

Tab 7. Update on PCB and DDT Concentrations in Broad
whitefish and Burbot Livers Harvested in 2001 near
Nuiqsut

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MEMORANDUM

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TO: GEORGE N. AHMAOGAK, SR., MAYOR

THROUGH: DENNIS PACKER, CAO

THROUGH: CHARLES D. N. BROWER, DIRECTOR

THROUGH: TAQULIK HEPA, DEPUTY DIRECTOR

FROM: TODD M. O'HARA, RESEARCH BIOLOGIST

DATE: SEPTEMBER 26, 2002

SUBJECT: UPDATE ON PCB AND DDT CONCENTRATIONS IN BROAD WHITEFISH AND BURBOT LIVERS HARVESTED IN 2001 NEAR NUIQSUT.

The former military and oil exploration activities at Umiat have resulted in documented environmental contamination of the Umiat area by various organochlorines (OCs), that are also known as persistent organic pollutants (POPs). These chemicals are well known to be persistent and to accumulate as they "travel up" the food chain. The terrestrial and aquatic environments near Umiat have been contaminated via improper disposal as has been documented by many reports. However, very little effort has been made to assess the extent of this contamination in biota (i.e., plants, wildlife, fish), especially biota that local residents may utilize as food (subsistence hunting and fishing). Preliminary data concerning fish contamination alarmed many subsistence fishers on the Colville River, including Nuiqsut residents. These preliminary data were gathered by the U.S. Army Corps of Engineers and were released to the public by the Alaska Department of Health

and Social Services. This information related to fish contamination has led to an unfortunate avoidance of a nutritious traditional food item, burbot liver. For this reason we requested and received burbot caught in the years 2000 and 2001 from Nuiqsut residents for chemical analyses (PCBs, DDTs, etc.). Some of these data (PCBs and DDTs) are reported in Table 1 and compared to the findings from the year 2000 listed in Table 2 (previously reported to the North Slope Borough Fish and Game Management Committee and the Director). The chemical analyses were performed in the laboratory of Dr. Derek Muir with Environment Canada, as part of a larger Department of Wildlife Management (DWM) project addressing contaminants in the Alaskan Arctic.

Table 1. Preliminary data from fish (broad whitefish and burbot) samples collected in 2001 near Nuiqsut, Alaska.

Broad white fish livers [blank corrected ng/g wet wt or ppb ww]

	<u>Mean</u>	<u>SD</u>	<u>N</u>	<u>Range</u>
% Lipid	4.19	1.04	19	2.6 to 6.01
<u>TOTAL PCB</u>	<u>7.03</u>	14.49	19	0.158 to 63.19
sPCB10	2.41	5.79	19	0.013 to 25.57
<u>sDDT</u>	<u>0.77</u>	2.31	19	0.001 to 10.03
SCHL	0.49	0.46	19	0.095 to 2.213
SHCH	0.22	0.09	19	0.065 to 0.400
SCBZ	0.47	0.18	19	0.246 to 0.968
smono-di	0.20	0.19	19	0.002 to 0.560
s-tri	0.31	0.46	19	0.001 to 1.909
s-tetra	1.10	1.59	19	0.009 to 5.528
s-penta	2.17	4.44	19	0.025 to 18.93
s-hexa	2.43	5.75	19	0.076 to 25.17
s-hepta	0.70	2.33	19	0.004 to 10.23
s-octa	0.12	0.41	19	0 to 1.807
s-nona	0.06	0.19	19	0 to 0.847

Table 1 continued

Burbot livers [blank corrected ng/g wet wt or ppb ww]

	Mean	SD	N	Range
% Lipid	38.15	6.95	4	31.36 to 45.62
TOTAL PCB	34.90	20.94	4	15.70 to 64.35
sPCB10	15.71	9.97	4	7.08 to 29.92
sDDT	10.20	5.44	4	3.87 to 16.89
SCHL	11.23	6.38	4	3.74 to 18.63
SHCH	3.27	1.41	4	1.60 to 4.54
SCBZ	8.51	3.85	4	3.31 to 11.99
smono-di	1.41	1.51	4	0.33 to 3.62
s-tri	2.89	2.25	4	1.05 to 6.16
s-tetra	4.57	2.91	4	1.45 to 8.34
s-penta	14.00	8.35	4	6.00 to 25.62
s-hexa	9.72	4.97	4	5.23 to 16.75
s-hepta	2.38	1.16	4	1.53 to 4.05
s-octa	0.25	0.16	4	0.12 to 0.48
s-nona	0.06	0.02	4	0.03 to 0.09

Broad whitefish roe [blank corrected ng/g wet wt or ppb ww]

	Mean	SD	N	Range
% Lipid	13.60	0.70	3	13.2 to 14.41
TOTAL PCB	4.43	2.60	3	2.18 to 7.28
sPCB10	1.67	1.10	3	0.86 to 2.92
sDDT	1.02	0.49	3	0.50 to 1.46
SCHL	1.75	1.65	3	0.26 to 3.52
SHCH	0.83	0.58	3	0.18 to 1.29
SCBZ	1.57	1.01	3	0.46 to 2.45
smono-di	0.25	0.18	3	0.04 to 0.36
s-tri	0.35	0.19	3	0.13 to 0.51
s-tetra	0.57	0.31	3	0.34 to 0.92
s-penta	1.62	1.14	3	0.65 to 2.88
s-hexa	1.38	0.72	3	0.86 to 2.21
s-hepta	0.26	0.15	3	0.15 to 0.44
s-octa	0.03	0.01	3	0.02 to 0.03
s-nona	0.01	0.002	3	0.01 to 0.01

Table 2. Concentrations of PCB and DDT (ppb or “parts per billion” wet weight) in burbot liver sampled in Nuiqsut and Umiat, Alaska in 2000, and updated with preliminary data from 2001.

