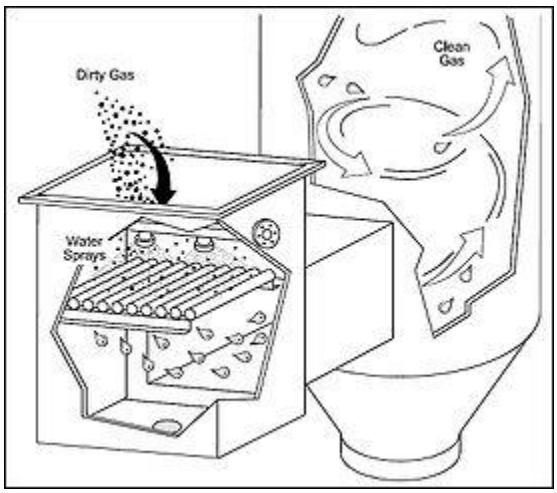


**Figure 7** - Venturi rod scrubber

The primary maintenance problem for venturi scrubbers is wear, or abrasion, of the scrubber shell because of high gas velocities. Gas velocities in the throat can reach speeds of 430 km/h (270 mph). Particles and liquid droplets traveling at these speeds can rapidly erode the scrubber shell.

Abrasion can be reduced by lining the throat with silicon carbide brick or fitting it with a replaceable liner. Abrasion can also occur downstream of the throat section. To reduce abrasion here, the elbow at the bottom of the scrubber (leading into the separator) can be flooded (i.e. filled with a pool of scrubbing liquid). Particles and droplets impact on the pool of liquid, reducing wear on the scrubber shell.

Another technique to help reduce abrasion is to use a precleaner (i.e., quench sprays or cyclone) to remove the larger particles.

The method of liquid injection at the venturi throat can also cause problems. Spray nozzles are used for liquid distribution because they are more efficient (have a more effective spray pattern) for liquid injection than weirs. However, spray nozzles can easily plug when liquid is recirculated. Automatic or manual reamers can be used to correct this problem. However, when heavy liquid slurries (either viscous or particle-loaded) are recirculated, open-wear injection is often necessary.

**Summary**

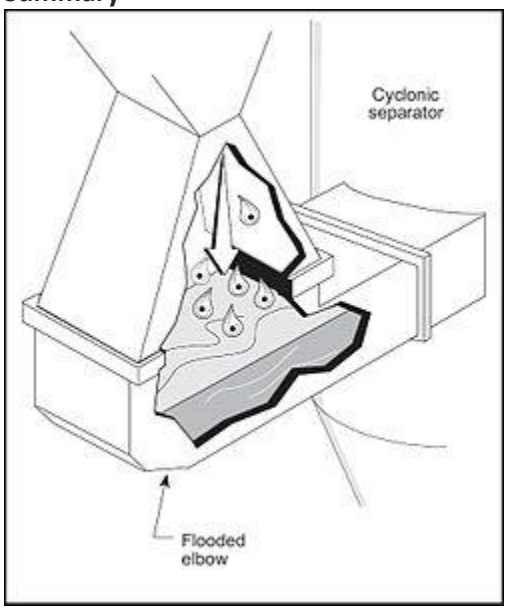


**Figure 8** - Flooded elbow

Venturi scrubbers can have the highest particle collection efficiencies (especially for very small particles) of any wet scrubbing system.

They are the most widely used scrubbers because their open construction enables them to remove most particles without plugging or scalding. Venturis can also be used to absorb pollutant gases; however, they are not as efficient for this as are packed or plate towers.
Venturi scrubbers have been designed to collect particles at very high collection efficiencies, sometimes exceeding 99%. The ability of venturis to handle large inlet volumes at high temperatures makes them very attractive to many industries; consequently, they are used to reduce particulate emissions in a number of industrial applications.
This ability is particularly desirable for cement kiln emission reduction and for control of emissions from basic oxygen furnaces in the steel industry, where the inlet gas enters the scrubber at temperatures greater than 350 °C (660 °F).
Venturis are also used to control fly ash and sulfur dioxide emissions from industrial and utility boilers.
The operating characteristics of venturi scrubbers are listed in **Table 1**.[3]

**Table 1. Operating characteristics of venturi scrubbers**

| Pollutant | Pressure drop (Δp) | Liquid-to-gas ratio (L/G) | Liquid-inlet pressure ($p_L$) | Removal efficiency |
|---|---|---|---|---|
| **Gases** | 13-250 cm of water (5-100 in of water) | 2.7-5.3 l/m$^3$ (20-40 gal/1,000 ft$^3$) | | 30-60% per venturi, depending on pollutant solubility |
| **Particles** | 50-250 cm of water (50-150 cm of water is common)<br>20-100 in of water (20-60 in. of water is common) | 0.67-1.34 l/m$^3$(5-10 gal/1,000 ft$^3$) | < 7-100 kPa (< 1-15 psig) | 90-99% is typical |

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1. *Johnstone, H. F.; Roberts, M. N. (1949-11-01). "Deposition of Aerosol Particles from Moving Gas Streams". Industrial & Engineering Chemistry.* ***41*** *(11): 2417–2423. doi:10.1021/ie50479a019. ISSN 0019-7866.*
2. *Jones, William P. (1949-11-05). "Development of the Venturi Scrubber". Industrial & Engineering Chemistry.* ***41*** *(11): 2424–2427. doi:10.1021/ie50479a020. ISSN 0019-7866.*

3. [h]Course SI 412C: Lesson 3 U.S. EPA Air Pollution Training Institute in collaboration with North Carolina State University, College of Engineering (NCSU)
4. US EPA Clean Air Technology Center

**SQ118.** *Based on the three Scrubber articles above, please identify which scrubbing system will provide the best overall air protection for the citizens of Newport and the affected area, and the natural environment (forests, wetlands, rivers, lakes, streams, waterfowl, wildlife, agriculture). Please base the decision on performance only (please do not include system cost).*

***By-Products, Silica Fume, and The Silicon Smelting Process***

The following is taken from:

**"Silica Fume"**

**By Gary M. Gapinski and John Scanlon**

Silica fume is a by-product or a very fine pozzolanic material, composed of mostly amorphous silica produced by electric arc furnaces during the production of elemental silicon or ferro silicon alloys. While the carbon in the reducing zone of the furnace strips the oxygen from most of the silicon monoxide, some of it does escapes to the upper reaches of the furnace and the reaction of silicon monoxide to silicon dioxide gives us silica fume.

**Silicon Smelting**

To understand silica fume, one must first understand the smelting of silicon metal. Silicon is smelted in large submerged arc electric furnaces

The furnace charge is quartzite, charcoal, wood chips and coal. The quartzite used for smelting silicon must be very pure and contain more than 99% silicon dioxide. The quartzite is usually river rock that has been very carefully washed to remove any fines. Typically, this rock is between 1 and 4 inches in diameter. The coal must also be very pure and washed to remove any fines. Alkalies and iron are undesirable tramp elements. The proper ratio of coal, quartzite, wood chips and charcoal are continuously added to the top of the furnace while silicon metal is tapped from the bottom. The coal, charcoal and wood chips provide an extremely reducing atmosphere near the bottom of the furnace and especially around the ends of the electrodes. Hot gases rising through the burden preheat it and the extreme temperature at the tips of the electrodes volatilizes the quartzite when it gets close to them. This silicon dioxide vapor reacts with the now porous, pure carbon to form carbon monoxide, silicon monoxide, silicon carbide and eventually silicon metal. The carbon monoxide gas rises through the burden and oxidizes to form carbon dioxide at the top of the furnace, where the atmosphere is oxidizing. More than three pounds of carbon monoxide are produced for each pound of silicon. Just like the carbon monoxide, silicon monoxide gas also rises through the burden. If the porous carbon phases don't strip away the last oxygen molecule, the silicon monoxide will eventually reach the oxidizing zone. While the carbon in the reducing zone of the furnace strips the oxygen from most of the silicon monoxide, some of it does escapes to the upper reaches of the furnace and the reaction of silicon monoxide to silicon dioxide gives us silica fume.

The silica fume that reaches the top of the furnace is sucked up into the hood that covers the top of the furnace by powerful bag house fans (Illustration # 4).

In order to meet very stringent environmental regulations, the bag house fans need to provide enough of a vacuuming action at the top of the furnace, so that no gases escape into the atmosphere and this does cause some problems. One of the reasons that the quartzite and coal are washed to remove the "fines" is so there will be no fines to be swept up the stack with the fume. Obviously, there are some fines still present and they do get pulled up the stack. For the silicon smelter, this isn't a problem. But for silica fume consumers an excessive presence of fine quartzite and coal contaminants places the end product outside of specification limits. These are tramp elements or oversize materials that you don't want in your silica fume. On the other hand, what does concern the silicon smelters is that partially ignited wood chips, are also routinely pulled up the stack. Smoldering wood chips and bag houses just

don't mix, so we have to separate the coal fines, quartzite fines, and wood chips, better known as "Heavies" from the silica fume. This is done first in the coolers and then in a series of cyclones that drop out all of the "Heavies". After this cleaning and cooling operation, silica fume is captured on the bags in the bag houses (Illustration # 5). The bags can be shaken or the compartment of the bag house backwashed to knock the fume from the bags. The fume is then moved into a silo either pneumatically or with a screw conveyor.

**Processing and Handling**

Typically the plants will have two different silo setups, one is for the storage, bulk loading and packaging of undensified silica fume and the other for the storage, bulk loading and packaging of densified silica fume. Undensified silica fume is the "as is " product that most Refractories use regularly, where as the densified product is made using undensified silica fume and some additional processing steps. The majority of densification silos have a very fine screen that covers the bottom section upon which the silica fume rests. Air is blown into the silo under the screen. This air gently rises through the silica fume causing the individual silica particles to rub against each other. As the particles touch, the naturally occurring van der Waals forces on their surface cause the particles to be attracted to each other. This attraction causes the particles to adhere to each other. The longer the air is allowed to flow through the fume bed, the greater the degree of agglomeration and correspondingly the density. Once the desired density is reached, the airflow to the silo is stopped. The newly densified silica fume can be shipped in bulk in pneumatic trucks, in super sacks or in small (usually 50 lb.) paper bags. The value of the densification process is most evident in shipments over long distances and especially for off shore customers because it greatly reduces the cost to transport 40 lbs/ft$^3$ silica fume versus 15 lbs/ft$^3$ material.

The end use of silica fume determines what form, densified or undensified, the consumer needs. The undensified fume in the bag house has a loose fill density of between 4 and 8 lbs/ft$^3$ very similar to talcum powder. By the time the fume gets to the silo, moves to the bagger, is blown into the bag, the bags stacked onto a pallet and the pallet shipped to the customer, that density has increased to12 to18 lbs/ft$^3$. Part of this density increase is due to the removal of air voids from between the individual silica fume particles, during handling. Another factor contributing to the density increase is caused by the stacking and subsequent compaction in the bags during shipping. In comparison densified silica fume typically has a density in the range of 40 lbs/ft$^3$, looks like small beads, flows like water and produces very little dust. The largest consumer of undensified silica fume is the refractories industry. However, not all refractory producers use undensified silica fume. Some have been very successful in developing technology that allows them to use 40 lbs/ft$^3$ densified silica fume to take advantage of the benefits of reduced shipping costs.

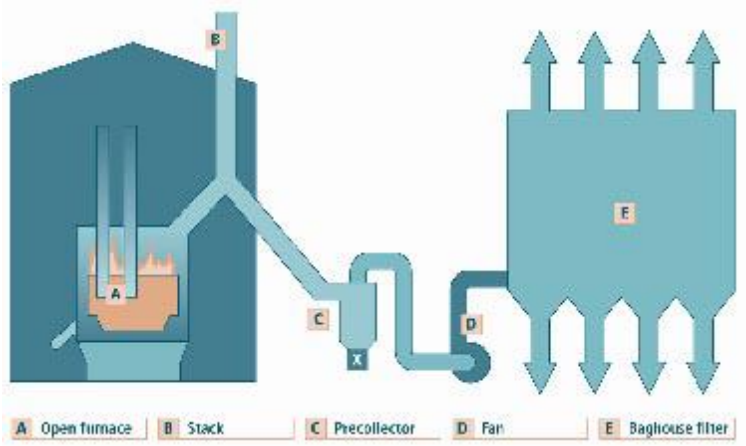

Illustration # 4

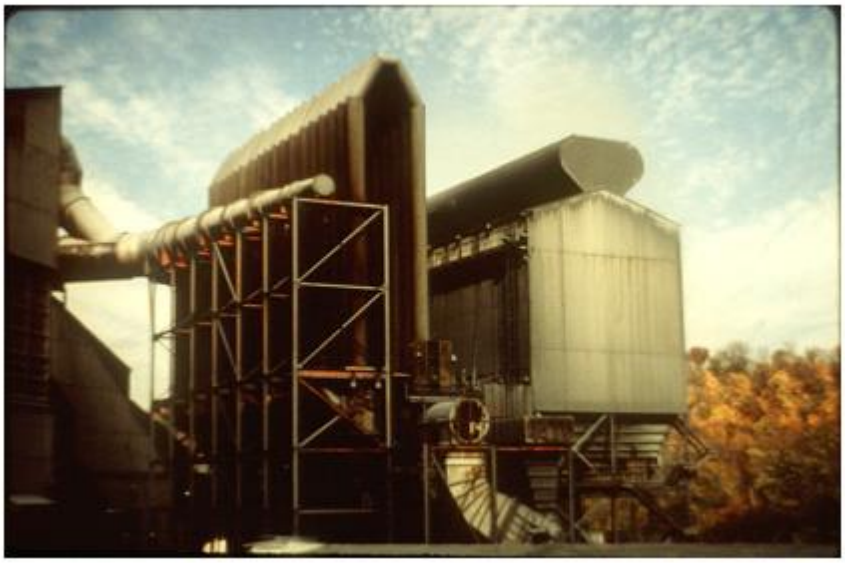

Illustration # 5

**SQ#119.** *Does the above except from the "Silica Fume" article describe the smelting process and flue collection process that will be used by the HiTest/PacWest smelter? Please provide details as to what will be the same, and what will be different.*

**The Tapping Process in Silicon Production**

H. Tveit, V. Andersen, K.H. Berget, and R. Jensen, *The Southern African Institute of Mining and Metallurgy Furnace Tapping Conference 2014*

*Elkem AS*

This paper presents some of the work carried out in order to improve the tapping process in silicon production, with special focus on the environmental and the safety standards. Some of the modelling work that has been done to improve the understanding of the process is described, together with the resulting implementation to improve tapping standards.

**Introduction**

The tapping process has seen improvement over the past 30 years, and some important tools such as simple automated tapping equipment have been introduced. However, further developments are still required, particularly in reducing operators' exposure to diffusive emissions.

