Climate Change Impacts on Water Quality in Alaska

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What is the message?

- 1. The climate is changing rapidly, impacting water quality and quantity
- 2. Levels of organics in the raw water are increasing and/or the make up is changing, challenging water treatment systems
- 3. Types of inorganic contaminants are increasing or changing challenging existing water treatment systems
- 4. Algal blooms are becoming increasingly troublesome clogging filters, increasing organic carbon loading and disinfectant by-product formation in water treatment systems
- 5. New pathogens are being introduced into water sources as the result of northward migration of new species potentially introducing new health risks such as giardia and cryptosporidium
- 6. Wild fires are becoming more prevalent, increasing turbidities in water sources but reducing issues associated with organics in water treatment systems



Total Change in Mean Seasonal and Annual Temperature (°F), 1949 - 2015						
Region	Location	Winter	Spring	Summer	Autumn	Annual
Arctic	Barrow	7.6	5.6	3.6	6.3	5.8
Interior	Bettles	7.1	4.2	1.5	2.0	3.7
	Fairbanks	7.2	3.6	2.0	1.0	3.4
	Delta Junction	8.9	3.5	0.7	1.0	3.5
	McGrath	8.1	4.5	2.4	2.7	4.4
West Coast	Kotzebue	7.4	1.8	2.9	3.2	3.8
	Nome	4.9	2.6	2.2	1.6	2.8
	Bethel	7.2	3.7	1.9	1.1	3.5
	King Salmon	8.9	4.1	1.5	1.8	4.1
	St Paul	0.6	1.2	2.5	1.4	1.5
	Cold Bay	21	1.3	2.0	1.2	1.6
Southcentral	Talkeetna	9.1	5.0	2.7	3.4	5.0
	Gulkana	7.9	2.5	0.6	0.5	2.8
	Anchorage	6.0	3.5	1.5	1.8	3.2
	Homer	6.6	3.7	3.1	2.4	4.0
	Kodiak	1.5	2.0	1.5	0.2	1.3
Southeast	Yakutat	5.4	2.8	2.1	1.1	2.8
	Juneau	6.6	3.0	1.9	1.6	3.2
	Annette	3.6	2.4	1.7	0.8	2.1
	Average	6.1	3.2	2.0	1.8	3.3
Alaska Climate Rese	earch Center	Geophysical Institute, University of Alaska Fairbanks				







Saxman, Alaska ADEC DBP Reported Results



Concentration (ug/L)





Concentration (ug/L)

Saxman, Alaska ADEC DBP Reported Results





Selawik Retrogressive Thaw Slump



~ $350,000 \text{ m}^3$ of material have been delivered from the slump to the river and alluvial fan.





This graph shows average values from projections from five global climate models used by the Intergovernmental Panel on Climate Change. Due to variability among models and among years in a natural climate system, such graphs are useful for examining trends over time, rather than for precisely predicting monthly or yearly values. For more information on the SNAP program, including derivation, reliability, and variability among these projections, please visit www.snap.uaf.edu.

Cyanobacteria bloom - Kotzebue Alaska, July 2009

- Increased nutrient loading
- Warmer water temperatures favor growth of bloom forming species such as cyanobacteria





- Tundra is giving way to forestation
- Warming is creating habitat for new species















- New microbiological contaminants
- Properly operated water treatment systems less affected
- Traditional water use is a serious concern



50 Annual Average Number of Large Wildfires 40 30 20 10 0 1950s 1960s 1970s 1980s 1990s 2000s 2010s CLIMATE CO CENTRAL Wildfires larger than 1,000 acres

Alaska Wildfires Have Increased Dramatically Since 1990

- Increased sediment load
- Increased nitrate concentrations
- Reduction in DOC up to 60%
- DBP yield per unit DOC unchanged

Uzun et al., 2016