Sample	Site	Mean Total PCB	Mean Total DDT
Burbot Liver (n=7) in 2000	Umiat*	376.7	459.3
Burbot Liver (n=11) in 2000	Nuiqsut	51.83	18.37
Comparison by site			
Umiat – Nuiqsut In 2000	Difference	324.9**	440.9**
Umiat / Nuiqsut in 2000	Fold factor	7.3 times higher at Umiat***	25 times higher at Umiat***
Umiat – Nuiqsut In 2001	Difference	376.7-34.90 = 341.8 greater at Umiat	459.3-10.2 = 449.1 greater at Umiat
Umiat / Nuiqsut in 2001	Fold factor	10.8 times higher at Umiat***	45 times higher at Umiat***

*Data from Attachment 1.

** The difference between sites (mean level Umiat burbot liver minus mean Nuiqsut liver level)

*** Levels are greater at Umiat than Nuiqsut.

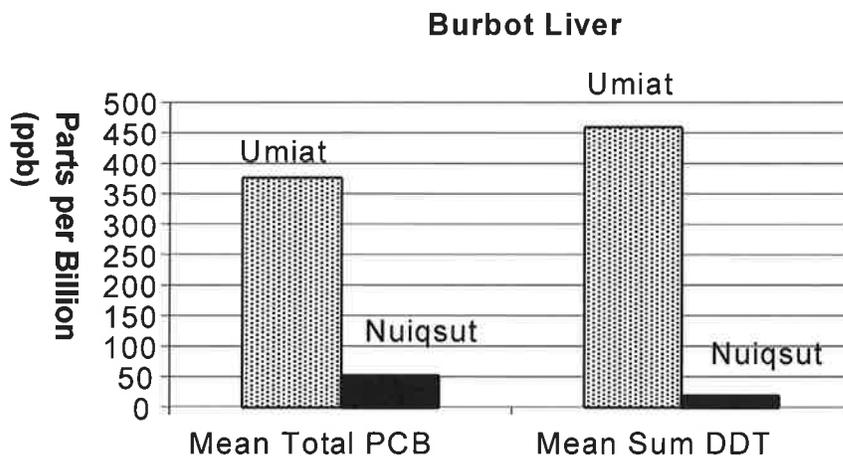


Figure 1: Comparing Umiat and Nuiqsut mean concentrations of total PCB and sum DDT using data from Tables 1 and 2.

Based on the results in Tables 1 and 2, and Figure 1 (above) it is quite clear that a very large difference exists for the level of contamination of burbot liver between Umiat and Nuiqsut. This large difference brings into question the actual sampling, research design,

site differences, and analysis of these fish, as well as the significance of the environmental contamination at Umiat to local Nuiqsut fishing activity. Basically, the burbot livers from Umiat have concentrations 7 to 11, and 25 to 45 times GREATER than the livers from Nuiqsut for PCBs and DDTs for years 2000 and 2001, respectively.

Reasons for these large differences need to be investigated and include;

- The contamination of the Colville River near Umiat is causing this large discrepancy,
- During sampling at Umiat materials (including the livers) were inadvertently contaminated,
- Seasonal (winter versus summer) differences in liver levels of contaminants,
- Laboratory differences in analyses and reporting of data,
- Actual site differences that we have not yet determined, and
- Various combinations of the above.

These recent data from Nuiqsut caught fish are good news for residents of Nuiqsut as the OCs levels (PCB and DDT) of burbot liver they were catching in 2000 and 2001 had levels of contaminants that were 7 to 11 (for PCBs) to 25 to 45 (for DDT) times less than those collected near Umiat. Based on this new information the consumption advisory released by the Alaska Department of Health and Social Services (Attachment 1) using Umiat data may be very misleading for Nuiqsut residents. We suggest that further sampling of fish occur along the Colville River (Umiat to Nuiqsut) and that laboratories investigate possible analytic differences or inadvertent contamination of samples, and that possible site differences in contamination be investigated. For comparison to a marine mammal, the PCB and DDT levels in Nuiqsut burbot liver are lower than in bowhead whale blubber (458.5 ng of PCB/g and 130.1 ng of DDT/g in bowhead blubber).