Challenges of the industrial silicon tapping process

Silicon production consists of a series of critical processes, the major ones being raw material handling, furnace operation, and refining and casting. Tapping is one of the critical processes and affects the overall process in several ways. In the tapping process, molten silicon at a temperature above 1500°C is drained from the furnace through a taphole, either continuously or discontinuously, using different tapping equipment. Keeping this critical process under control has several challenges:

• Good drainage of silicon from the smelting furnace is a prerequisite for stable furnace operation and optimal silicon yield. If silicon is allowed to accumulate in the furnace over time, it will react with either carbon or silicon dioxide, which in turn will disturb the furnace process and reduce the silicon yield (Schei, Tuset, and Tveit, 1998)

• Utilizing the right kind of tapping equipment is important to obtain the correct product quality. The tapping process may also have an adverse effect on the production yield and the total revenue

• **The tapping area has several safety challenges**. Operators are in close proximity to molten silicon, high temperatures, moving equipment, and complex logistics. **The risk of burns and crush injuries is high unless preventive action is taken**

• The tapping process performance affects the working environment. **The tapping area is one of the largest sources of internal air pollution at the smelting plants.**
Elkem has worked on the dust exposure challenges of the process through several different research programmes, both internally and in cooperation with other parties such as the Norwegian Ferroalloy Producers Research Association (FFF). Figure 1 shows the result of mapping the main dust-exposed areas at Norwegian ferroalloy smelting plants. The Norwegian Labour Inspection Authority has increased its focus on chronic obstructive pulmonary disease (COPD) with the objective of reducing dust exposure for workers in the Norwegian smelting industry (Arbeidstilsynet, 2011). Elkem started its process dust mapping programme 1999, and the final report was presented in 2005 (Hetland, 2005). **This work showed that exposure to excessive dust levels at a smelting plant over a prolonged time increases the risk of reduced lung capacity. The tapping area was found to be one of the highest risk areas. The health risks were confirmed by Johnsen (2009**). These findings prompted an increased effort within Elkem to improve the working environment.

**SQ#120**. *Do you agree with all statements in the above article from " **The Tapping Process in Silicon Production"** above? If not, please describe what you do not agree with.*

***Examples of other silicon smelters (Burnsville Miss, Iceland, Niagara, etc.)***

**SQ#121.** *Please perform a study and review of the silicon smelters in the United States, Canada, and Iceland that are currently operating or have been operating within the previous 20 years. Include the Burnsville, Mississippi smelter, the Niagara smelter in New York, the United Silicon Helguvík, Southwest Iceland smelter and other smelters in Iceland, and all other silicon smelters. Please include emissions and pollution data, accidents or significant health hazard events, explosions, and citizens' complaints. Please make this report available to the public.*

## ***Noise***

*From:*
**Live Science**, Pollution Facts & Types of Pollution, By Alina Bradford, Live Science Contributor | February 27, 2018 09:55pm ET
https://www.livescience.com/22728-pollution-facts.html

**Noise pollution**
"Even though humans can't see or smell noise pollution, it still affects the environment. Noise pollution happens when the sound coming from planes, industry or other sources reaches harmful levels. Research has shown that there are direct links between noise and health, including stress-related illnesses, high blood pressure, speech interference, hearing loss. For example, a study by the WHO Noise Environmental Burden on Disease working group found that noise pollution may contribute to hundreds of thousands of deaths per year by increasing the rates of coronary heart disease. Under the Clean Air Act, the EPA can regulate machine and plane noise."

*From:*
**Noise pollution: non-auditory effects on health,** Stephen A Stansfeld and Mark P Matheson, *Department of Psychiatry, Medical Sciences Building, Queen Mary, University of London, London, UK*
https://academic.oup.com/bmb/article/68/1/243/421340

In addition to auditory effects noise has on heath, it also disturbs sleep, makes complex task performance more difficult and has an effect on social behavior. Studies have confirmed occupational

and environment noise can have an effect on hypertension. Exposure to noise pollution effects children as well as adults.

http://app.leg.wa.gov/RCW/default.aspx?cite=70.107.010
*From:* **Washington State Legislature, RCW** 70.107.010
Purpose.
The legislature finds that inadequately controlled noise adversely affects the health, safety and welfare of the people, the value of property, and the quality of the environment. Anti-noise measures of the past have not adequately protected against the invasion of these interests by noise. There is a need, therefore, for an expansion of efforts statewide directed toward the abatement and control of noise, considering the social and economic impact upon the community and the state.

https://www.fontana.org/DocumentCenter/View/26241/Appendix-H---Noise-and-Vibration-Analysis?bidId
*From*: **NOI S E A N D V I B RAT ION IMPAC T ANALY S I S, MONARCH HILLS RESIDENTIAL PROJECT**
MASTER CASE NO. 16-012, CITY OF FONTANA, CALIFORNIA, April 2018
Medium trucks, (i.e., those with a gross vehicle weight between 5 and 13.25 tons) produce as much acoustical energy as approximately 5 to 16 automobiles depending on the speed with slower speeds demonstrating the greater differential. Similarly, heavy trucks (i.e., those with a gross vehicle weight in excess of 13.25 tons) produce as much acoustical energy as 10 to 60 automobiles again with slower speeds resulting in the greatest differential.

Electric arc furnaces are known to create loud noise (*Excerpts From:* **How Does an Electric ARC Furnace Work?** By Blake Flournoy, above)

**SQ#122**. *The tremendous increase in noise will not only have a significant negative impact on human health and the health of our natural environment and wildlife, but will also severely impact tourism and property values. How will local property owners and businesses be compensated for the loss of their livelihoods? Please provide a comprehensive study on the impacts of noise on rural communities prior to approving any permits.*

## ***Light***

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2627884/
*From*: **US National Library of Medicine,** National Institutes of Health
**Distracted by the Light**
"The ecologic effects of artificial light have been well documented. Light pollution has been shown to affect both flora and fauna. For instance, prolonged exposure to artificial light prevents many trees from adjusting to seasonal variations, according to Winslow Briggs's chapter on plant responses in the 2006 book *Ecological Consequences of Artificial Night Lighting*. This, in turn, has implications for the wildlife that depend on trees for their natural habitat. Research on insects, turtles, birds, fish, reptiles, and other wildlife species shows that light pollution can alter behaviors, foraging areas, and breeding cycles, and not just in urban centers but in rural areas as well."

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4763120/
**US National Library of Medicine**, National Institutes of Health
**"Light pollution": the possible consequences of excessive illumination on retina**
Light is the visible part of the electromagnetic radiation within a range of 380–780 nm; (400–700 on primates retina). In vertebrates, the retina is adapted to capturing light photons and transmitting this information to other structures in the central nervous system. In mammals, light acts directly on the

retina to fulfill two important roles: (1) the visual function through rod and cone photoreceptor cells and (2) non-image forming tasks, such as the synchronization of circadian rhythms to a 24 h solar cycle, pineal melatonin suppression and pupil light reflexes. However, the excess of illumination may cause retinal degeneration or accelerate genetic retinal diseases. In the last century human society has increased its exposure to artificial illumination, producing changes in the Light/Dark cycle, as well as in light wavelengths and intensities. Although, the consequences of unnatural illumination or light pollution have been underestimated by modern society in its way of life, light pollution may have a strong impact on people's health. The effects of artificial light sources could have direct consequences on retinal health. Constant exposure to different wavelengths and intensities of light promoted by light pollution may produce retinal degeneration as a consequence of photoreceptor or retinal pigment epithelium cells death. In this review we summarize the different mechanisms of retinal damage related to the light exposure, which generates light pollution."

https://www.sciencetopia.net/pollution/light/causes-effects

**Adverse effects on human health**

Various negative health effects on the health of people have been linked to light pollution.

- Over-illumination may cause increased headache, fatigue, stress and anxiety.
- Light trespass during nights can disrupt our sleep which may lead to long term health problems. Exposure to excessive light at night is known to suppress the production of melatonin which is responsible for boosting our immune system.
- Glare from outdoor lighting decreases our vision and increases chances of accidents at light.

Effects on the ecosystem

- Light pollution is especially threatening to nocturnal wildlife. It adversely effects the physiology of plants and animals.
- Light pollution around lakes impedes zooplanktons from consuming surface algae which leads to algal blooms that may disrupt plant life and lower the quality of water.
- Light pollution is also linked to change in migratory patterns of birds
- Light pollution around beaches and river shores may effect predatory-prey roles and mating and hunting habits of pelagic organisms. For example, sea turtles hatch when its dark and the hatchlings use the light over the water to return to the ocean. Light from the buildings on the beaches draws hatchlings away from the water. In this way, millions of sea turtles die every year in Florida.

Effects on astronomy -The field of astronomy is also affected because of light pollution.

- Skyglow, caused by light scattering in the atmosphere, tends to reduce the contrast of the night sky which makes it harder for astronomers to view the heavenly bodies.
- Light trespass may create disturbance in observations when it enters the telescope.

Atmospheric pollution

A study presented the American Geophysical Union in San Francisco established that excessive light destroys nitrate radicals. This prevents the natural reduction of photochemical smog at night which consequently increases atmospheric pollution.

**SQ#123**. *Do you agree with all the statements in the above three "Light" article excerpts? If not, please describe what you do not agree with, and explain why. What is your plan to mitigate the light pollution from the smelter?*

## ***Risk of Explosion, Dust***

*From:*

**Coping with Coal** Dust, 03/01/2012 | Daniel Mahr, PE, Energy Associates, PC and Michael A. Schimmelpfennig, PE, Ameren Missouri

The U.S. Occupational Safety and Health Administration (OSHA) reports that between 1980 and 2008, 422 combustible dust incidents were reported across 64 different industries; electric power generating utilities experienced 28 incidents. The U.S. Chemical Safety and Hazard Investigation Board (CSB) investigates and documents the causes of these industrial dust explosions. Each of the CSB dust explosion reports suggests a common cause: Companies and their employees failed to recognize the implicit danger of airborne and accumulated dust. *(coal 6)*

A flame need not be the ignition source. Dry powders can build up static electricity charges when subjected to the friction of transfer, conveyor belt friction on pulleys and idlers, and mixing operations. Adequate precautions should be provided, such as electrical grounding and bonding, or inert atmospheres.

Today, OSHA's instruction No. CPL 03-00-008 is the guiding directive for controlling dust in manufacturing facilities. CPL 03-00-008 and NFPA 654 define the conditions under which plants must immediately remove dust accumulations that are 1/32 inch thick. OSHA standard No. 29 CFR 1910.269(v)(11)(xii) requires the elimination or control of ignition sources when coal-handling operations may produce a combustible atmosphere. NFPA 654, which includes a comprehensive list of dust control, ignition sources, and damage control provisions, is also an invaluable reference. *(coal 6)*

**The Challenge with Handling Coal**

Coal-fired power plants typically store coal outdoors and normally avoid using enclosed bucket elevators, making the design of a coal-handling system unique and much different than, for example, a grain-handling system at an export terminal.

Most coal-fired plants have crushers, and those in northern climates will often feature enclosed transfer houses and conveyor galleries. Day silos store one or more shifts' supply of coal within the power block for operating reliability. Consequently, devastating fires and explosions such as those that occurred at Imperial Sugar and at grain export terminals, particularly during the 1970s, are an ever-present threat at coal-fired plants that ignore basic safety and housekeeping precautions.

At coal-fired plants, high-capacity conveying systems handle thousands of tons of coal per hour. When even a small fraction of this tonnage is released and becomes airborne, an unacceptable danger is present. The danger escalates because the conveyed product is also flammable and may reach explosive concentrations. Airborne dust eventually settles on a variety of surfaces and over time; thick layers accumulate in less-visible or inaccessible areas. These accumulations fuel the most devastating events when a small initial explosion shakes dust-laden equipment, piping, conduit, ducts, and structures, thereby propelling the dormant fuel into a dense, flammable cloud that feeds a rapidly expanding fireball. These secondary explosions typically cause the majority of the damage in a plant. *(coal 6)*

In a practical sense, the first step in eliminating the hazard is to understand dust formation processes and which dust control technologies will be most effective to reduce airborne dust at the source. The available technologies are usually classified as containment, suppression, collection, and flow control. Each individual technology will reduce dust formation at the source, but a holistic approach should be considered for the entire plant. *(coal 6)*

*From:*

**Death in the Line of Duty...A summary of a NIOSH fire fighter fatality investigation**

F2011-22 Date Released: September 14, 2012

One of the primary concerns for the bulk storage of coal is its ability to produce its own heat. The storage of bulk coal, whether inside a silo or stockpiled on the ground, releases heat slowly through oxidation. It is possible for enough heat to be released over a period of time to raise the coal temperature to self-ignition or spontaneous combustion. Such fires can be very stubborn to extinguish because of the amount of coal involved (often hundreds of tons) and the difficulty of getting to the seat of the fire. Moreover, bituminous coal in either the smoldering or flaming stage may produce copious amounts of methane and carbon monoxide gases. Methane is not a concern with sub-bituminous (PBR) coals.
In addition to their toxicity, these gases are highly explosive in certain concentrations, and can further complicate efforts to fight this type of coal fire. Even the most universal firefighting substance, water, cannot always be used because of the possibility of a steam explosion. Water contributes to the exothermic reaction of coal increasing the fire problem.

**SQ#124**. *Do you agree with all of the statements in the above two "Explosion" article excerpts? If not, please describe what you do not agree with, and explain why. What is your plan to prevent explosions from the smelter? Who will be liable for compensation for any injuries, fatalities, property damages, loss of income due to explosions at the smelter?*

**Smelter Work Environment—Workers, Employees: Heat Stress**
National Safety Council, Safet+Health
**OSHA to employers: Consider screening workers for heat stress when index hits 85 degrees**
July 25, 2018
Washington — OSHA's threshold for moderate occupational heat risks starts at a heat index of 91° F, but that "might not be sufficiently protective," according to an analysis by the agency.
Together with researchers from NIOSH, OSHA reviewed 25 cases of outdoor work-related heat illnesses (14 fatal and 11 nonfatal) that OSHA investigated between 2011 and 2016. In each case, researchers examined the worker's personal risk factors, heat acclimatization status, clothing and workload, along with environmental heat as measured by wet globe bulb temperature – which includes temperature, humidity, wind speed and sky conditions.
The heat index was below 91° F in 12 of the cases, including six of the fatalities. OSHA does not enforce a permissible exposure limit for heat, but recommends "basic heat safety and planning" at heat indexes below 91° F. With heat indexes of 91° F and above, the agency recommends implementing precautions.
The analysis suggests that when wet globe bulb temperature is unavailable, a heat index of 85° F could be used to screen for hazardous workplace environmental heat.
The agencies recommend a comprehensive heat stress prevention program that includes an acclimatization schedule, first aid training, provision of fluids, shady areas for rest breaks, and engineering and administrative controls to curb heat stress.
The analysis was published July 6 in the Centers for Disease Control and Prevention's *Morbidity and Mortality Weekly Report*.

*From:*
**Extreme heat is killing America's farm workers ,** Sam Rigby, 09/02/2018

In the Lake Apopka region of Florida, a typical August day might yield a high temperature of 92F, a heat made all the worse by the stifling humidity. The weather is bad enough for office workers who spend most of the day next to an air conditioner. For farm workers, who spend their August picking blueberries outdoors, the heat can be oppressive, even fatal.
Heat can induce dehydration, nausea, exhaustion, stroke, and death. Even among workers who endure little discomfort, heat can take a toll over time. Chronic dehydration, for example, can lead to kidney failure. Despite these risks, there is no federal standard protecting workers from extreme heat.

