Alaska Contaminants Synthesis Tables

2/25/15

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Table 1. Contaminants of potential concern in Arctic and/or Alaskan ecosystems

Table 2. Media previously used for air toxics monitoring in the Alaska

Table 3. Mercury health thresholds for humans and piscivorous wildlife used in WACAP

Table 4. Contaminant health thresholds for humans (whole fish) used in WACAP and based on USEPA thresholds

Table 5. Contaminant health thresholds for piscivorous wildlife (whole fish) used in WACAP

Table 6. Summary of non-lethal biomonitoring for toxics

Table 1. Contaminants of potential concern in Arctic and/or Alaskan ecosystems.

Contaminant	Where measured in Alaska?	Which media measured in?	WACAP Analyte?	New global sources?	Concentrations in AK likely to increase, decrease or stay the same in the next 10 years?	Fish Health Thresholds Available?
Mercury	NOAT/GAAR (WACAP report, Schwindt 2008) DENA (WACAP report, Eagles-Smith 2014, Gubala 1995), Schwindt 2008 WRST(Eagles-Smith 2014, Kowalski 2014) LACL(Eagles-Smith 2014) GLBA (Eagles-Smith 2014) Aleutian Archipelago (Ricca 2008, Anthony 1999 and 2007, Burger 2007) Adak Island (Stout 2002) Yukon Flats NWR (Matz 2007) Yukon River Basin (Hinck 2006 and 2007, Dunlap 2007, Jewett 2003) Arctic Coastal Plain, Cape Espenberg, Yujon-Kuskokwim Delta, Copper River Delta (Schmutz 2009)	Fish: (WACAP report, Hinck 2006 and 2007, Loring 2010, Jewett 2003 and 2007, Burger 2007, Eagles-Smith 2014, Kowalski 2014, Schwindt 2008, Loring 2010) Snow (WACAP report, Garbarino 2002) Vegetation (WACAP report, Lokken 2009) Sediment (WACAP report, Gubala 1995) Terrestrial Mammals: Gray Wolves (McGrew 2014), sled dogs (Dunlap 2007), Reindeer hair (Lokken 2009) Marine Mammals: Beluga Whales (Hoguet 2013), Sea Lion (Barron 2003) Birds: Seabirds (Ricca 2008), Bald Eagles and eggs (Stout 2002, Anthony 1999 and 2007), Lesser Scaup eggs (Matz 2007,	Yes	Yes - combustion	Stay the same or increase	Yes – exceedances for humans and wildlife

	Prudhoe Bay (Franson 2004) St. Lazaria Island, East Amatuli Island, St. George Island, Little Diomede Island, Bogoslof Lisand (Day 2006, Christopher 2002) Schrader Lake (Gubala 1995) Cook Inlet and Eastern Chukchi Sea (Hoguet 2013) Northwest Alaska (Garbarino 2002)	Fox 2005), Red-throated loon eggs (Schmutz 2009) , duck and eider eggs (Franson 2004) , Eiders (Stout 2002), Murre eggs (Day 2006, Christopher 2002)				
Brominated Flame Retardants	NOAT/GAAR (WACAP report, Ackerman 2008) DENA (WACAP report, Ackerman 2008) Hooper Bay, Noatak River delta, Ualik Lake, Shalak Island, Penny River delta, Middleton Island, Viesokol Rock (Vander Pol 2009) Bering Sea, Aleutian Islands, Gulf of Alaska, Southeast Alaska (Ikonomou 2011) Cook Inlet and Eastern Chukchi Sea (Hoguet 2013) Adak Island and Prince William Sound (Kannan 2008) Northern and Western Alaska (Kannan 2005) Beaufort and Chukchi Seas (Kannan	Fish (WACAP report, Ackerman 2008, Ikonomou 2011) Sediment (WACAP report) Marine Mammals: Beluga Whales (Hoguet 2013), Humpback Whales (Elfes 2010), Sea Otter (Kannan 2008), Polar Bears (Kannan 2005, McKinney 2011a, Muir 2006, McKinney 2011b) Birds: Gull eggs (Vander Pol 2009)	Yes but only in fish and sediment - PBDEs	Yes – consumer products	Stay the same or increase	Yes – No exceedances in Alaska to date

