

Chesapeake Energy Shellfish Study

CHESAPEAKE, VA

Letter Health Consultation

June 13, 2018

Virginia Department of Health
Division of Environmental Epidemiology
Richmond, Virginia 23219



Flammia, Dwight <dwight.flammia@vdh.virginia.gov>

chesapeake energy report

1 message

Flammia, Dwight <dwight.flammia@vdh.virginia.gov>

Wed, Jun 13, 2018 at 1:12 PM

To: Sandra Mueller <sandra.mueller@deq.virginia.gov>, "Darkwah, Gabriel" <Gabriel.Darkwah@deq.virginia.gov>

Cc: Caroline Holsinger <caroline.holsinger@vdh.virginia.gov>

I discussed the Chesapeake Energy Report with Keith Skiles (Shellfish Sanitation Division Director). Below contains information from the report, what was discussed with Keith, limitations in the report, and recommendations and conclusions based on what was provided in the report. Please let me know if you would like to discuss further.

Information from the report:

- Mummichogs were the only fin fish collected (these are bait fish and not consumed). There was "difficulty" in collecting targeted length (8 cm) mummichogs, and none were collected at DC_UPS-01 sampling station
- Blue crabs were collected at all sampling stations
- Hooked mussels collected at all stations except DC-UPS-01. Collected mussels range from 10.37-52.31 millimeters in length
- Dark mussels available only at SBER-UPS-01, and those collected ranged from 11.71-15.23 mm in length
- Neither target clams were found at any sampling station
- All specimens sent to the lab were tested for total arsenic

Discussion with Keith Skiles:

- All samples were taken from waterways that are closed to shellfish harvesting due to bacteria levels
- King Creek was the reference site which also has a shellfish harvesting closure
- Sampling dates are appropriate for biota collected
- Consumption rate for shellfish not readily available
 - 2014 article by USDA in *Nutrient* reports shellfish consumption with a mean of 75 grams/week (individual species not provided). However, consumption rate of mussels would be expected to be a small percent of that.

Limitations

- Size of mussels collected less than edible size (would a normal mussel be at least 2 inches or 50 millimeters. Difficulty in collecting mussels of edible size.
- Rate of mussel consumption in Virginia not known
- Concentration of total arsenic in specimens was reported
 - When fish/shellfish consumption advisories are based on arsenic, we evaluate the inorganic arsenic. **Inorganic arsenic** can account for up to 20% of the total arsenic in fish. However, it is usually much lower. Arsenic is ubiquitous in the environment and one needs to keep in mind background concentrations. Studies show arsenic concentrations in fish/shellfish ranging from 2 - 20 mg/kg (parts per million).
- The specimens collected in King Creek (reference site) had higher concentrations of total arsenic than sampling sites near Chesapeake Energy

Recommendations

- If an additional study was to be done to determine the effect on health from consuming bivalves and fish from these waterways VDH and DEQ should be consulted.
- Bivalves and fish should be tested for inorganic arsenic.

If we are to make conclusions based on what was provided,

- We would conclude that there is no health risk because the water ways are closed to shellfish harvesting thereby eliminating exposure, and
- mummichog is not a health risk because it is not consumed
- The additional cancer risk (see below) based on conservative assumptions is 4.6 in 100,000. This is between 1 in ten thousand and 1 in a million, which is used by regulatory agencies.

Derivation of Cancer Risk Level from Biota Arsenic Concentrations in Chesapeake Energy Report

The formula for calculating cancer risk from consuming two fish/shellfish meals per month having concentrations of total arsenic, 2.0 mg/kg follows. **Inorganic** arsenic represents a small percent of the total arsenic concentration in fish/shellfish. If we conservatively assume that inorganic arsenic is 20% of the total arsenic than the concentration used below is 0.4 mg/kg inorganic arsenic.

$$R = \frac{C \times CSF \times MS \times NM}{BW \times EDF \times T}$$

Where:

- C = Concentration of inorganic arsenic in edible portion in milligrams per kilograms (mg/kg)
 BW = Average consumer adult body weight in kilograms (80 kg)
 EDF = Exposure duration factor (78 years ÷ 32 years = 2.44)
 T = Time period 30 days (days/month)
 CSF = Inorganic oral cancer slope factor of 1.5 milligrams per kilograms per day (mg/kg/day)⁻¹
 MS = Average meal size of 8 ounces (oz) or 0.227 kg
 NM = Number of allowable meals per month (2 meals/month)

Substituting assumptions and factors in the equation

$$= 4.6 \text{ in } 100,000 \text{ additional cancers}$$

R = Risk of incremental increase in cancer over the background. Regulatory target risk is between 1 in 10,000 to 1 in 1,000,000

Dwight Flammia, Ph.D.
 State Public Health Toxicologist
 Virginia Department of Health
 101 North 14th Street Room 1540
 Richmond, VA 23219

Phone 804 864-8127
 Fax 804 864-8131