"We're finding more and more people that have dehydration. They have symptoms of heat stress, so they're really concerned about that. Plus, workers are afraid to report their symptoms," Economos said. "Their afraid to report to their supervisor or the crew leader or the labor contractor if they have symptoms of heat stress because they're afraid they'll be pulled off the job

Earlier this summer, Public Citizen, the United Farm Workers Foundation and Farmworker Justice submitted a petition to the Occupational Safety and Health Administration (OSHA) calling for heat protections for workers. The petition outlines several measures, which would compel employers to provide additional mandatory breaks on hot days, protective equipment such as , access to water and shade, and additional training and monitoring of workers

It's not just farm workers that are suffering in the heat. Between 1992 and 2016, nearly 800 workers died in extreme heat, while close to 70,000 suffered serious injury, according to data from the Bureau of Labor Statistics. As bad as those numbers sound, they likely obscure the truth. OSHA said that heat-related "deaths are most likely underreported, and therefore the true mortality rate is likely higher," though it also concluded that heat deaths are too rare to justify new standards. Advocates warn that rising temperatures will make outdoor work more dangerous and heat-related deaths more commonplace. The time to implement strong federal standards, they say, is now.
"There is an undiagnosed epidemic of heat-related illness and death in this country, and the problem will get much worse very quickly because of global warming," said David Arkush, managing director of Public Citizen's climate program. "Some of our most vulnerable workers are at the highest risk. We need to protect them right away, and we need aggressive action to halt greenhouse gas pollution and stop climate change."
"A few years ago, OSHA came out with recommendations for heat stress, which included rest, shade, and water. And the recommendations are great. Workers in outdoor environments need rest, shade, and water," Economos said. "But they're only recommendations. If there is not a regulation that mandates that employers give rest, shade, and water to their workers, it's not going to happen."

Scorching temperatures aren't just a threat to health and safety. Workers also accomplish less when toiling under a hot sun. Researchers quantified the loss in productivity in a 2010 study of Caribbean countries, finding that productivity starts to drop off little by little once the mercury tops 78 degrees. The average annual high in Florida is more than 83F. By mid-century, it's expected to hit 86 degrees, and it gets worse from there. Productivity lost to heat adds up day after day, year after year. The global economy could lose up to $2 trillion by 2030 as rising temperatures make it difficult to work outdoors, according to a 2016 study. Tropical regions are set to take the biggest hit.
*This post originally appeared on Nexus Media.*

**SQ#125**. *Do you agree with all of the statements in the above two "Heat Stress" article excerpts? If not, please describe what you do not agree with, and explain why. What is your plan to mitigate the extreme heat at the smelter? Who will be liable for compensation for any injuries, fatalities, or loss of income due to heat stress at the smelter?*

**(b) Land and Shoreline Use.** Relationship to existing land use plans and to estimated population, Housing, Light and Glare, Aesthetics, Recreation, Historic and cultural preservation, Agricultural crops. *Note: underlined topics = PacWest "line-outs"*

**Relationship to existing land use plans: The Process**

The Time-Line, Lack of Transparency, and Lack of Citizen Input of the HiTest/PacWest smelter project violates the Washington State Growth Management Act, and the Pend Oreille County Comprehensive Plan.
Secret land deals and other acts by Washington State government officials, Pend Oreille County commissioners, Pend Oreille County PUD, Pend Oreille County EDC, and HiTest Sands/PacWest have been uncovered by citizens, citizen groups, and the Kalispel Tribe. Inaccurate modeling data for the proposed smelter submitted by Rambol Environmental Consultants has been questioned by the Kalispel Tribe and citizens.
The legality of some of some of these actions are being challenged by citizens groups CANSS and Responsible Growth*Northeast Washington and the Kalispel Tribe.

The Following RCWs listed below represent just three sections of the Washington State Growth Management Act that have been violated by Washington State, Pend Oreille government officials, the Pend Oreille PUD, the Pend Oreille Economic Development Council (EDC), and HiTest Sands/PacWest officials:

**RCW 36.70A.010**
**Legislative findings.**
"The legislature finds that uncoordinated and unplanned growth, together with a lack of common goals expressing the public's interest in the conservation and the wise use of our lands, pose a threat to the environment, sustainable economic development, and the health, safety, and high quality of life enjoyed by residents of this state."

**RCW 36.70A.011**
**Findings—Rural lands.**
"Finally, the legislature finds that in defining its rural element under RCW 36.70A.070(5), a county should foster land use patterns and develop a local vision of rural character that will: Help preserve rural-based economies and traditional rural lifestyles; encourage the economic prosperity of rural residents; foster opportunities for small-scale, rural-based employment and self-employment; permit the operation of rural-based agricultural, commercial, recreational, and tourist businesses that are consistent with existing and planned land use patterns; be compatible with the use of the land by wildlife and for fish and wildlife habitat; foster the private stewardship of the land and preservation of open space; and enhance the rural sense of community and quality of life."

**RCW 43.21C.020**
**Legislative recognitions—Declaration—Responsibility.**
"(2) In order to carry out the policy set forth in this chapter, it is the continuing responsibility of the state of Washington and all agencies of the state to use all practicable means, consistent with other essential considerations of state policy, to improve and coordinate plans, functions, programs, and resources to the end that the state and its citizens may:
(a) Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;

(b) Assure for all people of Washington safe, healthful, productive, and aesthetically and culturally pleasing surroundings;
(c) Attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences;
(d) Preserve important historic, cultural, and natural aspects of our national heritage;
(e) Maintain, wherever possible, an environment which supports diversity and variety of individual choice;
(f) Achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities; and
(g) Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.
**(3) The legislature recognizes that each person has a fundamental and inalienable right to a healthful environment and that each person has a responsibility to contribute to the preservation and enhancement of the environment."**

**SQ#126.** *Is the Department of Ecology required to comply with the Washington State Growth Management Act?*
*If so, please provide an explanation of why the Dept. of Ecology chooses to contradict the Washington State Growth Management Act by rushing through this process (skipping the SEPA checklist) and putting its relationship with HiTest Sands/PacWest above citizens' rights to live in a healthy environment.*

**(c) Transportation.** Transportation systems, vehicular traffic; waterborne, rail, and air traffic; Parking; Movement/circulation of people or goods; Traffic hazards

**Newport, Washington School District: Transportation** 18 regularly scheduled Bus Routes
Regularly Scheduled Routes:

| | | |
|---|---|---|
| **Rt 1:** | | **Hwy 2, Hwy 211, Fertile Valley, Old State Hwy , Jermain Loop** |
| **Rt 3:** | | **Davis Lake, Hwy 211, Sacheen Terrace, Hwy 2** |
| **Rt 4:** | | **North Shore, Jorgens Loop, Viet, Panhead Hill** |
| **Rt 5:** | | **Hwy 2, Telephone Rd, Green Rd, Driskell Loop** |
| **Rt 6:** | | **Hwy 41, Rena Rd, Roberts/Saunders, Garrett Rd, Blanchard Crk** |
| **Rt 7:** | | **Leclerc, Conklin Meadows** |
| **Rt 8:** | | **Deer Valley, Rocky Gorge** |
| **Rt 9:** | | **Hwy 211, Baker Lake, Turk, Deeter, Hwy 20, McCloud Crk, Bobier,** |
| **Rt 10:** | | **Hwy 20, Herbs Dr, Yergens, Levitch, Dalkena, Russell Rd, Turner Rd** |
| **Rt 11:** | | **Hwy 2, South Shore** |
| **Rt 12:** | | **Scotia, Camden, Rosema Rd** |
| **Rt 13:** | | **Spring Valley, Lillijard, Stohr, Bergan, Big Foot** |
| **Rt 14:** | | **Deer Valley, Coyote Trail, McCloud Crk** |
| **Rt 15:** | | **Hwy 2, Spring Valley, Elmers Loop, Thompson Rd** |
| **Rt 17:** | | **Special Needs** |
| **Rt 19:** | | **Special Needs** |

**Activity Route**
**Route 1:** Takes LeClerc Rd to Usk Bridge and then highway 20 back to Newport.
**Route 2:** Takes Deer Valley Rd, left onto Hwy 211 then left on Hwy 2 back to Newport.
- Some stops are: Store n More, Paint the Wind (Hwy2 and Hwy 211), Merv's Mercantile , & South Shore Store

**Route 3:** Highway 2 out to Camden Rd., left onto Scotia Rd, right onto Spring Valley to the Mennonite Church
**LIMITED SNOW ROUTES**

| | **No Service to….** | **Meet At ….** |
|---|---|---|
| **Route1:** | **Balcom Road** | **Balcom & Fertile Valley** |
| **Route 1:** | **Jermain** | **Jermain & Fertile Valley** |
| **Route 3:** | **Davis Lake** | **Davis Lake & Hwy 211** |
| **Route 3:** | **Sacheen Terrace** | **Sacheen Terrace & Hwy 211** |
| **Route 4:** | **Runs the same** | |
| **Route 5:** | **Runs the same** | |
| **Route 6:** | **Garrett Rd** | **Roberts Ln & Hwy 41** |
| **Route 6:** | **Rena Rd** | **Rena Rd & Hwy 41** |
| **Route 7:** | **Sandy Shores** | **Sandy Shores & LeClerc Rd** |
| **Route 8:** | **Rocky Gorge** | **Rocky Gorge & Hwy 211** |
| **Route 8:** | **Gray Rd** | **Gray Rd & Deer Valley** |
| **Route 9:** | **Baker Lake Rd** | **Baker Lk Rd & Turk Rd** |
| **Route 10:** | **Herbs Drive** | **Herbs Dr & Hwy 20** |
| **Route 10:** | **Yergens Rd** | **Yergens Rd & Hwy 20** |
| **Route 10:** | **Levitch Rd** | **Levitch Rd & Hwy 20** |
| **Route 10:** | **Turner** | **Dalkena** |
| **Route 11:** | **Runs the same** | |
| **Route 12:** | **Rosema** | **Rosema & Camdon** |
| **Route 13:** | **Runs the same** | |
| **Route 14:** | **McCloud Creek** | **Corner of Willy Way & Coyote Trail** |
| **Route 15:** | **Thompson Rd** | **Jefferson & Spring Valley** |
| **Route 17:** | **Runs the same** | |
| **Route 19:** | **Runs the same** | |

Citizens Calculation of Railroad and Truck Traffic Based on Available Data

| **Raw Materials – quartz, coal, carbon and woodchips**<br><br>**PacWest data** | **Tons per year as per PacWest documents.** | **Rail cars/trucks tonnage**<br><br>**RG*NEW estimates** | **Number of train cars or trucks per year inbound to the smelter**<br><br>**RG*NEW estimates** | **Number of train cars or trucks per year outbound of the smelter**<br><br>**RG*NEW estimates** | **Total number of cars and/or trucks inbound and outbound per year**<br><br>**RG*NEW estimates** |
|---|---|---|---|---|---|
| **Crystalline silica (quartz)** | 170,000 | 100 tons per cargo rail car | 1,700 train cars inbound full | 1,700 train cars outbound empty | *3,400 train cars per year inbound and outbound |
| **Coal/carbon** | 150,000 | 100 tons per coal car | 1,500 coal train cars inbound full | 1,500 coal train cars outbound empty | *3,000 coal train cars per year inbound and outbound |
| **Wood chips** | 130,000 | 24,000# per truck road limit (12 tons) | 10,833.33 trucks inbound | 10,833.33 trucks outbound | **21,666.66 chip trucks inbound and outbound per year |
| **Silicon produced** | 73,000 | 100 tons per cargo rail car | 730 rail cars inbound empty | 730 rail cars outbound full | *1,460 rail cars outbound/inbound |

Total number of inbound/outbound trains per year = *7,860 train cars; per week = 151.15; **per day = 22**
Total number of inbound/outbound woodchips trucks per year **21,666.66 woodchip trucks;
per week = 416.66; **per day = 60**

"A proposed rail spur would connect the facility site with existing tracks, and an onsite rail loop would be used to hold the trains while cars containing raw materials are unloaded. Unloading operations would occur only between 7 AM and 10 PM; the number of rail cars unloaded per day is expected to range between 0 and 100, with an average of approximately 10 per day. An average of approximately 5 rail cars would be loaded with product, either silicon metal or silica captured by the filter control system, and shipped off-site each day. In-bound and our-bound rail shipments are expected to occur throughout the year. Loading and unloading activities would be covered and fugitive dust would be mitigated by suppression methods. A switching locomotive would be available onsite to coordinate rail movements as needed." ***PacWest letter to the Department of Ecology, June 05, 2018.***

**SQ#127**. *What will be the total emissions from the additional rail traffic and the truck traffic used to support the smelter? Will the rail and truck traffic emissions be included in the PSD determination? If not, please explain why.*

**There are 18 regularly scheduled bus routes that accommodate Newport Schools**.
School buses are used to transport students to and from home and school and extracurricular activities like field trips and athletic events. We also need to take into consideration the school buses bringing students into Newport for extracurricular activities from other school districts.
Highway 2 and 41 are the main routes for those school buses. Those are also the main routes for PacWest trucks and employee vehicles. Highways 20 and 211 are also bus routes – all bus routes converge on Highway 2

The case can be made that the increase in truck, train and car travel on Highway 2 and Highway 41 also increases the chance of accidents. There are three train rail crossings that Newport School buses must stop at: two on Highway 2 and 41 and one Highway 20. Plus, all Newport School District buses converge on Highway 2 in order to let students off at the three separate schools.

*From:* **Congressional Research Service**, **Commercial Truck Safety: Overview,** David Randall Peterman Analyst in Transportation Policy, March 21, 2017
"More than 11 million large trucks travel U.S. roads, and almost 4 million people hold commercial driver's licenses. In 2015, large trucks were involved in more than 400,000 motor vehicle crashes serious enough to be registered by police, with nearly 100,000 of those crashes causing injuries and around 3,600 resulting in fatalities."

*From:* **bts.dot.gov, Transportation Statistics Annual Reports, 2017**
Most children go to school every school day. As was discussed in box 2-A in chapter 2, most children are transported to and from school in motor vehicles, either a personal or family vehicle (45 percent in 2009) or a school bus (39 percent). Relatively few (15 percent or less) walk or bike.
How safe are their trips to and from school? NHTSA found that, in the 10 years between 2006 and 2015, a total of 301 school-aged children (18 and under) died in school transportation-related crashes [USDOT NHTSA 2017j]. This amounts to about 30 school- children deaths per year on average. Over the 10-year period, 54 of the children who died were occupants of school buses or other school- transportation vehicles (about 5.4 fatalities per year), and 137 were school children occupying other vehicles, such as a family vehicle (13.7 fatalities per year). Children who were on foot accounted for 102 fatalities, while bicyclists and other pedalcyclists comprised 8 deaths—for a combined average of 11 fatalities per year. About 64 percent of the school-age pedestrians that died were struck by a school bus or a vehicle functioning as a school bus, while 36 percent of pedestrian deaths of school children involved other vehicles. Over one- fifth of the school bus-child pedestrian fatalities occurred as the bus was starting up in the road, while about 11 percent of the school children pedestrian fatalities happened as another vehicle type passed or overtook a vehicle.
The above statistics indicate that some school- children fatalities happen as children approach or walk away from their transport vehicle as they go to and from school. A recent U.S. General Accountability Office study reports that, when participating school bus drivers were asked to note the number of times a vehicle illegally passed the bus when stopped to pick up or drop off students, these drivers reported 74,000 instances in a single day [USGAO 2017].
The total number of people of all ages who died in school-transportation related crashes over the 2006 to 2015 year period was 1,313—or about 131 per year on average. This was about 100 more deaths of people per year than the
30 school-aged children who died annually [NHTSA 2017i].

**SQ128**. *What traffic safety controls will be put in to accommodate the tremendous increase in traffic to support the smelter? Who will be liable for compensation for any injuries, fatalities, or loss of income due any accidents where transport vehicles for HiTest/PacWest are at fault?*

**(d) Public Services and Utilities.** Fire, Police, Schools, Parks or other recreational facilities, Maintenance, Communications, Water/stormwater, Sewer/solid waste, Other Governmental services or utilities.

**City of Newport Utilities**
The City of Newport Public Works Department maintains the city's 1.1 square miles of streets, water, and sewer services for its citizens and visitors.