	2005, McKinney 2011a, Muir 2006, McKinney 2011b)					
Perfluorinated Compounds	Cook Inlet and Eastern Chukchi Sea (Reiner 2011) Adak Island and Prince William Sound (Kannan 2008) Point Hope, Shishmaref, Little Diomede, Hooper Bay Beaufort and Chukchi Seas (Kannan 2005)	Marine Mammals: Beluga Whales (Reiner 2011), Sea Otter (Kannan 2008), Seals (Quakenbush 2008) , Polar Bears (Kannan 2005)	No	Yes – consumer products	Stay the same or increase	No

Chlorpyrifos	NOAT/GAAR (WACAP report, Ackerman 2008, Hageman 2006, Hageman 2010, Flanagan Pritz 2014, Alaska Fish report 2013 Schrlau 2011) DENA (WACAP report, Ackerman 2008, Hageman 2006, Hageman 2010, Flanagan Pritz 2014, Alaska Fish report 2013, Schrlau 2011) WRST(Flanagan Pritz 2014, Alaska Fish report 2013, Schrlau 2011) LACL(Flanagan Pritz 2014, Alaska Fish report 2013) KATM(Flanagan Pritz 2014, Alaska Fish report 2013, Schrlau 2011) GLBA (WACAP report, Schrlau 2011) STLE (WACAP report, Schrlau 2011) Northwest Alaska (Garbarino 2002)	Fish (WACAP report, Ackerman 2008, Flanagan Pritz 2014, Alaska Fish report 2013) Snow (WACAP report, Hageman 2006, Hageman 2010, Schrlau 2011, Garbarino 2002) Vegetation (WACAP report, Schrlau 2011) Sediment (WACAP report) Air (WACAP report, Schrlau 2011)	Yes	Yes - agriculture	Stay the same or increase	Yes – No exceedances in Alaska to date
Chlorothalonil	Canadian Arctic (Hoferkamp 2010) Barrow (Shunthirasingham 2010)	Lakes (Hoferkamp 2010) Air (Shunthirasingham 2010)	No	Yes - agriculture	Stay the same or increase	No
Chlorthal-Dimethyl Dacthal (DCPA)	NOAT/GAAR (WACAP report, Ackerman 2008, Hageman 2006, Hageman 2010, Flanagan Pritz 2014, Alaska Fish report 2013 Schrlau 2011) DENA (WACAP report, Ackerman	Fish (WACAP report, Ackerman 2008, Flanagan Pritz 2014, Alaska Fish report 2013) Snow (WACAP report, Hageman 2006, Hageman	Yes	Yes - agriculture	Stay the same or increase	Yes – No exceedances in Alaska to date

	2008, Hageman 2006, Hageman 2010, Flanagan Pritz 2014, Alaska Fish report 2013, Schrlau 2011) WRST(Flanagan Pritz 2014, Alaska Fish report 2013, Schrlau 2011) LACL(Flanagan Pritz 2014, Alaska Fish report 2013) KATM(Flanagan Pritz 2014, Alaska Fish report 2013, Schrlau 2011) GLBA (WACAP report, Schrlau 2011) STLE (WACAP report, Schrlau 2011) Northwest Alaska (Garbarino 2002) Barrow (Shunthirasingham 2010)	2010, Schrlau 2011, Garbarino 2002) Vegetation (WACAP report, Schrlau 2011) Sediment (WACAP report) Air (WACAP report, Schrlau 2011, Shunthirasingham 2010)				
Diazinon	Not measured in Alaska to date but measured in the Norwegian Arctic and Canadian Arctic (Hoferkamp 2010)	Ice Core and Lakes (Hoferkamp 2010)	No	Yes - agriculture	Stay the same or increase	No
Endosulfan	NOAT/GAAR (WACAP report, Ackerman 2008, Hageman 2006, Hageman 2010, Flanagan Pritz 2014, Alaska Fish report 2013 Schrlau 2011) DENA (WACAP report, Ackerman 2008, Hageman 2006, Hageman 2010, Flanagan Pritz 2014, Alaska Fish report 2013, Schrlau 2011, Schwindt 2009) WRST(Flanagan Pritz 2014, Alaska Fish report 2013, Schrlau 2011)	Fish (WACAP report, Ackerman 2008, Flanagan Pritz 2014, Alaska Fish report 2013, Hinck 2006, Allen-Gil 1997, Schwindt 2009) Marine Mammals: Polar Bears (Bentzen 2008) Snow (WACAP report, Hageman 2006, Hageman 2010, Schrlau 2011, Garbarino	Yes	Yes - agriculture	Stay the same or increase	Yes – No exceedances in Alaska to date