As additional information I have calculated the “Allowed or Recommended” consumption amounts (i.e., pounds of liver from burbot per week per person) of burbot liver using 1) the data from Umiat and Nuiqsut used to prepare Tables 1 and 2, and Figure 1, and 2) the Canadian guidelines (Northern Contaminants Program) for the

consumption of traditional foods, like fish and wildlife (Jensen *et al.*, 1997). Jensen and colleagues prepared a very comprehensive report addressing contaminants exposure in peoples of northern Canada via the consumption of wildlife and fish. The work by Jensen *et al.* (1997) is a leading report in this field, directly addresses consumption by people in the North, and I use it here to give guidance on human contaminants exposure via consumption of burbot liver taken from the Colville River. Presented below are two sets of calculations used to determine the amount of Nuiqsut burbot liver that can be safely consumed. These example calculations are for an “average person” (155 pounds in body weight) and are conducted for years 2000 and 2001. As mentioned earlier, the example calculations use the guideline data (Jensen *et al.*, 1997) regarding the safe level of DDT and PCB that can be consumed per day and these example calculations use the actual data from the burbot liver samples from Nuiqsut sampled in 2000 and 2001.

Burbot liver from Nuiqsut in 2000 (reported previously)

PCB: 70 kg (155 lb) human X 1.0 ug of PCB/kg of human body weight/day = 70 ug of PCB /day divided by 51.83 ng/g (or 0.05183 ug of PCB /g in burbot liver) = 1350.5 g of Nuiqsut burbot liver per day or approximately 9450 g per week or 9450 g X 0.03527 ounces/g =

333.3 ounces (20.8 pounds) of Nuiqsut burbot liver per week can be safely consumed.

DDT for 2000: 70 kg (155 lb) human X 20 ug of DDT/kg of human body weight/day = 1400 ug of DDT /day divided by 18.37 ng/g (or 0.01837 ug of DDT /g in burbot liver) = 76,211 g of fish per day or approximately 533,000 g per week, or

18,800 ounces (1175 pounds) of Nuiqsut burbot liver per week can be safely consumed.

Burbot liver from Nuiqsut in 2001 (new data)

PCB: 70 kg (155 lb) human X 1.0 ug of PCB/kg of human body weight/day = 70 ug of PCB /day divided by 34.9 ng/g (or 0.0349 ug of PCB /g in burbot liver) = 2005.7 g

of Nuiqsut burbot liver per day or approximately 14040 g per week or 14040 g X
0.03527 ounces/g =

**495.2 ounces (31 pounds) of Nuiqsut burbot liver per week can be safely
consumed based on 2001 data.**

DDT for 2001: 70 kg (155 lb) human X 20 ug of DDT/kg of human body weight/day
= 1400 ug of DDT /day divided by 10.2 ng/g (or 0.0102 ug of DDT /g in burbot liver)
= 137,254 g of fish per day or approximately 960,784 g per week, or 960,784 g per
week X 0.03527 ounces/g =

**33,886 ounces (2117 pounds) of Nuiqsut burbot liver per week can be safely
consumed.**

Based on these data, Nuiqsut residents should consume burbot livers taken near Nuiqsut and they should recognize the cultural and nutritional value of eating these fish products. We sympathize with these residents that the food is contaminated, however, examination of the burbot livers obtained in 2000 and 2001 near Nuiqsut indicate they are safe to eat based on the Canadian guidelines (Jensen *et al.*, 1997), using the calculations above conducted separately for years 2000 and 2001. We feel these Nuiqsut caught burbot samples will likely better reflect what Nuiqsut residents are consuming as compared to samples collected near Umiat. Broad whitefish livers and roe were less contaminated than the burbot livers. Other tissues from these fish are being analyzed and data will be provided when available.

Based upon the examination of a limited sampling of fish from Nuiqsut and Umiat areas, and based upon the respected Canadian guidelines report by Jensen *et al.* (1997) it seems clear that the liver from fish taken at Nuiqsut can be safely consumed. It also appears that burbot taken near Nuiqsut are less contaminated than those near Umiat, and this is good news for Nuiqsut residents. In view of the information available to me from the limited sampling at Nuiqsut and Umiat, I make the following recommendations.

1. Nuiqsut residents should continue to eat liver from burbot and other fish taken at Nuiqsut.

2. In order to reduce concern and uncertainty by Nuiqsut residents there should be;
 - a. A more rigorous sampling of fish in waters at Nuiqsut and Umiat and in the waters in between, and
 - b. An appropriate sampling of river sediments in the Umiat area and downstream in order to assess the extent of river sediment contamination due to the Umiat site.
 - c. These data from 2001 require specific congener analyses to determine the source by “finger printing” the chemical signature of the PCBs and this can be conducted for a few thousand dollars and could be available early next year if the Mayor or Director approve funding this effort.

We appreciate the assistance of the Nuiqsut fishers and the Director and Deputy Director of the DWM for supporting this investigation. We will continue this effort and hope to soon share the final results with residents of Barrow, Nuiqsut, and the NSB Fish and Game Management Committee.

Thank you!

Citation

JENSEN, J., K. ADARE, AND R. SHEARER. 1997. Canadian Arctic Contaminants Assessment Report. Department of Indian Affairs and Northern Development (Ontario Catalogue No. R72-260/1997E, ISBN 0-662-25704-9), Ottawa, Ontario, Canada. 460 pp.