**City of Newport Fire**
CALL 911 - IN CASE OF A FIRE
The Newport Fire Department is a completely volunteer fire department serving the city limits of Newport. We also have a mutual aid agreement with three adjoining districts, Fire Districts #3 and #4 and West Pend Oreille Fire District #1 of Idaho, bringing our total coverage to 160 square miles. Newport Fire Department's ISO fire class is 7.
Currently 13 very dedicated people volunteer their time to provide fire services to all the citizens within our community. If you are interested in becoming a volunteer firefighter for the City of Newport call Newport City Hall at (509) 447-5611.
Notice: No Outdoor Burning in Newport
No outdoor burning is allowed within the City of Newport and the Newport Urban Growth Area. Washington State law RCW 70.94.6514 prohibits outdoor burning and further outlines the restrictions.

**City of Newport Police**
IN CASE OF EMERGENCY DIAL 911
* To contact a police officer - Non-Emergency Call (509) 447-3151
* Code Enforcement issues (509) 447-5611
* Dog problem or dog "At Large" (509) 447-1980
* To check on dog licenses or lost dog issues (509) 447-5611
* To request Police records use the Police Records Request Form
* To request Extra Patrol Services use the Extra Patrol Request Form
* File a complaint use the Complaint form
* Apply for a Lateral Police Officer here
The City of Newport contracted with the Pend Oreille County Sheriff for law enforcement services from 2/01/2006 until 12/31/2017.
**Newport Police Department as of 2018**
Police Chief - Mark Duxbury
Police Officers - Raul Lopez and Ryan Nuvill
City Prosecutor - Joshua Maurer

**City of Newport Public Works**
The City of Newport Public Works Department maintains the city's 1.1 square miles of streets, water, and sewer services for its citizens and visitors.

A Small Works Roster has been established for the purpose of notifying qualified contractors of pending Public Works projects and may be utilized whenever the City of Newport seeks to construct any project when the estimated cost is less than $300, 000. the Newport Small Works Roster application.

**Public Works Personnel:**

Public Works Director - David North
Street Maintenance Worker - Russ Perry
Street Maintenance Worker - Marc Wilkinson
Code Enforcement - Ed Rochek

**WWTP Operators**

WWTP Supervisor - Josh Howard
Bryce Seaney
Brian Eggleston

**Water Operator**

Gene Kolar

**City of Newport Parks & Recreation**

The City of Newport's main park is located at First Street and Calispel Avenue. The park features a large concrete covered stage, picnic tables, a covered shelter, children's playground equipment, a splash pad and a skateboard park. The skateboard park features two halfpipes, two quarterpipes, and several grinders.

**The Newport Spray Park** officially opened June 14, 2013. The spray park was made possible through a grant from the State of Washington RCO. The Newport Spray Park has a 3000 square foot splash pad with spraying water features and is located inside the Newport City Park at First Street and Calispel Avenue. The hours of operation are daily 10 am to 7 pm weather permitting. For the 2018 season, the spray park planned opening will be June 7. The spray park will remain open tenatitively until September 4, 2018 when it will close for the season.

**TJ Kelly Park** is located at the corner of Washington Avenue at First Street. TJ Kelly was the first elected mayor of Newport and this park was named in his honor. The park opened officially on August 20, 2010. The park features a rock waterfall, rock benches, covered picnic tables, and a public restroom.

**Fred G. Anderson Veteran's Memorial Park** is located at 211 S. Union Avenue next to the Newport Firehall. This park was named in honor of former Mayor and Vietnam veteran Fred Anderson for his military service and all those men and women who have honorably served in the armed forces. The park opened officially on September 25, 2012. The park features benches, military flags, and a public restroom.

**The Little People's Park** is located at 436 S. Union Avenue. This park has a children's swing set, slide, and a small basketball court.

Parks are open to the public and paid reservations for events can be made by contacting Newport City Hall (509) 447-5611.

**Pend Oreille County Public Hospital District #1**

Pend Oreille County Public Hospital District #1 is a municipal corporation established in 1921 and authorized to provide for “the health care needs of District residents and other persons.”

Located in Newport, Pend Oreille County, Washington, the District owns and operates:

- Newport Hospital & Health Services
- 50-bed Long Term Care Facility (will be replaced with new advanced care assisted living facility by Summer 2019)
- River Mountain Village (42-unit Assisted Living Facility)

- Newport Health Center (Primary Care Clinic)
- 24-bed Acute Care
- 24-hour Emergency Department
- Diagnostic Imaging (Radiology)
- Physical and Rehabilitative Therapy
- General Surgical Services
- Obstetrics Unit and 2 Private Birthing Rooms
- Laboratory Services

***Newport Hospital & Health Services*** *714 W. Pine Street Newport, WA 99156*
***Our Mission*****: The staff at Newport Hospital and Health Services commits to be trusted as the first-choice healthcare provider for our community.**
Whether you are a resident of the greater Pend Oreille Valley, Priest River, Idaho; Priest Lake, Idaho or are just passing through for recreation in the great outdoors, Newport Hospital and Health Services provides expert care when you need it, **24 hours a day, seven days a week.** As a critical access hospital with a rural health clinic, we offer excellent care to all and proudly serve as a patient-centered medical home to our residents in Eastern Washington and our neighbors in Priest River, Idaho and North Idaho. NHHS employs seven primary care physicians, three emergency room physicians, four health care affiliates, two Certified Registered Nurse Anesthetists, an Outpatient Wound provider, and General Surgeons. We offer complete obstetrical care including epidural anesthesia and Cesarean deliveries in a private, family setting.
Outpatient services are comprised of full-service diagnostic imaging (radiology), laboratory, pathology and licensed physical and restorative therapy. NHHS also offers short stay and same day surgical services and a fully staffed general medical acute care unit.
If you're looking for Newport doctors or Newport WA primary care services, Newport Hospital and Health Services is the place to go!

**Pend Oreille County Fire Departments**

| Fire Department | General Area Served | Web Address |
|---|---|---|
| Cusick | Town of Cusick | |
| Ione | Town of Ione | |
| Metaline | Town of Metaline | |
| Metaline Falls | Town of Metaline Falls | |
| Newport | City of Newport | http://www.newport-wa.org/departments/fire.html |
| South Pend Oreille Fire & Rescue | Elk, Diamond Lake, Sacheen Lake, and Fertile Valley | http://www.spofr.org/ |
| Fire District 2 | North County | |
| Fire District 4 | Dalkena, Davis Lake, Cusick & Usk | http://www.pofd4.org/ |
| Fire District 5 | Locke-Ruby | http://www.pofd5.org/ |

| | | |
|---|---|---|
| Fire District 6 | Leclerc & Furport | https://www.facebook.com/PENDOREILLEFIREDIST6/ |
| Fire District 8 | Spring Valley | https://www.pocfire8.org/ |
| Kalispel Tribal Public Safety Dept | Kalispel Tribe of Indians | https://www.kalispeltribe.com/programs-and-services/public-safety |

***Access Washington***
**Where to Get Help in Pend Oreille County**

**Pend Oreille County Emergency Management,** 231 S. Garden Ave **,** Newport, WA 99156**,** Phone: 509-447-3731**,** Email: jboggs@pendoreille.org http://www.pendoreilleco.org/county/em_2.asp
**Local Red Cross Chapter,** Greater Inland Northwest**,** 315 W. Nora Avenue**, Spokane, WA,** Phone: 509-326-3330 http://www.redcross.org/local/wa/northwestregion/chapters/greater-inland-northwest

**SQ#129**. *Do you think that the emergency health and safety facilities in Newport are sufficient to support the Newport community if the smelter is built? Where is the nearest HazMat team?*

**Newport Schools**

**Newport, WA Public Schools (2018-19)**
**School Location-Grades-Students**

Newport **Newport High Schoo**l, 1400 W. 5th Street Newport, WA 99156 , (509)447-2481
Grades: 9-12 | 355 students
Newport **Pend Oreille River School**, **Alternative School**, 1201 West 5th Street Newport, WA 99156 (509)447-3167, Grades: K-12 | 15 students
Newport **Sadie Halstead Middle School**,331 S. Calispel Avenue, Newport, WA 99156 , (509)447-2426
Grades: 5-8 | 327 students
Newport **Stratton Elementary Schoo**l, 1201 W. 5th Street Newport, WA 99156 , (509)447-0656
Grades: PK-4 | 388

**Private School**
Newport **Life Prep Academy**, 3461 COYOTE TRL, NEWPORT WA 99156, Elementary/Secondary (Co-ed), Grades**:** 1 to 12, Students**:** 42

**SQ#130**. *The following maps below show the dangerously close proximity of the Smelter to 4 of Newport's schools. A great deal of fear and anxiety exits in Newport regarding the smelter's toxic impacts on our children's health. Please provide a program of initial screening of Newport's school children's health, and continuous annual monitoring of students' health. This program should be funded by both HiTest/PacWest and Washington State.*

Red lines extend from the smelter site to Newport Schools

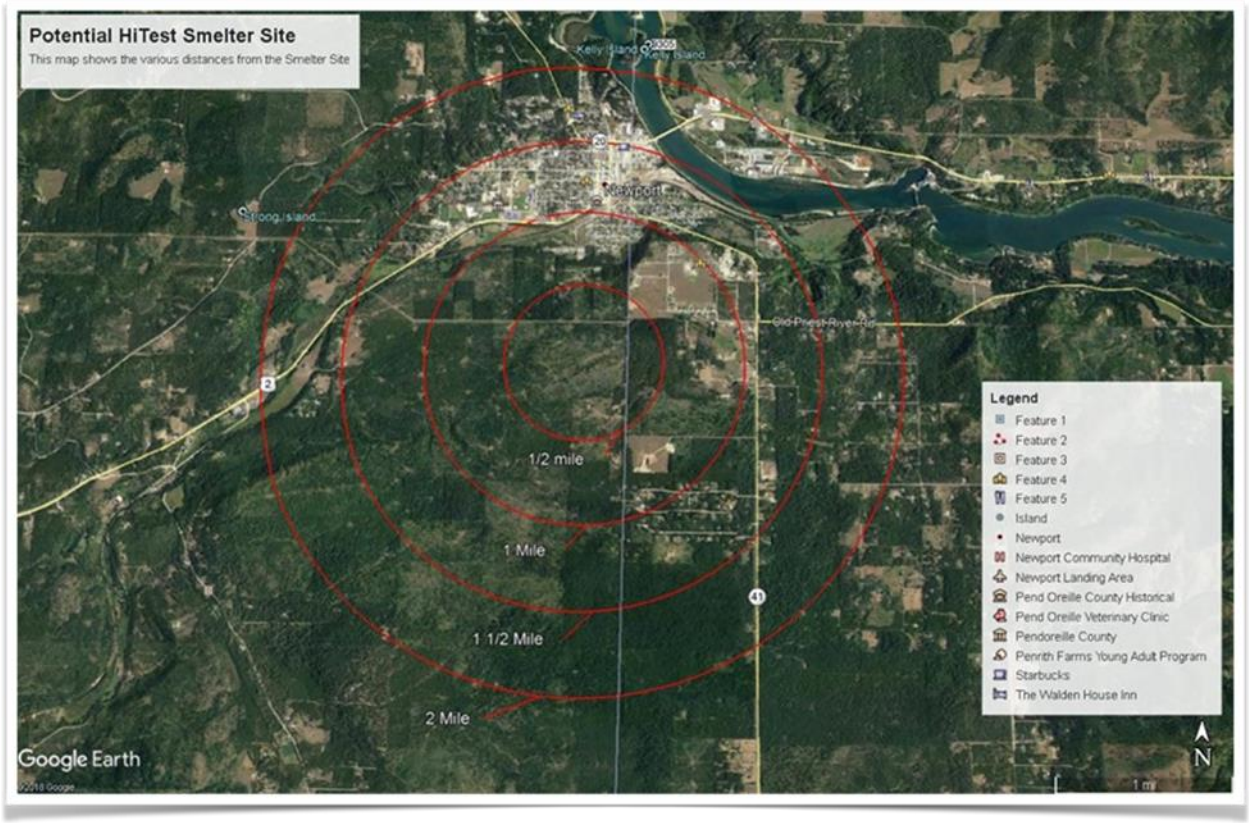

Photo showing distance of schools, downtown Newport, the Pend Oreille River, and the Little Spokane River watershed from the proposed smelter site.

## SECTION 3: ALTERNATIVES

**Alternatives to coal reductants, silicon solar cells, and heavy industry**

***Silicon Smelting without Coal, alternative sources of Silica, Extraction of silicon from $SiO_2$ without smelting,*** *articles and excerpts*

***Silicon is Not the best material for solar energy conversion***
INVESTIGATION REPORT CET/IR289R, ALTERNATIVE REDUCTANTS FOR SILICON SMELTING *(click on the link on the lower left of the document)*
https://www.coastwatchers.org.au/investigation-report-alternative-reductants-for-silicon-smelting/

*From*: **Silicon processing:from quartz to crystalline silicon solar cells**
It is clear from its properties that silicon is not the ideal material for solar energy conversion. It is no surprise that there is extensive research going into the search for new materials for solar cells. Thin-film semiconductors are gaining popularity in industry, particularly cadmium telluride (CdTe), which is only second to crystalline silicon in terms of market share in the photovoltaic industry. Cadmium telluride is both a direct band gap semiconductor and has a band gap within the optimum band gap.

There are other important factors to be considered for an ideal solar cell material; these include: material availability, non-toxic materials, easy production methods suitable for mass production, sound photovoltaic conversion efficiency, and long term stability of the solar cell material**12**. As mentioned previously, the dominance of silicon in the photovoltaic industry is attributed to historic reasons, *i.e.* availability of high-quality material in large quantities for the semiconductor market**12**.

It was established that silicon is not necessarily the best material for solar energy conversion; therefore the future could see materials of high energy conversion efficiency and low production costs. It would be desired that such materials are in abundance, environmentally friendly, and show long-term stability. The prospects of a sizeable 'green' contribution to electricity production from photovoltaics are good.

Electrochimica Acta 65 (2012) 57– 63

**Formation of a silicon layer by electroreduction of SiO2 nanoparticles in CaCl2 molten salt,** Sung Ki Cho, Fu-Ren F. Fan, Allen J. Bard∗
Center for Electrochemistry, Department of Chemistry and Biochemistry, 1 University Station A5300, The University of Texas at Austin, Austin, TX 78712, United States

**1. Introduction**
Currently there is a high demand and consumption of silicon as a material for photovoltaic (PV) devices. Most photovoltaic devices are based on the crystalline silicon p-n junction, and accordingly, the price of silicon has a great effect on the cost of these devices. The purity of silicon required for photovoltaic devices, which is called 'solar silicon', is 99.9999% (6N), which is less pure than that for electronics applications (11N). There is therefore a strong interest in developing a low cost production processes for solar silicon, compared to conventional high purity silicon production process such as the Siemens process, especially a process that can produce thin films of needed purity and crystallinity directly. Generally, high purity silicon is produced by the carbothermic reduction of SiO2 with carbon at 2000 ◦C followed by the purification with HCl at 1000 ◦C. These processes are highly energy-consuming with

considerable emission of CO2. Electrochemical approaches for producing silicon have been studied; these are attractive because they could lead to a less expensive route to solar Si.