	LACL(Flanagan Pritz 2014, Alaska Fish report 2013) KATM(Flanagan Pritz 2014, Alaska Fish report 2013, Schrlau 2011) GLBA (WACAP report, Schrlau 2011) STLE (WACAP report, Schrlau 2011) Barrow (Shunthirasingham 2010) Yukon River Basin (Hinck 2006) Elusive Lake, Schrader Lake, Feniak Lake, Desperation Lake (Allen-Gil 1997) Beaufort Sea (Bentzen 2008) Northwest Alaska (Garbarino 2002)	2002) Vegetation (WACAP report, Schrlau 2011) Sediment (WACAP report, Allen-Gil 1997) Air (WACAP report, Schrlau 2011, Shunthirasingham 2010)				
Lindane	NOAT/GAAR (WACAP report, Ackerman 2008, Hageman 2006, Hageman 2010, Flanagan Pritz 2014, Alaska Fish report 2013 Schrlau 2011) DENA (WACAP report, Ackerman 2008, Hageman 2006, Hageman 2010, Flanagan Pritz 2014, Alaska Fish report 2013, Schrlau 2011, Gubala 1995) WRST(Flanagan Pritz 2014, Alaska Fish report 2013, Schrlau 2011)	Fish (WACAP report, Ackerman 2008, Flanagan Pritz 2014, Alaska Fish report 2013, Miles 2009, Wilson 1995, Hinck 2006, de Brito 2002, Allen-Gil 1997) Snow (WACAP report, Hageman 2006, Hageman 2010, Schrlau 2011, Garbarino 2002) Vegetation (WACAP report, Schrlau 2011)	Yes	Yes - agriculture	Stay the same or increase	Yes – No exceedances in Alaska to date

	LACL(Flanagan Pritz 2014, Alaska Fish report 2013) KATM(Flanagan Pritz 2014, Alaska Fish report 2013, Schrlau 2011) GLBA (WACAP report, Schrlau 2011) STLE (WACAP report, Schrlau 2011) Barrow (Hoekstra 2002, 2003, 2005, Kucklick 2002, Shunthirasingham 2010, Shunthirasingham 2010) Barrow and Kaktovik (Hoekstra 2002) Brooks Range (Allen-Gil 1997) Aleutian Islands (Ricca 2008, Anthony 1999 and 2007, Miles 2009, Reese 2012) Aleutian Islands and SE Alaska (Cross Sound/Port Althrop) (Jessup 2010, Bacon 1999) Adak Island and Prince William Sound (Kannan 2008) Bogoslof Island, East Amatuli Island, Little Diomede Island, St. George Island, St. Lazaria Island (Vander Pol 2004) Hooper Bay, Noatak River delta, Ualik Lake, Shalak Island, Penny River delta, Middleton Island, Viesokol Rock (Vander Pol 2009)	Sediment (WACAP report, Gubala 1995, Allen-Gil 1997) Air (WACAP report, Schrlau 2011, Shunthirasingham 2010) Terrestrial Mammal - Arctic Fox (Hoekstra 2003), Arctic Ground Squirrels (Allen-Gil 1997) Marine Mammals: Beluga Whales (Hoguet 2013), Bowhead Whales (Hoekstra 2002 and 2005), Humpback Whales (Elfes 2010) , Sea Otters (Jessup 2010, Kannan 2008, Bacon 1999), Walrus (Wiig 2000) , Polar Bears (Kannan 2005, McKinney 2011a, Verreault 2005, McKinney 2011b, Bentzen 2008, Kucklick 2002) Zooplankton (Hoekstra 2002) Mussels (Reese 2012) Birds: Seabirds (Ricca 2008), Murre eggs (Vander Pol 2004 and 2011), Gull eggs (Vander Pol 2009), Bald Eagles and eggs(Stout 2002, Anthony 1999 and 2007) , Lesser Scaup eggs (Matz 2007, Fox 2005) , duck and eider eggs (Franson 2004) , Eiders (Stout 2002)				

