PETROLEUM COKE DUST EMISSIONS FROM OPEN RAIL CARS IN NORTHWEST WASHINGTON AND SOUTHWEST BRITHISH COLUMBIA

(in progress)

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Partnership for International Emissions Reductions

- The Swinomish Indian Tribal Community
- U.S. Environmental Protection Agency (R-10)
- The Shell Petroleum Refinery (Anacortes, WA)
- Institute for Tribal Environmental Professional

General Background

The Shell refinery ships petroleum coke by rail and barge. This presentation deals with rail transportation because the coke rail shipments cross the Swinomish Reservation within one half mile from the refinery. Since late 1983 the Shell Oil Refinery in Anacortes Washington has been shipping petroleum coke, in open gondola type box cars, from the refinery to the Alcan Inc. aluminum smelter in Kitimat British Columbia (Figure 1).

Figure 1: Location of Petroleum Coke Shipping Route from Shell Refinery in Anacortes, WA to Alcan Aluminum Smelter in Kittimat, BC.

Specific background information

- Each car is capable of carrying seventy- five to one hundred tons of coke.
- Fifty to sixty gondola cars carrying coke are shipped a week, three hundred and sixty five day per year,
- 3,750 to 6000 tons of coke are shipped weekly.
- 195,000 to 312,000 tons are shipped yearly.
- 4,485,00 to 7,176,000 tons have been
- shipped to date.

Significance of shipping route

- The total rail track length from the oil refinery to the Aluminum smelter is 1520 kilometers
- Eighty percent (1140 kilometers) of the tracks are within 1 kilometer of water.
- Most of the route in NW Washington and the B.C. south coast is along the shore and in some cases directly over water.

Figure 2: Close Up View of Petroleum Coke Shipping Route from Shell Refinery in Anacortes, WA into British Columbia

New coke loading method, older method had full sides & high middle

Why is there concern?

- Emissions from petroleum coke contain significant amounts of fine dust particles in the PM10 and PM 2.5 size range. These emissions are currently regulated by EPA in Region 10 under the FARR.
- Petroleum coke contain numerous toxics including heavy metals and PAHs that are carcinogenic.

Shell petroleum coke 1994 metals analysis

Metal	Concentration PPM	
Arsenic	less than	2.6
Barium		0.99
Cadmium	less than	2.6
Cobalt		0.62
Chromium		3.9
Mercury	less than	2.6
Lead	less than	2.6
Vanadium		36.0

Table 1. Shell petroleum coke 1994 PAH analysis

Compound	Concentration PPM
2- Methylnaphthalene	2.5
Anthracene	0.66
Benzo(a)anthracene	2.2
Benzo(a)pyrene	2.2
Benzo(b)fluoranthene	1.1
Chrysene	2.3
Dibenzo(a,h)anthracene	0.99
Dibenzifloran	0.21

Table 1.Shell petroleum coke 1994 PAH analysis continued

Compound	Concentration PPM
Indeno (1-2-3-cd) pyrene	0.56
Fluorene	0.31
Naphthalene	1.6
Pyrene	1.7
Benzo(g,h.,l,)perylene	1.4
Total PAHs in petroleum coke	21

Figure 3. Location of track on N end of Reservation. Why is there concern?