… Nohira et al. [16,17] reported that solid SiO2 can be electrochemically reduced to crystalline silicon in a calcium chloride melt. In a CaCl2 melt, electrons can be transferred from a metal (molybdenum, tungsten, nickel) cathode directly to a mechanically contacted solid quartz piece. The reduction reaction starts at metal/electrolyte/metal oxide three-phase interface and the oxygen ion is removed from the solid structure.
$SiO2(s) + 4e- \rightarrow Si(s) + 2O2$

This seems to be a promising approach, because silicon dioxide is a cheap and abundant source material and the operating conditions are less severe than those for other molten salt systems. In this study, we show that one can produce a silicon layer on Mo surface from SiO2 NPs simply added into the CaCl2 melt. We performed cyclic voltammetry for this reaction in the CaCl2 melt, and also characterized the silicon deposit by SEM-EDS, XRD and XPS. However, the deposit still is not of sufficient quality to be useful for solar applications.
http://bard.cm.utexas.edu/resources/Bard-Reprint/885.pdf

## How Do You Make Cheaper, Greener Silicon from Rice? 23 December 2015

A major breakthrough has been made in the process for manufacturing silicon. Not only does the new method use less energy (with potential cost savings of 90%), but it has a carbon footprint of almost zero and so has minimal environmental impact.
Since the 1930's chemists have faced a 'great challenge' in how to manufacture silicon with less energy. Whilst the element silicon is readily available in all manner of organic substances, up till now scientists had been unable to efficiently uncouple the silicon from its tight bond with oxygen.
That is until Richard Laine, a professor of materials science and engineering at the University of Michigan discovered how it was possible. He is focusing his further studies on the readily available agricultural waste of rice hull ash; the burnt remains of the shell that surrounds a grain of rice. As the University noted, "Laine found two easy and inexpensive ways to break that bond: ethylene glycol, or antifreeze, and ethanol, or grain alcohol. The antifreeze combined with a small amount of sodium hydroxide weakens the chemical bonds between the silica and rice hull ash at the beginning of the process, dissolving the silica into a liquid solution. The solution is then heated to 390 degrees Celsius, forming a polymer of silica and antifreeze.
Grain alcohol is then added at the end of the process. It's chemically similar to antifreeze, so it easily swaps in to replace the antifreeze, which is then recycled. The liquid silica can then be distilled out of this second solution and used to make a high-purity precipitated silica product for industrial use."
One of the most significant aspects of this discovery is that the basic raw material can be taken from any number of agricultural waste products, as silicon is abundant in most of them, but for now Laine plans to focus on processing rice hulls. Currently, thousands of tons of hulls produced every day are burnt for fuel, however many more thousands of tons are simply dumped as waste. This discovery may make this waste useable.
As a result of this research, Laine was awarded the 2015 Michigan Green Chemistry Governor's Award and plans to turn his idea into a profitable enterprise. As Laine said whilst collecting his award, "I think eventually, we'll be producing high-purity silica and other silicon compounds right next to the rice fields. By processing the rice husks we'll be able to produce high-grade silica in a single location with little or no carbon footprint. It's really very exciting."
Questions still remain about the effectiveness of the up scaling and the quality of the mass product that will be produced, but as Laine explains, "If scale up is successful, the process will change the way high

purity alkoxysilanes and precipitated and fumed silica are produced worldwide, because there are multiple sources of biogenic silicas everywhere."

*Excerpts From:*
**Hydrogen To Replace Coking Coal In The Reduction Of Iron Ore In Steelmaking? Maybe One Day**
Feb. 14, 2017 5:58 PM ET, *Original Post By Stuart Burns*

The Austrian steelmaker Voestalpine, Siemens (OTC:SMQFY) of Germany, and Austrian renewable energy company Verbund (OTCPK:OEZVY) are building an experimental facility to economically produce hydrogen from water, which would then be used in place of coking coal for steelmaking. You might remember that my colleague, Jeff Yoders, noted that Voestalpine touted research into using hydrogen to reduce iron ore at its new DRI facility in Texas when the facility opened last year.
*Voestalpine's $750 million direct-reduced iron ore facility in Corpus Christi, Texas, could one day be fueled by hydrogen and not natural gas.*
By the consortium's own admission, an economically viable hydrogen process could take 20 years. But should it eventually prove successful that the benefits of decarbonizing a range of energy intensive industries such as ceramics, aluminum, glass, and cement in addition to steel could dramatically reduce emissions from one of the largest sources of industrial CO2 emissions.

*Excerpts From:*
**Lead Smelting Going Green with New Technology from Doe Run**, Andrew Topf Feb. 1, 2011

As one of the world's largest lead producers, Missouri-based Doe Run has introduced a new hydrometallurgical process to replace centuries-old, high-temperature lead smelting. The company expects the process to transform the way primary lead metal is manufactured.
Working with its technology partner, Engitec, Doe Run's technology uses a wet chemical process to dissolve lead concentrates into solution, then extracts the lead from the solution using an electric current. The process is similar to the electrowinning process used to extract zinc from concentrates, but this is the first time it has been tried for lead production.
The greatest advantage of traditional lead smelting is its familiarity; however, the process has a number of limitations. The use of natural gas to heat the coke in the blast furnace, as well as for refining and casting the lead, makes the process extremely energy intensive. The process generates slag heaps and also requires sophisticated and expensive emissions-capture systems to filter the gases.

We looked at other pyro processes that do a better job of capturing sulphur and lead emissions, but we couldn't find technology that was capable of meeting those NAAQS standards."
Instead, the company began testing a hydrometallurgical process that uses fluoboric acid as a reagent to dissolve the lead.

Pyatt says that the process offers several environmental advantages, with the most important being an absence of slag heaps, along with virtually no air emissions. The low temperature means a substantially reduced carbon footprint due to low energy inputs. Importantly, the reagent (fluoboric acid) can be recycled for several years.

**Researchers make key improvement in solar cell technology**
February 29, 2016, Washington State University

Kelvin Lynn, a Regents professor in the Washington State University School of Mechanical and Materials Engineering and Department of Physics, helped researchers reach a milestone in solar cell fabrication. Credit: Washington State University

Researchers have reached a critical milestone in solar cell fabrication, helping pave the way for solar energy to directly compete with electricity generated by conventional energy sources.

Led by the U.S. Department of Energy's National Renewable Energy Laboratory and in collaboration with Washington State University and the University of Tennessee, the researchers improved the maximum voltage available from a cadmium telluride (CdTe) solar cell, overcoming a practical limit that has been pursued for six decades and is key to improving its efficiency. The work is published in the Feb. 29 issue of *Nature Energy*.

Silicon solar cells currently represent 90% of the solar cell market, but it will be difficult to significantly reduce their manufacturing costs. CdTe solar cells offer a low-cost alternative. They have the lowest carbon footprint of any other solar technology and perform better than silicon in real world conditions, including in hot, humid weather and under low light. However, until recently, CdTe cells haven't been as efficient as silicon-based cells.

One key area where CdTe has underperformed was in the maximum voltage available from the solar cell, called open-circuit voltage. Limited by the quality of CdTe materials, researchers for the past 60 years were not able to get more than 900 millivolts out of the material, which was considered its practical limit.

The research team improved cell voltage by shifting away from a standard processing step using cadmium chloride. Instead, they placed a small number of phosphorus atoms on tellurium lattice sites and then carefully formed ideal interfaces between materials with different atomic spacing to complete the solar cell. This approach improved the CdTe conductivity and carrier lifetime each by orders of magnitude, thereby enabling the fabrication of CdTe solar cells with an open-circuit voltage breaking the 1-volt barrier for the first time. The innovation establishes new research paths for solar cells to become more efficient and provide electricity at lower cost than fossil fuels.

"It's a significant milestone. It's been below 900 millivolts for decades," said Kelvin Lynn, Regents professor in WSU's School of Mechanical and Materials Engineering and Department of Physics, who led WSU's effort.

The NREL researchers treated the crystals, built and characterized the solar cells, while WSU researchers, including Santosh Swain and Tursun Ablekim, developed -the crystal material used in the cells. The WSU researchers grow their crystals in a technique called melt growth, which allows precise control over purity and composition. Purity is extremely critical to the process, so the researchers mix, prepare and vacuum-seal the materials in an industry-standard clean room. They then synthesize the crystal in a furnace above 1100 degree °C and then cool it from the bottom up at a rate of about one millimeter per hour. The researchers then cut the crystal into polished wafers to make the solar cells.

"Others have tried dopants, but they didn't have the control and purity that we have. And, the purity matters," said Lynn. "WSU is known for growing really high quality and purity crystals. You have to control every step."

While researchers have improved silicon-based cells almost to their theoretical limit, there is significant room for efficiency improvements for cadmium telluride, which could be bettered by an additional 30 percent, said Lynn.

**Explore further:** Organic solar cell breakthrough gives big performance boost

**More information:** "CdTe solar cells with open-circuit voltage breaking the 1 V barrier," *Nature Energy* (2016). DOI: 10.1038/nenergy.2016.15 , **Provided by:** Washington State University

**Polymer crystals hold key to record-breaking energy transport**, **Date:** May 24, 2018 **Source:** University of Bristol

Scientists have found a way to create polymeric semiconductor nanostructures that absorb light and transport its energy further than previously observed.

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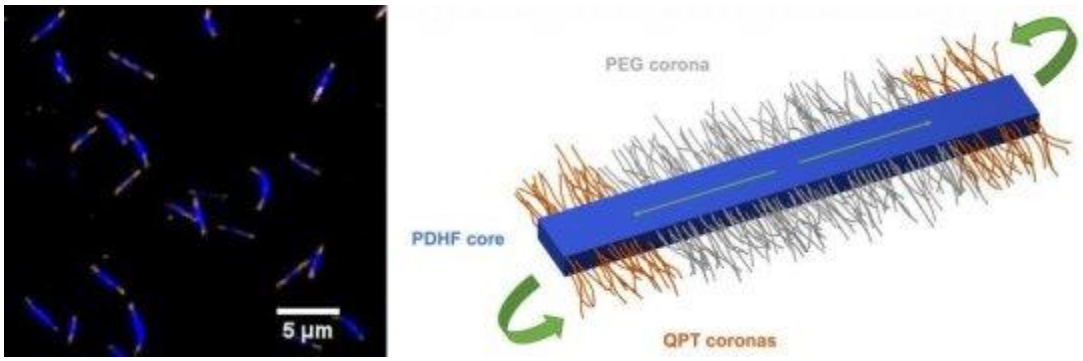


Image showing light emission from the polymeric nanostructures and schematic of a single nanostructure.
*Credit: University of Bristol*

Scientists from the universities of Bristol and Cambridge have found a way to create polymeric semiconductor nanostructures that absorb light and transport its energy further than previously observed.

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This could pave the way for more flexible and more efficient solar cells and photodetectors.

The researchers, whose work appears in the journal *Science*, say their findings could be a "game changer" by allowing the energy from sunlight absorbed in these materials to be captured and used more efficiently.

Lightweight semiconducting plastics are now widely used in mass market electronic displays such those found in phones, tablets and flat screen televisions. However, using these materials to convert sunlight into electricity, to make solar cells, is far more complex.

The photo-excited states -- which is when photons of light are absorbed by the semiconducting material -- need to move so that they can be "harvested" before they lose their energy in less useful ways. These excitations typically only travel ca. 10 nanometres in polymeric semiconductors, thus requiring the construction of structures patterned on this length-scale to maximise the "harvest."

In the chemistry labs of the University of Bristol, Dr Xu-Hui Jin and colleagues developed a novel way to make highly ordered crystalline semiconducting structures using polymers.

While in the Cavendish Laboratory in Cambridge, Dr Michael Price measured the distance that the photo-exited states can travel, which reached distances of 200 nanometres -- 20 times further than was previously possible.

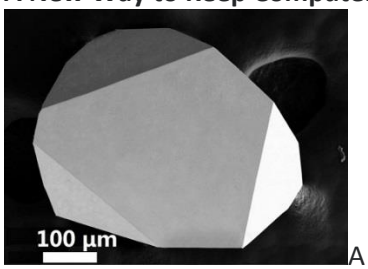
200 nanometres is especially significant because it is greater than the thickness of material needed to completely absorb ambient light thus making these polymers more suitable as "light harvesters" for solar cells and photodetectors.

Dr George Whittell from Bristol's School of Chemistry, explains: "The gain in efficiency would actually be for two reasons: first, because the energetic particles travel further, they are easier to "harvest," and second, we could now incorporate layers ca. 100 nanometres thick, which is the minimum thickness needed to absorb all the energy from light -- the so-called optical absorption depth. Previously, in layers this thick, the particles were unable to travel far enough to reach the surfaces."

Co-researcher Professor Richard Friend, from Cambridge, added: "The distance that energy can be moved in these materials comes as a big surprise and points to the role of unexpected quantum coherent transport processes."
The research team now plans to prepare structures thicker than those in the current study and greater than the optical absorption depth, with a view to building prototype solar cells based on this technology. They are also preparing other structures capable of using light to perform chemical reactions, such as the splitting of water into hydrogen and oxygen.

HOME INDUSTRIES CONSUMER ELECTRONICS ARTICLE, Consumer Electronics

**A New Way to Keep Computer Chips Cool, *Tony Pallone*** 06 July 2018



A crystal of boron arsenide imaged with an electron microscope. Source: University of Texas at Dallas.

You could call it an issue that's really started to "heat up." With smaller, faster and more powerful electronic devices, finding ways to keep computer chips from overheating has become increasingly challenging.
Most computer chips are made of silicon, a crystalline semiconducting material that does an adequate job of dissipating heat. But newer devices draw more current and generate more heat, and even with the addition of other cooling technology incorporated into devices, silicon can handle only so much.
"For high-powered, small electronics, we cannot use metal to dissipate heat because metal can cause a short circuit. We cannot apply cooling fans because those take up space," according to Bing Lv, an assistant professor of physics at the University of Texas at Dallas. "What we need is an inexpensive semiconductor that also disperses a lot of heat."
To that end, Lv and his colleagues have produced crystals of boron arsenide, a semiconducting material with an extremely high thermal conductivity. Lv's work over the past three years has focused on boosting the performance of boron arsenide. Previous research had predicted it could spread heat as well as the material with the highest-known thermal conductivity: diamond. While diamond is impractical for widespread electronics use, its thermal conductivity clocks in around 2,200 watts per meter-kelvin (W/mK). Silicon, by contrast, has a value of around 150 W/mK. Lv's initial work produced boron arsenide crystals with a value around 200 W/mK. By optimizing the crystal-growing process, Lv and his team have managed to boost that value to about 1,000 W/mK.
"To jump from our previous results of 200 watts per meter-kelvin up to 1,000 watts per meter-kelvin, we needed to adjust many parameters, including the raw materials we started with, the temperature and pressure of the chamber -- even the type of tubing we used and how we cleaned the equipment," Lv said.
The optimized process involves a technique called chemical vapor transport, which brings raw elements through a temperature differential within a chamber. To measure thermal conductivity, research groups from the University of Illinois at Urbana-Champaign used a method called "time-domain thermoreflectance" (TDTR). It was developed at Illinois over the past 12 years.
"TDTR enables us to measure the thermal conductivity of almost any material over a wide range of conditions and was essential for the success of this work," said David Cahill, head of Illinois' Department of Materials Science and Engineering and a corresponding author of the boron arsenide study.
"I think boron arsenide has great potential for the future of electronics," Lv said. "It's semiconducting properties are very comparable to silicon, which is why it would be ideal to incorporate boron arsenide into semiconducting devices."