	St. Lazaria Island, St. George Island, St. Lawrence Island, Cape Lisburne (Vander Pol 2011) Adak Island (Stout 2002) Yukon Flats NWR (Matz 2007) Yukon River Basin (Hinck 2006) Prudhoe Bay (Franson 2004) Schrader Lake (Wilson 1995) Gulf of Alaska (de Brito 2002) Schrader Lake (Gubala 1995) Elusive Lake, Schrader Lake, Feniak Lake, Desperation Lake (Allen-Gil 1997) Cook Inlet and Eastern Chukchi Sea (Hoguet 2013) Aleutian Islands and SE Alaska (Cross Sound/Port Althrop) (Jessup 2010) St. Lawrence Island and Little Diomede Island (Wiig 2000) Beaufort, Chukchi, and Beaufort Seas (Kannan 2005, McKinney 2011a, Verreault 2005, McKinney 2011b, Bentzen 2008) Northwest Alaska (Garbarino 2002)					

Methoxychlor	NOAT/GAAR (WACAP report, Ackerman 2008, Hageman 2006, Hageman 2010, Flanagan Pritz 2014, Alaska Fish report 2013 Schrlau 2011) DENA (WACAP report, Ackerman 2008, Hageman 2006, Hageman 2010, Flanagan Pritz 2014, Alaska Fish report 2013, Schrlau 2011) WRST(Flanagan Pritz 2014, Alaska Fish report 2013, Schrlau 2011) LACL(Flanagan Pritz 2014, Alaska Fish report 2013) KATM(Flanagan Pritz 2014, Alaska Fish report 2013, Schrlau 2011) Glacier Bay (WACAP report, Schrlau 2011) Stilikine LeConte (WACAP report, Schrlau 2011) Yukon River Basin (Hinck 2006)	Fish (WACAP report, Ackerman 2008, Flanagan Pritz 2014, Alaska Fish report 2013, Hinck 2006) Snow (WACAP report, Hageman 2006, Hageman 2010, Schrlau 2011) Vegetation (WACAP report, Schrlau 2011) Sediment (WACAP report) Air (WACAP report, Schrlau 2011)	Yes	Yes - agriculture	Stay the same or increase	Yes – No exceedances in Alaska to date
Dieldrin	NOAT/GAAR (WACAP report, Ackerman 2008, Hageman 2006, Hageman 2010, Flanagan Pritz 2014, Alaska Fish report 2013 Schrlau 2011) DENA (WACAP report, Ackerman 2008, Hageman 2006, Hageman 2010, Flanagan Pritz 2014, Alaska Fish report 2013, Schrlau 2011)	Fish (WACAP report, Ackerman 2008, Flanagan Pritz 2014, Alaska Fish report 2013, Wilson 1995, Hinck 2006 and 2007) Snow (WACAP report, Hageman 2006, Hageman 2010, Schrlau 2011, Garbarino 2002)	Yes	Yes - Agriculture	Stay the same or decrease	Yes. Some exceedances in subsistence thresholds.

	WRST(Flanagan Pritz 2014, Alaska Fish report 2013, Schrlau 2011) LACL(Flanagan Pritz 2014, Alaska Fish report 2013) KATM(Flanagan Pritz 2014, Alaska Fish report 2013, Schrlau 2011) GLBA (WACAP report, Schrlau 2011) STLE (WACAP report, Schrlau 2011) Barrow (Hoekstra 2002, Kucklick 2002, Shunthirasingham 2010, Shunthirasingham 2010) Aleutian Archipelago (Ricca 2008, Anthony 1999 and 2007) Aleutian Islands and SE Alaska (Cross Sound/Port Althrop) (Jessup 2010, Bacon 1999) Bogoslof Island, East Amatuli Island, Little Diomede Island, St. George Island, St. Lazaria Island (Vander Pol 2004) Hooper Bay, Noatak River delta, Ualik Lake, Shalak Island, Penny River delta, Middleton Island, Viesokol Rock (Vander Pol 2009) St. Lazaria Island, St. George Island, St. Lawrence Island, Cape Lisburne (Vander Pol 2011) Adak Island (Stout 2002)	Vegetation (WACAP report, Schrlau 2011) Sediment (WACAP report) Air (WACAP report, Schrlau 2011, Shunthirasingham 2010) Marine Mammals: Bowhead Whales (Hoekstra 2002) , Sea Otters (Jessup 2010, Bacon 1999), Polar Bears (Verreault 2005, McKinney 2011b, Bentzen 2008, Kucklick 2002) Birds: Seabirds (Ricca 2008), Murre eggs (Vander Pol 2004 and 2011), Gull eggs (Vander Pol 2009), Bald Eagles and eggs (Stout 2002, Anthony 1999 and 2007) , Lesser Scaup eggs (Matz 2007, Fox 2005) , duck and eider eggs (Franson 2004) , Eiders (Stout 2002)				