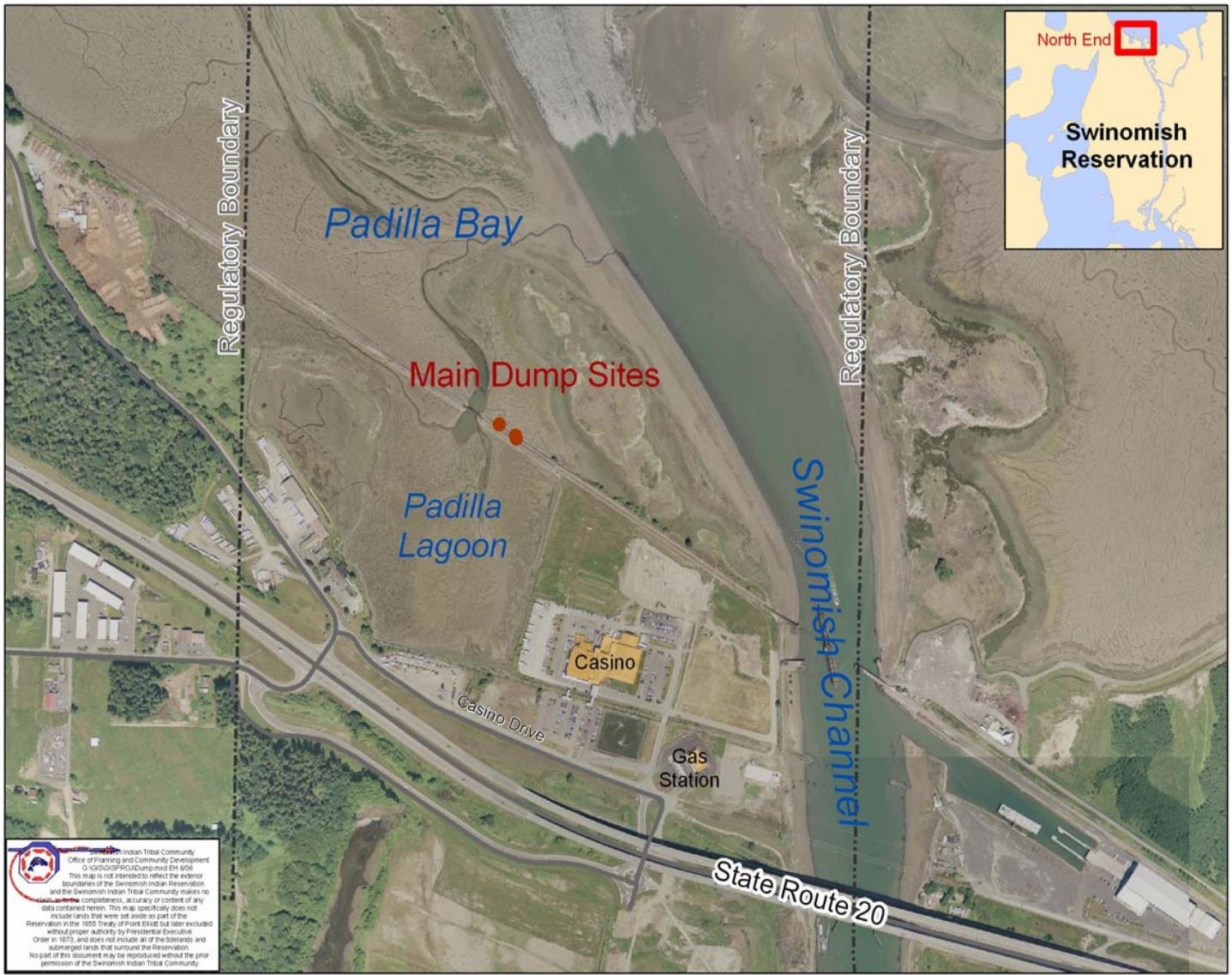

Figure 4. Spill location next to track

Figure 5. more spilling down the track

Figure 6. Coke spill into water

SOLUTIONS IN PROGRESS

- Leaky rail cars will not be used
- Rail cars will be loaded as shown above
- Rail car hoppers will be inspected after loading
- Outside of rail cars will be cleaned after loading
- Verification of the above procedures will be entered into a daily loading log

Figure 7. Recently washed rail car

Figure 8. recently washed rail car

Figure 9. cleaned hopper ready for inspection

Impacts of these solutions

- Coke spilling along trail tracks and adjacent aquatic habitats should be all but eliminated.
- The above mentioned will benefit all people and habitat along the coke shipping route.

More solutions in the near future

- The Shell Oil Company will install a binding spray station at the Anacortes refinery
- They will apply the binder to all of the coke produced at the refinery immediately after production
- The binder application has the potential to reduce more than 90% of fine dust emissions from handling, storage, loading and unloading and shipping by road rail and barge

Determination of fine dust emissions from shipping petroleum coke

- The Institute for Tribal Environmental (ITEP) Professionals and the Engineering Dept. at Northern Arizona have volunteered to assist with fine particulate (PM10, PM 2.5) transport emissions modeling
- EPA has agreed to assist with high resolution chemical analysis of the Shell refinery petroleum coke to enable refined modeling by ITEP.