Lv said the next step will include trying other processes to improve the growth and properties of the material for large-scale applications.
The research appears in the July 5 edition of Science.
To contact the author of this article, email tony.pallone@ieeeglobalspec.com

**SQ131**. *There is a significant amount of research investigating cleaner, greener methods for extracting silicon from silicon dioxide without the use of coal and fossil fuel reductants, and also significant, forward thinking investigation into materials other than silicon for use in solar cells (one investigator is from our local Washington State University. Why aren't these more forward and environmentally friendly pursuits given support over using the old, coal burning and polluting technology of the HiTest/PacWest smelter?*

**SQ132.** *There is growing speculation that the use of silicon for computer chips may start being replaced to other materials that are more resistant to the heat generated by newer, high-powered, smaller devices. As demand for silicon declines, what will become of the toxic HiTest/PacWest silicon smelter? If the smelter closes, who will be responsible for the smelter site clean-up and environmental damage?*

## *"Smart" Growth instead of Exploitive Growth*

**Smart Growth in Small Towns and Rural Communities**, United States Environmental Protection Agency

**Background**
**Small towns and rural communities throughout the United States are looking for ways to strengthen their economies, provide better quality of life, and build on local assets.** Many rural communities and small towns are facing challenges, including rapid growth at metropolitan edges, declining rural populations, and loss of farms and working lands.
Slow-growing and shrinking rural areas might find that their policies are not bringing the prosperity they seek, while fast-growing rural areas at the edge of metropolitan regions face metropolitan-style development pressures.
**Smart growth strategies can help rural communities achieve their goals for growth and development while maintaining their distinctive rural character.**

- Planning where development should or should not go can help a rural community encourage growth in town, where businesses can thrive on a walkable main street and families can live close to their daily destinations.
- Policies that protect the rural landscape help preserve open space, protect air and water quality, provide places for recreation, and create tourist attractions that bring investments into the local economy.
- Policies that support walking, biking, and public transit help reduce air pollution from vehicles while saving people money.

**What is smart growth?**

Learn more about what smart growth strategies look like on the ground in cities, suburbs, small towns, and rural areas in This Is Smart Growth.
**"Smart growth" covers a range of development and conservation strategies that help protect our health and natural environment and make our communities more attractive, economically stronger, and more socially diverse.**
Development decisions affect many of the things that touch people's everyday lives — their homes, their health, the schools their children attend, the taxes they pay, their daily commute, the natural

environment around them, economic growth in their community, and opportunities to achieve their dreams and goals. What, where, and how communities build will affect their residents' lives for generations to come.
Communities of all sizes across the country are using creative strategies to develop in ways that preserve natural lands and critical environmental areas, protect water and air quality, and reuse already-developed land.

- They conserve resources by reinvesting in existing infrastructure and rehabilitating historic buildings.
- By designing neighborhoods that have homes near shops, offices, schools, houses of worship, parks, and other amenities, communities give residents and visitors the option of walking, bicycling, taking public transportation, or driving as they go about their business.
- A range of different housing types makes it possible for senior citizens to stay in their neighborhoods as they age, young people to afford their first home, and families at all stages in between to find a safe, attractive home they can afford.
- Through smart growth approaches that enhance neighborhoods and involve residents in development decisions, these communities are creating vibrant places to live, work, and play.
- The high quality of life makes these communities economically competitive, creates business opportunities, and strengthens the local tax base.

Based on the experience of communities around the nation that have used smart growth approaches to create and maintain great neighborhoods, the Smart Growth Network developed a set of 10 basic principles to guide smart growth strategies:

The Smart Growth Network's Getting to Smart Growth series provides 200 policies that communities can consider implementing to make sure that development happens how and where they want it.

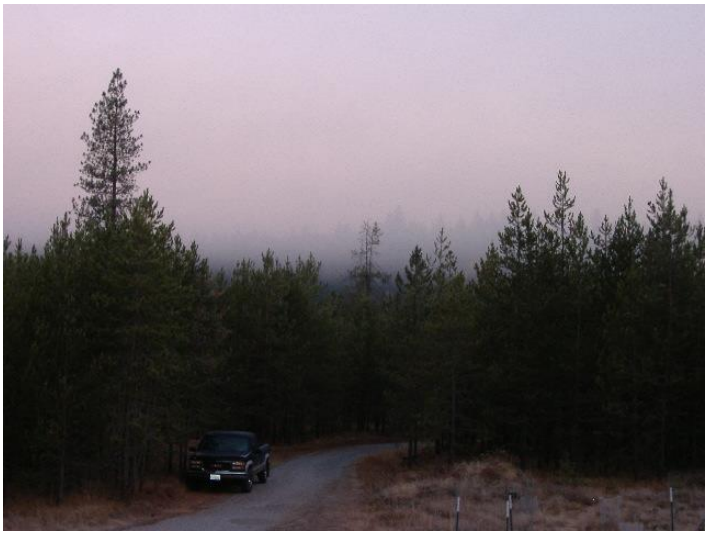
- Mix land uses.
- Take advantage of compact building design.
- Create a range of housing opportunities and choices.
- Create walkable neighborhoods.
- Foster distinctive, attractive communities with a strong sense of place.
- Preserve open space, farmland, natural beauty, and critical environmental areas.
- Strengthen and direct development towards existing communities.
- Provide a variety of transportation choices.
- Make development decisions predictable, fair, and cost effective.
- Encourage community and stakeholder collaboration in development decisions.

**SQ133.** People move to Newport, Washington and Pend Oreille County to seek a more natural environment and a healthy way of living. Many long-term residents live here because of they enjoy and are thankful for rural way of life that Newport and the Inland Northwest offer. Many citizens have been trying to communicate these desires to Pend Oreille County officials and the city of Newport officials, but citizens are prohibited to voice their concerns, desires, and opposition to the HiTest PacWest smelter.

Many citizens are trying to support a “Smart Growth” approach to our area. Pend Oreille County and Newport are definitely not the only areas in America that are facing these issues. Yet, other rural communities are adopting a “Smart Growth” approach and are having success.

**SQ134**. *Please provide a comprehensive review of the Smart Growth approach, and please make it available to the public. Please answer the following question: Do you believe that locating the toxic smelter in Newport fits with the “Smart Growth” approach?*

## SECTION 4: Appendix: Photographs—Thermal Inversion Fog



Scotia Road Property, 10/17/2018, 7:17 am. (#19)

Scotia Road Property, 10/17/2018, 7:20 am. (#22)

Scotia Road Property, 10/17/2018, 8:15 am. (#26)
**SECTION 4**: **Appendix**: **Photographs—Thermal Inversion Fog**

Scotia Road Property, 10/17/2018, 8:34 am. (#30)

Scotia Road Property, 10/18/2018, 7:48 am. (#31)

Scotia Road Property, 10/18/2018, 9:13 am. (#32)

**SECTION 4**: **Appendix**: **Photographs—Thermal Inversion Fog**

Scotia Road Property, 10/20/2018, 8:18 am. (#34)

Scotia Road Property, 10/20/2018, 9:01 am. (#40)

Scotia Road Property, 10/20/2018, 9:32 am. (#44)

**SECTION 4**: **Appendix**: **Photographs—Thermal Inversion Fog**

Scotia Road Property, 10/22/2018, 7:19 am. (#54)

Scotia Road Property, 10/22/2018, 7:42 am. (#57)

Scotia Road Property, 10/22/2018, 8:03 am. (#59)

**SECTION 4**: **Appendix**: **Photographs—Thermal Inversion Fog**

Scotia Road Property, 10/22/2018, 8:13 am. (#62)

Scotia Road Property, 10/22/2018, 8:46 am. (#66)

## **SECTION 4**: **Appendix**: **Photographs—Forest Fire smoke, Pend Oreille County**

Scotia Road Property, 08/19/2018, 8:59 am

Scotia Road Property, 08/19/2018, 6:38 pm

**SECTION 4**: **Appendix**: **Photographs—Forest Fire smoke, Pend Oreille County Area**

**SECTION 4**: **Appendix**: **Photographs—Forest Fire smoke, Pend Oreille County Area**

## SECTION 4: Appendix: Citizen Comments

I am busy on the CANSS Facebook group today.
The Steering Committee would like to use this Facebook forum for a special request of its members this evening.
Could you please, no pressure, write a brief summary or not so brief, on how you feel the HiTest Silicon Smelter would affect you, your family and your home and environment.

Some suggestions: why did you move into the area; are there health issues to consider; have you ever lived in an urban industrial area and what were your reasons for leaving; if the smelter is built what would you do - stay and adjust - move out - what; would you seek work in the smelter? What do you believe or know would happen to the value of your home and property? Write from your experience and your heart - we want to hear from you - those who will be most affected, and It is important to hear from you.
This thread is not political or a judgement zone.

1. Sunday while having lunch with friends the conversation turned to the smelter. I can honestly say that as we discussed the residents living in close proximity to the purposed site, I felt tears welling up and a knot in my stomach. I've heard and read your concerns and my heart is broken for you. I moved here five years ago to get away from a crime ridden town to live in a safe place. What I've found is a little piece of heaven on earth. My life is full living here. The clean air, the wonderful people and the beautiful wildlife make living here so precious. Although I live on the east end of Priest River I do have concerns about the toxic emissions. Prevailing winds will blow it our way. I have a great appreciation and admiration for all of you that are fighting to keep the smelter out. Just know that Besides praying, I'm informing and writing and calling each time I see a new post. Keep the faith CANNS you're not alone.
Bobbie Moss

2. Moved here to retire. Then I found out about the Smelter. Landowner knew but failed to tell me about the Smelter. I offered 19,000 Dollars less than what the property is listed for. Landowner Balked. Oh well. My final offer. If it doesn't fly, I will bail this doomed area!! To many other places to retire without the Threat.. Lawrence Ha'ae

3. I was born in Newport. Raised in Priest River and my husband and I have lived in Oldtown during our 45 years of marriage. We raised two children on our 10 acres 3 miles south of town. In 2016 we sold our home to our son his wife and they have 3 children. We have built a shop on same property with plans to travel next year when we retire and come back here periodically. This has always been a quiet end of the county road, great place to raise children. My daughter in law loves to garden and raise goats, chickens and ducks. To think a smelter could change this way of life is disturbing. What will this do to our health, peacefulness, water quality or water levels. With this recent sale to them, we will be hard pressed to sell the house property and shop and get a return on investment if property values decline residing so near this proposed smelter.
Diane Schaff

4. Our family moved here nearly 40 years ago when we were in our early thirties to seek a place of refuge from the hustle and bustle of California , away from rattlesnakes, cars, bad water, industry, etc. into what appeared to be heaven. We have a log cabin where we raised our two kids, I taught school, and my husband owned Phil's Saw Shop. My 2 girls love the outdoors and are creative and artistic. I garden avidly, log for firewood, and walk these beautiful woods. We love our well water. With a smelter we are afraid of

losing all this and more including the air we breathe, our soil, and water. We fight for our current wonderful life and fear with a silicon smelter we'll have to leave. We hope this will always be our happy home.
Vicki Hager Bronson

5. There is one fact, ALL smelters emit emissions and a certain percentage of those are bad. Over time this smelter WILL affect our environment and our health just like any other pollution. It may not affect us, unless they make mistakes, it may not affect our children but it will affect our grandchildren.
I lived in the suburbs of Salt Lake City my entire life and their pollution is now some of the worst in the nation. The rates of asthma, heart disease, and respiratory viruses have definitely increased. Salt Lake doesn't have a silicon smelter and yes they do have worse, with oil and gas refineries and definitely more pollution with a higher population, but they now have no solutions as to how to change that. It just keeps getting worse.
We moved to Priest River to get away from that. It just saddens me to see this smelter being developed because it is just the beginning. When do we as people decide that our health, well-being, and environment are more important than money. I work in healthcare and see these affects daily.
It really isn't about the jobs. My husband has gotten 4 job offers and we haven't even moved into our house yet. I have been told I could easily get a job at Newport hospital if I wanted one. I guess the older I get, the more I see and the more of a beautiful life I want that doesn't include a smelter.
Denise Loyle Hoog

6. As a 35-year Priest River Native, I have lived here my entire life. I attended K through 12th grade in Priest River, and am very proud of it. My husband is also a Priest River Native of 40 years. Together, we decided to stay here, and we've both worked full time jobs for our entire adult lives here. When we got to a point of deciding to plant our roots, both of us were insistent that we wanted to stay in the area... and we wanted to stay because of our way of life. We both enjoy the outdoors so much here and don't for one minute, take for granted our clean air, water and fertile soils. My husband and his 4 brothers are avid hunters and fishermen and his Mom and sisters and myself rely on our gardens for much of our summers and even do some canning. Because of this way of life, we chose to purchase 10 acres of land on Old Priest River Road (3.8 miles of proposed smelter location) and decided to build our own home out of pocket. After seven long years, and a whole lot if love and determination, we completed that home in Nov. Of 2016. We even went as far as planning to retire here even though we're still sorta young. With the proposal of this smelter, we now question if we would stay if it gets built. The sad truth is No. Neither of us want to take the risk. We are in fear of our very way of life being stolen from us. We are concerned about the long term environmental impacts that smelters are known for having. I'm worried we will lose our tourism, our peace, and our pristine environment that we have grown to love and depend on. We are worried that the value of our home, will decrease as well, and that's disheartening.
The most important thing on top of all this, is that it should be placed in a pre- existing industrial location. The proposed location does not fit with the dense rural residential populous. This location is ludicrous in my mind.
Chandra Griesemer

7. My husband, Ted, and I have been married for 58 years and have lived in Pend Oreille County for 54 years of those years. We raised 6 children, have 19 grandchildren and over 30+ great grandchildren with more on the way. Ted was transferred to Newport with the U.S. Forest Service as a forest manager; he is a forest ecologist and was the acting ranger at the Falls Ranger District when the Sundance Fire blew up. We have 240 acres in timber land and pasture and have been "good stewards" of that land for all these years with the intent of leaving it in pristine shape to our children and their children. Every year we encounter bear, cougar, deer, elk, moose, wolves, coyotes, even a grizzly bear came and visited once or twice, plus marmots to name a few. The birds - too many to name and more. We have a wet land in our forest that drains underground into the Little Spokane, which is a mile from our farm. I am sharing this information with

you for a reason. We were able to provide a way of life in this area where are children could grow up eating fresh garden produce, drinking warm milk from our milk cows, eating fresh eggs and wild meat, plus participating in 4-H, Boy Scouts and other programs that provided a good training for living and a healthy lifestyle. We were blessed to be able to provide all of this because we live in a rural environment. We could have never lived this way had we lived in an industrial area - impossible. The thought of Newport and neighboring areas becoming industrialized breaks my heart. What gives HiTest the right to come in here and plop down a 4 stack silicon smelter that will emit toxic emissions, disrupt our rural way of life and cause good people to move out. In my way of thinking it is not only wrong for this area economically, but morally wrong. We need more areas like we have here now, not less. I support local industry and jobs, but let's make them jobs that reflect and support our present way of life, not destroy it.
Phyllis Kardos

8. I have lived here in Pend Oreille County my entire life, this is my home where I am raising 5 children. My great grandmother was full-blood Kalispel Indian and lived here before the dams were installed. I love this area because it is beautiful. We have an abundance of lakes, rivers and streams. We have such a diverse wildlife population here for hunting and subsistence. It is also very pure still and so our recreation opportunities are second to none. One of our biggest economic contributors is tourism, people flock here because of the beauty, because of our recreation. Does anyone believe a smelter will enhance that? We know a smelter will emit pollution, we just don't know how much and how fast yet. We are simply stewards for the next generation, is this the legacy we want to leave our children? Do we want to risk their health for an alleged number of jobs? Are we that desperate? A smelter in Pend Oreille County will have a net negative result. Tourism will flock somewhere else, people will move, property values could drop, and those that Are left could face serious health issues. That frightens me. How will this affect our water, our fish, our forests, our wildlife, our economy, our future, our lives...
Curt Holmes

9. I was born in CDA, moved to AZ in 1980, and out on Hoodoo Loop in 2005, it is home, love to clean air and beautiful blue skies, I have breathing problems brought on by strong odors (perfumes, candles, etc), it that smelter is built, I will have to move.
Becky Snyder

10. I was born and raised outside of Seattle and dreamt of moving to Sandpoint for about a decade, before finally moving here with our family in 2012. We moved first to Priest River, where I was in awe every day of how beautiful my surrounding landscape was. We then settled on Newport in 2013, and my feelings have not changed. In fact, I just bought a home here in June. People call this God's country for a reason.I left the smog, pollution, and big industry behind. I have young children, and I have a son with severe special needs. I chose to move here for their upbringing, for the small towns, the breathtaking beauty, the clean mountain air and water.
The idea of a large industrial smelter plant settling here, tainting our landscapes and views, polluting our air and water... that a few men with the right amounts of money, can come along and forever change our bit of God's country here.
I want to stay here, as my whole family loves this place but I would seriously re-consider staying in Newport for the long haul if this becomes our reality.
JJ Farmin

11. My Husband and I have dreamed of retiring here in North Idaho for many years. The Pristine nature of North Idaho was very attractive because we love the outdoors, I also suffer from Lupus, an autoimmune disease that destroys my Skin, Skeletal Muscular system, Organs and causes Chronic Pain disorder. Stress is a major trigger, hence why we sought this area for the Peaceful way of life, Clean Air, Clean Water, No light and Noise Pollution, less Traffic etc.