	Yukon Flats NWR (Matz 2007) Yukon River Basin (Hinck 2006 and 2007) Prudhoe Bay (Franson 2004) Schrader Lake (Wilson 1995) Beaufort, Chukchi, and Beaufort Seas (Verreault 2005, McKinney 2011b, Bentzen 2008) Northwest Alaska (Garbarino 2002)					
Chlordanes	NOAT/GAAR (WACAP report, Ackerman 2008, Hageman 2006, Hageman 2010, Flanagan Pritz 2014, Alaska Fish report 2013 Schrlau 2011) DENA (WACAP report, Ackerman 2008, Hageman 2006, Hageman 2010, Flanagan Pritz 2014, Alaska Fish report 2013, Schrlau 2011, Gubala 1995, Schwindt 2009) WRST(Flanagan Pritz 2014, Alaska Fish report 2013, Schrlau 2011) LACL(Flanagan Pritz 2014, Alaska Fish report 2013) KATM(Flanagan Pritz 2014, Alaska	Fish (WACAP report, Ackerman 2008, Flanagan Pritz 2014, Alaska Fish report 2013, Miles 2009, Wilson 1995, Hinck 2006 and 2007, de Brito 2002, Allen-Gil 1997, Schwindt 2009) Snow (WACAP report, Hageman 2006, Hageman 2010, Schrlau 2011, Garbarino 2002) Vegetation (WACAP report, Schrlau 2011) Sediment (WACAP report, Gubala 1995, Allen-Gil 1997)	Yes	Yes - Agriculture	Stay the same or decrease	Yes. Some exceedances in subsistence thresholds and Kingfishers.

	Fish report 2013, Schrlau 2011) GLBA (WACAP report, Schrlau 2011) STLE (WACAP report, Schrlau 2011) Barrow (Hoekstra 2002, 2003, 2005, Reese 2012, Kucklick 2002, Shunthirasingham 2010, Shunthirasingham 2010) Barrow and Kaktovik (Hoekstra 2002) Aleutian Islands (Ricca 2008, Anthony 1999 and 2007, Miles 2009) Aleutian Islands and SE Alaska (Cross Sound/Port Althrop) (Jessup 2010, Bacon 1999) Adak Island and Prince William Sound (Kannan 2008) Bogoslof Island, East Amatuli Island, Little Diomede Island, St. George Island, St. Lazaria Island (Vander Pol 2004) Hooper Bay, Noatak River delta, Ualik Lake, Shalak Island, Penny River delta, Middleton Island, Viesokol Rock (Vander Pol 2009) St. Lazaria Island, St. George Island, St. Lawrence Island, Cape Lisburne (Vander Pol 2011) Adak Island (Stout 2002)	Air (WACAP report, Schrlau 2011, Shunthirasingham 2010) Terrestrial Mammal: Arctic Fox (Hoekstra 2003) Marine Mammals: Beluga Whales (Hoguet 2013), Bowhead Whales (Hoekstra 2002, 2005) Humpback Whales (Elfes 2010) , Sea Otters (Jessup 2010, Kannan 2008, Bacon 1999), Sea Lion (Barron 2003) , Walrus (Wiig 2000) , Polar Bears (Kannan 2005, McKinney 2011a, Verreault 2005, McKinney 2011b, Bentzen 2008, Kucklick 2002) Birds: Seabirds (Ricca 2008), Murre eggs (Vander Pol 2004 and 2011), Gull eggs (Vander Pol 2009), Bald Eagles and eggs (Stout 2002, Anthony 1999 and 2007) , Lesser Scaup eggs (Matz 2007, Fox 2005) , duck and eider eggs (Franson 2004) , Eiders (Stout 2002) Zooplankton (Hoekstra 2002) Mussels (Reese 2012)				

	Yukon Flats NWR (Matz 2007) Yukon River Basin (Hinck 2006 and 2007) Prudhoe Bay (Franson 2004) Schrader Lake (Wilson 1995) Gulf of Alaska (de Brito 2002) Schrader Lake (Gubala 1995) Elusive Lake, Schrader Lake, Feniak Lake, Desperation Lake (Allen-Gil 1997) Cook Inlet and Eastern Chukchi Sea (Hoguet 2013) St. Lawrence Island and Little Diomede Island (Wiig 2000) Beaufort, Chukchi, and Beaufort Seas (Kannan 2005, McKinney 2011, Verreault 2005, McKinney 2011b, Bentzen 2008) Northwest Alaska (Garbarino 2002)					
DDTs	NOAT/GAAR (WACAP report, Ackerman 2008, Hageman 2006, Hageman 2010, Flanagan Pritz 2014, Alaska Fish report 2013 Schrlau 2011)	Fish (WACAP report, Ackerman 2008, Flanagan Pritz 2014, Alaska Fish report 2013, Miles 2009, Wilson 1995, Hardell 2010, Hinck 2006 and 2007,	Yes	Yes – Malaria control	Stay the same or decrease	Yes. Some exceedances in subsistence thresholds and

	DENA (WACAP report, Ackerman 2008, Hageman 2006, Hageman 2010, Flanagan Pritz 2014, Alaska Fish report 2013, Schrlau 2011, Gubala 1995, Schwindt 2009) WRST(Flanagan Pritz 2014, Alaska Fish report 2013, Schrlau 2011) LACL(Flanagan Pritz 2014, Alaska Fish report 2013) KATM(Flanagan Pritz 2014, Alaska Fish report 2013, Schrlau 2011) GLBA (WACAP report, Schrlau 2011) STLE (WACAP report, Schrlau 2011) Barrow (Hoekstra 2002, 2003, 2005, Kucklick 2002, Shunthirasingham 2010, Shunthirasingham 2010) Barrow and Kaktovik (Hoekstra 2002) Brooks Range (Allen-Gil 1997) Aleutian Islands (Ricca 2008, Anthony 1999 and 2007, Miles 2009, Hardell 2010, Reese 2012, Myers 2008) Aleutian Islands and SE Alaska (Cross Sound/Port Althrop) (Jessup 2010, Bacon 1999) Adak Island and Prince William	Ewald 1998, de Brito 2002, Hardell 2010, Allen-Gil 1997, Schwindt 2009) Snow (WACAP report, Hageman 2006, Hageman 2010, Schrlau 2011, Garbarino 2002) Vegetation (WACAP report, Schrlau 2011) Sediment (WACAP report, Gubala 1995, Allen-Gil 1997) Air (WACAP report, Schrlau 2011, Shunthirasingham 2010) Terrestrial Mammals: Arctic Fox (Hoekstra 2003), Arctic Ground Squirrels (Allen-Gil 1997) Marine Mammals: Beluga Whales (Hoguet 2013) Bowhead Whales (Hoekstra 2002, 2005) Humpback Whales (Elfes 2010) , Sea Otters (Jessup 2010, Kannan 2008, Bacon 1999), Sea Lion (Myers 2008, Barron 2003) , Walrus (Wiig 2000), Seals (Loughlin 2002, Beckmen 1999) , Polar Bears (Kannan 2005, McKinney 2011a, Verreault 2005, McKinney 2011b, Bentzen 2008, Kucklick 2002)				Kingfishers.

	Sound (Kannan 2008) Bogoslof Island, East Amatuli Island, Little Diomede Island, St. George Island, St. Lazaria Island (Vander Pol 2004) Hooper Bay, Noatak River delta, Ualik Lake, Shalak Island, Penny River delta, Middleton Island, Viesokol Rock (Vander Pol 2009) St. Lazaria Island, St. George Island, St. Lawrence Island, Cape Lisburne (Vander Pol 2011) Adak Island (Stout 2002) Yukon Flats NWR (Matz 2007) Yukon River Basin (Hinck 2006 and 2007) Prudhoe Bay (Franson 2004) Schrader Lake (Wilson 1995) Copper River, Lower Fish Lake, Round Tangle Lake (Ewald 1998) Gulf of Alaska (de Brito 2002) Schrader Lake (Gubala 1995) Elusive Lake, Schrader Lake, Feniak Lake, Desperation Lake (Allen-Gil 1997) Cook Inlet and Eastern Chukchi Sea (Hoguet 2013)	Birds: Seabirds (Ricca 2008), Murre eggs (Vander Pol 2004 and 2011), Gull eggs (Vander Pol 2009), Bald Eagles and eggs(Stout 2002, Anthony 1999 and 2007) , Lesser Scaup eggs (Matz 2007, Fox 2005) , duck and eider eggs (Franson 2004) , Eiders (Stout 2002) Zooplankton (Hoekstra 2002) Mussels (Reese 2012)				