My Husband, a 100% Disabled Veteran needed to be close to Hwy 2 for an easier Commute to the VA Hospital in Spokane WA.
When the timing was right we sold our home in Southern California for less than Market value and we walked away from everything, Family, Friends, my Career, etc. to fulfill that lifelong dream. We bought our forever home in Solar Acres Oldtown Idaho, it closed Escrow on 7-27-17 and our home sits less then 400 Meters from the proposed site, which we learned of only 8 weeks after moving in, via a flyer on our door introducing us to our new neighbor "HiTest Sands Silicon Smelter".
We were in shock and frankly still are as how can something like this happen. We knew we were surrounded by State and Public Lands; therefore, how can someone Build a large Industrial complex in the Middle of the Forest. Now we're faced with disclosure issues and fear our property values will tank now that HiTest has announced their plans.
'It's bad enough that I Have nightmares every night plagued with images of a huge, bright, loud filthy Smelter literally in our front yard.
I'm sickened by those who continued to push this Smelter upon the people, when the majority of the people don't want it. In the beginning, Transparency and honesty from HiTest and local Government would have made it possible to make different life changing decisions, now we're all prisoners in our own home.
We're pleading to have the site moved to a preexisting Industrial site as it has no place in a Rural Dense Residential Population.
Theresa and Axel

12. We moved here a year ago from the east coast to be close to family. We chose this area because it was rural, lots of wildlife and relatively low cost of living. However, my husband has COPD and I can't imagine what breathing any of this will do to him. We will move.
Janine Roth

13. We moved here in 1977 when we bought 20 acres and built our dream log home. Since then we have put our hearts n souls into creating gardens, orchard, greenhouse, raising chickens and enjoying our outdoor living space and local mountains, lakes, streams. We raised our 3 children here and now our grandchildren enjoy the same amenities as their parents: peace and quiet and spending every waking minute outside playing (creatively) in the woods. When we designed our home we told people that this was our future retirement home, and now it is.

Like many, we moved here for the very things that are described in the Pend Oreille County Comprehensive Plan: “peace and tranquility”… “quality of life”… “new development compatible with the surrounding uses, sensitive to the surrounding natural areas, and retaining the rural character of the community”… “protect private property rights, preserve the quality of the natural environment and rural lifestyle that we enjoy”... a smelter is not compatible with any of those things.

This is not an industrial area, this is a RURAL AREA and bringing in a smelter will destroy the very reasons so many of chose to live here (knowing full-well that we would be commuting long distances to work). I drove 1-hour each way for over 20 years and did not complain because that was the CHOICE we made in order to enjoy the Quality of Life that this smelter will ruin. Is this the new American Way to let corporate interests destroy our citizens' American Dreams?

We are still sorting out/ learning about risks to our health and environment (we do know there WILL be risks because no smelter is 100% clean). BUT there is one thing that is for sure: bringing in industry will change the character and quality of this region.

In addition to risks of air/ water/ light/ noise pollution, we know for sure this will be a huge monstrosity that will be an EYESORE seen from miles in all directions, definitely not a good thing for tourism- and- a daily

reminder that a corporation can come in, regardless of citizens' opinions, and ram something down our throats just to offer a few jobs.
Yes, jobs (CLEAN JOBS!) are needed. Meanwhile, there are unfilled aerospace positions available in Newport right now. This facility should be placed at a pre-existing industrial plant or in the middle of nowhere where it wont affect peoples' lives/ health/ quality of life. It most definitely does not belong here!
Christine Veblin Bishop

14. My wife and I moved here in 1976 with one young daughter and a plan for one or two more. We built our own log home in the woods outside of Newport and have never made any plans to live anywhere else. We are now retired and moving has not been an option that we care to consider. My profession as an Ironworker has given me a unique and thorough familiarity with large infrastructure projects.
I have worked on several large pulp mill jobs here in the northwest as well as coal fired power plants and was supervision on the installation of the coal handling facilities for two different mines in eastern Montana. I was a supervisor at the Pend Oreille Newsprint mill at Usk, Washington from the foundation to the roof. I am very familiar with the pollution and environmentally problems that are associated with power plants and pulp mills and the problems their siting locations present in maintenance and continuing operations.
I am very certain that the people in this valley and communities therein will not like the area we have called home for over 40 years after this Smelter and all of it required infrastructure developments and environmental disruptions.
I have seen what happens to a beautiful area that was heavily contaminated by toxic industrial pollution and chemical wastes and poorly handled maintenance problems and improper storage of dangerous chemical byproducts.
I will do everything I can to resist the installation of this catastrophic pollution source on a site that is literally on the doorstep of Newport and Oldtown.
The community water supply would be at risk the site is nearly on top of it. 4 schools, the hospital and more than one elder care facility are in a very close proximity and downwind of this potentially dangerous pollution source.
The highways and local infrastructure will be seriously stressed by tremendous increases in heavy truck and railway expansion and the dust and coal ash particulates from handling incoming materials multiple times.
I am very well aware of the problems associated with this type of operation placed in exactly the wrong place.
I am perfectly willing to join a class action or any other efforts we may decide to undertake to protect my home and the homes and health of the citizens in these community's where my children grew up and where I have chosen to live out my days.
Dan K. Wight Newport, Washington

15. I was born and raised here and this is not the right area for big industry! There will be trucks of quartz, coal, and wood chips coming in constantly. They say the wood chips will come from the area cleaning up fire hazards, which is great but they are going to be going through A LOT OF WOOD. Where will they start getting it from when the cleanup wood is gone? I have young children and I worry how this will affect their small growing body's and organs. This will slowly pollute our body's, air, water, and land. Even if they keep the output within the allowed amount it will slowly be hurting us and hurting everything around us. It is still poison going somewhere near where we live and play every day even if in small amounts imagine the buildup and dispersion after 5 years, 20 years, 40 or their proposed 50 years.
Johni Lin Hamilton

16. I will sell and move!... And my adult children with their children and my Father will go,as well! I have never lived in industrial area ON PURPOSE! And would not support the demise of all that we are so blessed to have here.
Dawn Scott

17. Before my husband and I got married we looked from Lenore, Idaho, Lewiston, Idaho, Clarkston Wa (my home town), Athol, Cda, Hayden, Bonners Ferry. ..for our forever home together. He already had a home in Oldtown. I could not find a place or area that was as beautiful as what he already had. So after we married my kids and I moved up here. It was an adjustment. I knew my kids made it their home as well. We listen to coyotes out the window instead of traffic. We can drive to towns like Spokane and cda. The small town living is priceless. We than bought property in Newport. We wanted our kids to be able to attend good public schools and build our retirement home. It's a beautiful piece of land. 20 acre parcels all around. Quiet. Now the news of a smelter plant possibly going in has been so stressful. I love this area. I've been so sad with the idea of having to sell our home and property and move. I'm to old to start over. I wanted my kids to graduate from here and raise families here. I will fight with all I have to keep our home and dreams alive.
Michelle Naylor

18. I moved into the city of Newport 2 years ago after selling my lovely rural property. I am concerned that this smelter is not being located at least 5 miles away. One mile from town is too close. Did they look into the silicon smelter located at Kaiser in North Spokane?
Rita Sewlittle

19. I and spouse and kids moved to Spokane 31 years ago. After 20 years we decided to fulfill an old wish and move to the country somewhere. I figured out that if I worked in north Spokane, I could commute from the Newport area in well under an hour on a normal day, and that made the move well worth it. It is so peaceful at our five acres in Oldtown, and while the climate is colder than I prefer, the environment up to now has been clean, refreshing, (on non-fire days, anyway!) and exhilarating. We had planned to spend the rest of our lives here. However, I will not subject our lungs and the water we drink to any uncaptured smelting byproducts. Living 1.5 miles directly east of the proposed facility, we would surely get the brunt of whatever comes out of those two, or four, smokestacks. The offer of local jobs that the smelter will supposedly provide does not justify by any means the potential hazards, because of location. I have been doing this daily commute for ten years, and another guy I work with has been doing the same commute for twice as long. Any able-bodied person who wants to live here but who works in Spokane can do the same as we do, if necessary. I am pro-business, pro-industry, and not normally an environmental activist, but the notion of locating an inherently dirty industry that produces invisible silica dust and potentially harmful chemicals so close to a school where young children's health could be at stake is so absurd and asinine that the project cannot be permitted. Failure is not an option.
Tom Garrett

20. I dreamed of moving here after visiting family many moons ago. The dream was hazy at the beginning, but always in the back of my mind. After visiting on vacation, holidays, many trips to Owens soda fountain and Silverwood, and another child later, the opportunity to realize the dream came to reality. When we arrived in Newport on May 7th 2009, there was a double rainbow welcoming us to our new home. We had searched high and low for a decent place to rent, and lived in a little house next to highway 41, with the sound of Jake braking log trucks coming down Idaho Hill. One night in the wee hours, someone failed to apply brakes and took out a tree, mesquite bushes, mailbox and anything else in its path.

But I kept on, with the dream. I sent my daughter to Idaho Hill, population 150-160, we made friends, I joined the PTO, I volunteered at Priest River Ministry's as the legal advocate. Every day we thanked God and our lucky stars to breath clean air, and to see those stars, surrounded by trees that gave home to Eagles and Hawks. We fished and easily camped, surrounded by the beauty of this Piney North woods. I was fortunate to eventually purchase a home and land, my heart home at last. Creating my own "Little House in The Big Woods"

Along the way I have learned their is very little man won't do for profit and fame, and there is no justice. Thats a hard one, yet true. We might see glimpses, but the scales are tipped by gold.
The idea of smeltering any thing here is the worst choice for our untapped beauty and resources. I believe if we as a community were tasked with creating more jobs (because there are already many unfilled family wage positions at Kodiak, Aerocet, Stimson) we could have a thriving downtown Newport and Priest River. It is time to start thinking outside of the circle. Widening our horizons for a community that isn't harmed permanently by the choices of a few. If we aren't at the table, we will be on the menu. I would like to be able to pass onto my children and grandchildren a legacy of well managed healthy forests, rivers and life, wild and tamed. Thank you for listening neighbor.
Regards, Cara Whiting

21. Agreed - I think that these little towns could be awesome BUT greed and Corp are winning out!...and they don't have to follow the same rule book.
Soloa Shaw

22. I've lived in this area my entire life (38 years) and chose to raise my family here. The health concerns for me and my family are real. We have asthma and allergies, which I'm sure the syptoms would be exacerbated by this smelter. Also, the wildlife and and environment could very possibly be effected as well. The negatives absolutely outweigh the positives, which I am still trying to find.
Allison Taylor

23. My wife and i moved from Hood River Oregon to get away from rabid politics and mega companies forcing there crap on the people despite voters shooting down the levies and governor ignoring the people. Cascade locks wanted the water bottling plant but the county voted it down, brown stepped in and over turned the voters. We don't need this here, it will ruin our air, our water, our trees and wildlife, green will turn it all brown. Idaho is my home now, i'am a Idahoan! I will fight to keep it' our Idaho.
Jackson Emmert

24. My husband and I moved here 16 yrs. ago from Alaska, we both have asthma, it has not flared up in over 20 yrs. because we have lived where the environment has been clean and we want to keep it that way. The effects of the smelter plant would be devastating to us, our wildlife and our environment. We chose to live in a Dense Rural Residential Area because we love it. There is no GOOD that will come from this.
Mike Farris

25. My husband, youngest daughter and son moved to Newport, WA on May 31, 2003. We started a business with a friend and fell in love with the area, the people and all that it had to offer. In 2007 we purchased the property that we built on and have lived on for 9 years. We chose it because it was out of town, but still close enough if we need anything, it was peaceful, quite, and full of trees and wildlife. Another big reason was because we lived in a big city where there were gunshots daily, missing people and we felt that we needed something safer for our children. We love living in a dense rural residential populas. Part of the reason we chose to live where we do is that I have asthma and PTSD - the country environment brings me peace. We have never lived in an urban industrial area and have no desire to. The noise 24/7 is enough to set off my PTSD. If the smelter is built my husband and I WILL move since our home door is only 130 feet from the property line of the proposed smelter. Our children are grown and live on their own, our son and his wife bought their first home last year and that breaks my heart because they would be "stuck" living with this horrible thing, risking their home and future of children. Just living in the area of the smelter is bad enough, but I would NEVER consider working at such a toxic place! The value of our home, our property taxes, electricity costs are all going to change dramatically. Our home value will drop, because, let’s be real, who wants to by a home 130 feet from a silicon smelter? Property taxes will go up, electricity prices will go up, all thanks to a business that came from another country, who I might add, has never built or ran anything

like this! I think the saddest thing to me is that we have come to love this town, and many of the people in it have become family to us. We've raised two of our children here, our grandchildren come and visit us and we take them fishing and playing in the pristine area, which we will no longer be able to do if this monstrosity comes to be built. Our grandchildren WILL NOT be brought anywhere near this. I don't understand why the commissioners or anyone else involved would want to "stain" and "destroy" the beauty and peacefulness of this amazing area. Why would you take a place that is flooded in the warmer weather with tourism and destroy it? Why would you not do more research into the pro's and con's of this on your community? Why would you hide the process for so long before it's aware to the public? And WHY would you not listen to what the majority of your community is saying? This smelter is going to destroy not only the pristine, beautiful area we all live it, but it is also going to destroy our community, our friends and our family. Our health, wellness, environment and wildlife are at risk - all because of greed, that's what it boils down to. 15 years of living our dream in Newport, WA is now turning into our nightmare. This type of facility needs to be built in a pre-existing industrial site, which the current proposed site is not. ~
Hollie Drange

26. I am 38 yrs old and grew up here. The smelter would literally be at my back yard (close to). I have severe asthma and my also has asthma. We are hunters and gardeners. I live here because this is my home, this is the lifestyle I want to maintain. I love the outdoors and the wildlife. The smelter would ruin every aspect of why I live here. I would have to move.
Chanda Mittan

27. Seven years ago, my wife and I purchased a beautiful home on 5 acres in Oldtown. One of the best features was the location - out the back door and direct access to miles of Idaho state land, PUD (now HiTest), and industrial timber land. We, as well as many others, hunt, x-c ski, motorcycle, ATV, run, and walk our dog on those trails and roads. Our kids are always running around those woods! However, losing access is the least of our worries. The smelter will be 400 yards from our house. Will it be safe to eat veggies from our garden? Safe to drink water from our well? What happens when we get the occasional inversion? We won't stick around long enough to find out. HiTest in, we're out (just hope we can find a buyer for the place).
Todd Anderson

28. I'm a 4th generation Priest River resident. Just recently moved back 2 years ago and bought a house in PR. Now we are already in the process of buying a house in Newport. I really hope for the sake of my wife and kids( the 5th generation being raised in the area) that the hi test smelter will be built somewhere else. We hunt, fish, pick morels, and huckleberries it saddens me that those wonderfull things could be at risk. Just because a foreign company can't pass the permit stage in their own country.
Daniel Hirst

29. My husband was transferred to Seattle (on a mobile crew with bnsf) in 1997. I spent 3 months driving this state, looking at homes. I hated Seattle. Not enough land to live on over there. At the time I needed to be close to a hospital (I had cancer). I finally got out a map of his work district, drew an X, said, the center is it. That was Spokane. Oh no, that won't do. I can't live there. Way to many people for me. I was driving up to Bonners Ferry via hwy 2. Drove threw Newport back when union street was still a dirt road. There were no one ways, lol, I said, this is it. This is where I want to live. No people ( I sometimes have a difficult time playing will with others ) clean water, outdoor water for gardening, lovely river, wonderful lake's, clean air. Found a property out near diamond lake. 20 years ago I had one raised bed for gardening. I have 5.9 acres, I now work with the blessings of the universe 10,000 square foot garden on the back half of the property. 48 raised beds up front on totally organic soil, that I composted from my organically raised horse.

I have started looking at other areas I would or could live. I know I will not be able to continue my garlic farm after a few years if the smelter goes in. I want to stay but, not sure I will be able to maintain the same lifestyle as I have. When I landed here. I said, this is it. I am digging in, not one more move. I might still have one more move left in me. I know allot of people have said, I will move out of the country if trump gets elected, there was no bum rush at the boards. But, a part of who I am at the soul needs to work the soil. If I no longer have clean air, clean water, healthy soil, a part of me will literally die. At time's I have thought, how can the race for money be more important than the lives of so many people? Then, I realize money is always more important than lives.
Renee Johnson-Wehrung

30. My father bought land in Newport in the early 1960's. His dream was to build a hunting lodge as hunting was very prevalent then. After my dad passed, my brother moved onto the property to build a beautiful, artistic story book home with his blood, sweat and tears (he is a master carpenter). It took him 14+ years to build because he had to work in Seattle, San Diego to make enough to buy building materials for the house. My family loved this area because of the beauty that surrounds, the wide open spaces (which there aren't many left anymore). We are naturalists at heart, that is why this area appealed to our family. To see this smelter plant come in and devastate the area, cause massive health risks..really, really angers me. Why, Why would a Smelter plant be built where there is such beauty and residents living so close??? I am tired of corporate America/Canada bulldozing in to destroy environments for their personal gain. We should not have to fight for the environment. We should be as one (governments included) to protect the our environment. I can't help but feel "When is this going to stop". I wanted to keep this lot because it is the only connection to my parents. They would rollover in their graves if they new what is happening now. I, personally, am selling because I am close to retiring and moving to the Sequim area. My brothers are contemplating selling, too. It's tough for my brothers because they are in the 70's. I worry about my brothers because they will and are fighting this. What a stress to put on elders. This is the time of life when there is enjoyment, relaxation, not having to fight for the right to live where they have built their lives and have become embedded in the community.
Theresa Kuper

31. I have lived in this area mostly since 1968. I decided years ago that I wanted to live here, work here and raise my children here. Now I am retired, with children, grandchildren and great grandchildren. And someone wants to put a smelly old smelter almost in my back yard. (We live at the extreme South end of Newport). Well, I say NO. I do not want it here. I have done my research on this smelter and there is NOTHING good about it. If there was, they would have kept it in Canada. That speaks volumes. I don't want it here and I will fight it to the end. I hope many others feel the same way. I won't even go into detail of all the issues that are so prevalent with a silicon smelter. None of them any GOOD!
Pat Masters

Exactly Phyllis! And I do not want this toxic waste site in my back yard. So many in this area are still so uninformed as to what this smelter WILL DO to this area. And I do mean what it will TRUTHFULLY do. None of it any good.
Pat Masters

32. We have lived in Blanchard, ID for around 25 years. Me from Utah, hubby from Montana, met in Oregon, moved here from S Idaho...We have worked our whole lives for something we can call ours. Something beautiful and worthwhile. We have 5 acres & have worked diligently towards our organic garden. I work at the local resort and have tried for many years to "go green" there, too. Our resort employs around 50 locals (more in summer months) When our travel industry shrivels up, where will we work? When my produce is not healthy...where will we eat? and....who will buy our house that we have worked so hard for as an investment?

Alice Anderson Lobdell

33. And yet we can't get our Economic Development (EDC) people to bring in businesses that support tourism and all of the recreational and other outdoor activities that this area has to offer. And our Commissioner's authorize and promote plans that are contrary to growing a tourism industry after taxpayer funds have been spent to develop and expensive marketing campaign. If the only kinds of jobs that they can bring in are those that threaten the lives of the residents AND everything on this wonderful list, it is time to acknowledge that we need new people on the EDC and in the Commissioner's seats!
Linda Waring

34. Every vegetable and fruit we produce with our own hands and on our own land is organic - how can we call our food organic with toxic pollutants accumulating on and leeching into our soil year after year after year.
My husband spends hours pulling weeds by hand instead of using pesticides just to preserve the natural integrity of the soil.
After a silicon smelter the soil will have little organic integrity.
Anonomous

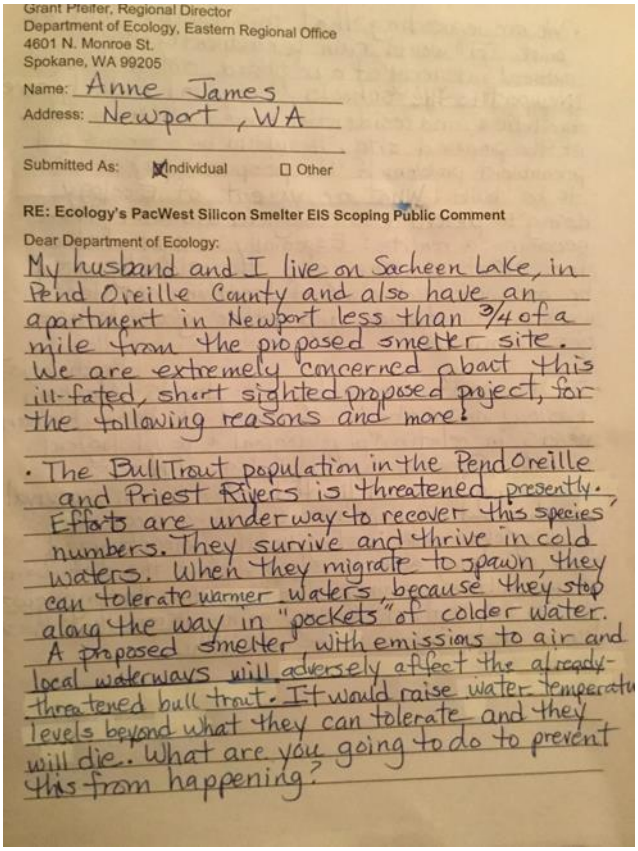
35. I also have a garden, raised beds, all organic, and I just now finished building a greenhouse next to my garage, and I spent a lot of money putting in water, real walls and a foundation.. I have asked my contractor to hold off installing the electrical until we find out something. Sad...
Judith Loy

36. We need to make them see that not only is this a big risk to our health, and safety, it is also a big risk to our financial stability as a city and county after seeing the problems United Silicon is having. We are not a country the size of Iceland, we are a small town in the mountains of Washington our economy could not handle a failure like that. Speak their language, because it is what they will hear.
Denise Loyle Hoog

37. We could use some exposure. This smelter is being fast tracked and there is little time to stop it. It is going to be built by a private Canadian company with no experience in smelting. This is my post that summarizes the situation.

"Dear Washington State,
What am I if I claim to be pro-environment, supportive of green technology and practices, but I keep my property clean by burning my garbage right at the edge of my property so my smoke blows into my neighbors place. Well pat me on the back! I am green.
I lived in WA for most of my life. I was proud of WA's green leanings. But you learn things. Things that leave you wondering if the people of this country have any voice at all.
So WA, has courted, given free land(192 acres), written a bill just for this company to subsidize their power use, which you all will be paying for, and is basically in the process of ramming a silicon smelter down the throats of Newport WA, and North Idaho. This is a tourist destination. A place of pristine beauty where many people come to enjoy hiking, skiing, swimming, you name it. But it's rural, poor, and vulnerable to industrial invasion. It is classic really. Locating toxic polluting smelters in a poor area is a very successful strategy. You can bet if this was coming to the outskirts of Seattle they would be slapped with so many legal roadblocks that it would never be viable.
The company, HiTest, is run by two Canadian entrepreneurs who over the years have "founded" and dabbled in many unrelated ventures. They acquired a quartz mine recently, and with a little experience in mining, they are now ready to embark upon a full blown silicon smelter. How they managed to acquire funding is a question I really want the answer to. The smelter will be the largest in the country. The market opened up

due to duties Canada applied to imported silicon products, so one wonders how long the market will even be here. The air pollution "studies" and I say that loosely, are based upon data from the Deerpark area, which is an entirely different system, with different wind patterns and topography, not to mention is lacking in two years-worth of data. Here is their website, I think you will find it interesting. http://hitestsand.com/
The placement of this smelter is just south of Newport, and as close to the boundary of Idaho as physically possible. Winds prevail east. Right across the street, but in Idaho, so of no concern to WA, is a heavily populated residential area. Schools, organic farms border the site.
This smelter is a "project of statewide significance" thus bypassing regular permitting processes and allowing those to be "expedited" WA commissioners lied right to the faces of all the people who attended the last public meeting. Stating they did not know when the permitting process would begin. But then we find an Oct 3rd press release from the commissioners themselves, stating the permitting process has begun.
We need lawyers badly but there is no time, no money and WA will have their smelter. And you my friends, will be paying for a Canadian company's power, water and infrastructure (just over a mil in the first year). While we will just die slowly over time, from air pollution. Did I mention WA is in the process of selling Avista power to a Canadian company also? That will be your second power company sold to Canada.
Jami Martin



Grant Pfeifer, Regional Director
Department of Ecology, Eastern Regional Office
4601 N. Monroe St.
Spokane, WA 99205

Name: Anne James
Address: Newport, WA

Submitted As: ☒ Individual ☐ Other

**RE: Ecology's PacWest Silicon Smelter EIS Scoping Public Comment**

Dear Department of Ecology:

My husband and I live on Sacheen Lake, in Pend Oreille County and also have an apartment in Newport less than 3/4 of a mile from the proposed smelter site. We are extremely concerned about this ill-fated, short sighted proposed project, for the following reasons and more!

- The Bull Trout population in the Pend Oreille and Priest Rivers is threatened presently. Efforts are underway to recover this species' numbers. They survive and thrive in cold waters. When they migrate to spawn, they can tolerate warmer waters, because they stop along the way in "pockets" of colder water. A proposed smelter with emissions to air and local waterways will adversely affect the already-threatened bull trout. It would raise water temperatures levels beyond what they can tolerate and they will die. What are you going to do to prevent this from happening?

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• We are requesting that this facility not be built. It would ruin permanently the cultural integrity of our proud, small town. Newport has 11 schools, hospital, elder care facilities, and residential homes within a mile of the proposed site. This would be a serious and permanent problem if the prosposed project were to be built: What is the Dept. of Ecology doing to prevent this ecological disaster from becoming a reality? Especially in light of the fact that children and the elderly would be at increased risk of breathing air laced with sulfur dioxide and other greenhouse gas emissions.

• In Maslow's Hierarchy of Needs, Psychologist Abraham Maslow wrote about fulfillment of basic human needs in relation to physiological & psychological growth. Specifically Physiological Needs: these are biological requirements for human survival, including but not limited to: breathing clean air, drinking clean water, eating healthy/uncontaminated food and being able to sleep without the disturbance of unrelenting ear and brain-assaulting factory noise. Maslow states that the first level needs to be met, before the subsequent (higher) levels of human needs can be reached. How is the Dept. of Ecology going to ensure these human/biological needs continue to be met in a healthy manner?

Grant Pfeifer, Regional Director
Department of Ecology, Eastern Regional Office
601 N. Monroe St.
Spokane, WA 99205

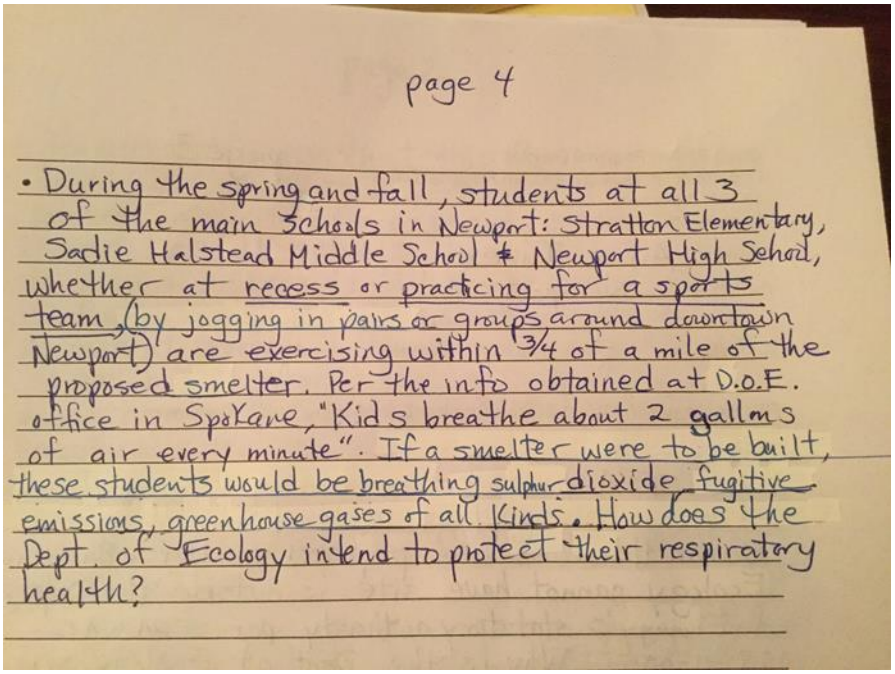
Name: Anne James
Address: Newport

Submitted As: ☒ Individual ☐ Other

**RE: Ecology's PacWest Silicon Smelter EIS Scoping Public Comment**

Dear Department of Ecology:

• The SEPA process is starting too early. There is no permit application that has been submitted for the proposed smelter. Building a polluted industrial site is outside the Dept. of Ecology's statutory authority, per SEPA WAC 197-11-055. Why is the Dept. of Ecology so determined to accommodate a Canadian Corporation that wants to build a significant pollution source in our community?



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• During the spring and fall, students at all 3 of the main schools in Newport: Stratton Elementary, Sadie Halstead Middle School & Newport High School, whether at recess or practicing for a sports team, (by jogging in pairs or groups around downtown Newport) are exercising within 3/4 of a mile of the proposed smelter. Per the info obtained at D.O.E. office in Spokane, "Kids breathe about 2 gallons of air every minute". If a smelter were to be built, these students would be breathing sulphur dioxide, fugitive emissions, greenhouse gases of all kinds. How does the Dept. of Ecology intend to protect their respiratory health?

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