	St. Lawrence Island and Little Diomede Island (Wiig 2000) St. George Island and St. Paul Island (Loughlin 2002) St. George Island (Beckmen 1999) Beaufort, Chukchi, and Beaufort Seas (Kannan 2005, McKinney 2011, Verreault 2005, McKinney 2011b, Bentzen 2008) Northwest Alaska (Garbarino 2002)					
Hexachlorobenzene (HCB)	NOAT/GAAR (WACAP report, Ackerman 2008, Hageman 2006, Hageman 2010, Flanagan Pritz 2014, Alaska Fish report 2013 Schrlau 2011) DENA (WACAP report, Ackerman 2008, Hageman 2006, Hageman 2010, Flanagan Pritz 2014, Alaska Fish report 2013, Schrlau 2011) WRST(Flanagan Pritz 2014, Alaska Fish report 2013, Schrlau 2011) LACL(Flanagan Pritz 2014, Alaska Fish report 2013) KATM(Flanagan Pritz 2014, Alaska	Fish (WACAP report, Ackerman 2008, Flanagan Pritz 2014, Alaska Fish report 2013, Miles 2009, Hardell 2010, Hinck 2006, de Brito 2002, Hardell 2010, Allen-Gil 1997) Snow (WACAP report, Hageman 2006, Hageman 2010, Schrlau 2011, Garbarino 2002) Vegetation (WACAP report, Schrlau 2011, Howe 2004) Sediment (WACAP report,	Yes	Yes – Agriculture and chemical manufacturing	Stay the same or decrease	Yes – No exceedances in Alaska to date

	Fish report 2013, Schrlau 2011) GLBA (WACAP report, Schrlau 2011) STLE (WACAP report, Schrlau 2011) Eastern Alaska (Howe 2003) Barrow (Hoekstra 2002, 2003, 2005, Kucklick 2002, Shunthirasingham 2010) Barrow and Kaktovik (Hoekstra 2002) Brooks Range (Allen-Gil 1997) Aleutian Islands (Ricca 2008, Anthony 1999 and 2007, Miles 2009, Hardell 2010 Hardell 2010, Reese 2012) Aleutian Islands and SE Alaska (Cross Sound/Port Althrop) (Jessup 2010, Bacon 1999) Bogoslof Island, East Amatuli Island, Little Diomede Island, St. George Island, St. Lazaria Island (Vander Pol 2004) Hooper Bay, Noatak River delta, Ualik Lake, Shalak Island, Penny River delta, Middleton Island, Viesokol Rock (Vander Pol 2009) St. Lazaria Island, St. George Island, St. Lawrence Island, Cape Lisburne (Vander Pol 2011)	Allen-Gil 1997) Air (WACAP report, Schrlau 2011, Shunthirasingham 2010) Terrestrial Mammal - Arctic Fox (Hoekstra 2003), Arctic Ground Squirrels (Allen-Gil 1997) Marine Mammals: Bowhead Whales (Hoekstra 2002, 2005) , Sea Otters (Jessup 2010, Bacon 1999), Sea Lion (Barron 2003), Seals (Loughlin 2002) , Polar Bears (Kannan 2005, Verreault 2005, McKinney 2011b, Bentzen 2008, Kucklick 2002) Birds: Seabirds (Ricca 2008), Murre eggs (Vander Pol 2004 and 2011), Gull eggs (Vander Pol 2009), Bald Eagles and eggs(Stout 2002, Anthony 1999 and 2007) , Lesser Scaup eggs (Matz 2007, Fox 2005), duck and eider eggs (Franson 2004), Eiders (Stout 2002) Zooplankton (Hoekstra 2002) Mussels (Reese 2012)				

	Adak Island (Stout 2002) Yukon Flats NWR (Matz 2007) Yukon River Basin (Hinck 2006) Prudhoe Bay (Franson 2004) Gulf of Alaska (de Brito 2002) Elusive Lake, Schrader Lake, Feniak Lake, Desperation Lake (Allen-Gil 1997) Cook Inlet and Eastern Chukchi Sea (Hoguet 2013) St. George Island and St. Paul Island (Loughlin 2002) Beaufort, Chukchi, and Beaufort Seas (Kannan 2005, Verreault 2005, McKinney 2011b, Bentzen 2008) Northwest Alaska (Garbarino 2002)					
Polychlorinated Biphenyls (PCBs)	NOAT/GAAR (WACAP report, Ackerman 2008, Hageman 2006, Hageman 2010, Flanagan Pritz 2014, Alaska Fish report 2013 Schrlau 2011) DENA (WACAP report, Ackerman 2008, Hageman 2006, Hageman 2010, Flanagan Pritz 2014, Alaska	Fish (WACAP report, Ackerman 2008, Flanagan Pritz 2014, Alaska Fish report 2013, Shaw 2006, Miles 2009, Wilson 1995, Hardell 2010, Hinck 2006 and 2007, Ewald 1998, de Brito 2002, Hardell 2010, Allen-Gil 1997, Schwindt 2009)	Yes – selected PCBs	Yes – still being released from transformers	Stay the same or decrease	Yes – No exceedances in Alaska to date

	Fish report 2013, Schrlau 2011, Gubala 1995, Schwindt 2009) WRST(Flanagan Pritz 2014, Alaska Fish report 2013, Schrlau 2011) LACL(Flanagan Pritz 2014, Alaska Fish report 2013) KATM(Flanagan Pritz 2014, Alaska Fish report 2013, Schrlau 2011) GLBA (WACAP report, Schrlau 2011) STLE (WACAP report, Schrlau 2011) Barrow (Hoekstra 2002, 2003, 2005, Kucklick 2002) Barrow and Kaktovik (Hoekstra 2002) Brooks Range (Allen-Gil 1997) Aleutian Islands (Ricca 2008, Anthony 1999 and 2007, Shaw 2006, Miles 2009, Hardell 2010, Hardell 2010, Reese 2012, Myers 2008) Aleutian Islands and SE Alaska (Cross Sound/Port Althrop) (Jessup 2010, Bacon 1999) Adak Island and Prince William Sound (Kannan 2008) Bogoslof Island, East Amatuli Island, Little Diomede Island, St. George	Snow (WACAP report, Hageman 2006, Hageman 2010, Schrlau 2011, Garbarino 2002) Vegetation (WACAP report, Schrlau 2011, Howe 2004) Sediment (WACAP report, Gubala 1995, Allen-Gil 1997, Krummel 2008) Air (WACAP report, Schrlau 2011) Terrestrial Mammals: Arctic Fox (Hoekstra 2003), Arctic Ground Squirrels (Allen-Gil 1997) Marine Mammals: Beluga Whales (Hoguet 2013), Bowhead Whales (Hoekstra 2002, 2003, 2005) Humpback Whales (Elfes 2010) , Sea Otters (Jessup 2010, Kannan 2008, Bacon 1999), Sea Lion (Myers 2008, Barron 2003) , Walrus (Wiig 2000), Seals (Wang 2007, Loughlin 2002, Beckmen 1999) , Polar Bears (Kannan 2005, McKinney 2011a, Verreault 2005, McKinney 2011b, Bentzen 2008, Kucklick 2002)				

	Island, St. Lazaria Island (Vander Pol 2004) Hooper Bay, Noatak River delta, Ualik Lake, Shalak Island, Penny River delta, Middleton Island, Viesokol Rock (Vander Pol 2009) St. Lazaria Island, St. George Island, St. Lawrence Island, Cape Lisburne (Vander Pol 2011) Adak Island (Stout 2002) Yukon Flats NWR (Matz 2007) Yukon River Basin (Hinck 2006 and 2007) Arctic Coastal Plain, Cape Espenberg, Yujon-Kuskokwim Delta, Copper River Delta (Schmutz 2009) Yukon-Kuskokwim Delta (Wang 2005) Prudhoe Bay (Franson 2004) Schrader Lake (Wilson 1995) Copper River, Lower Fish Lake, Round Tangle Lake (Ewald 1998) Gulf of Alaska (de Brito 2002, Wang 2007) Schrader Lake (Gubala 1995) Elusive Lake, Schrader Lake, Feniak Lake, Desperation Lake (Allen-Gil	Birds: Seabirds (Ricca 2008), Murre eggs (Vander Pol 2004 and 2011), Gull eggs (Vander Pol 2009), Bald Eagles and eggs(Stout 2002, Anthony 1999 and 2007), Lesser Scaup eggs (Matz 2007, Fox 2005), Red-throated loon eggs (Schmutz 2009), Spectacled Eider eggs (Wang 2005), duck and eider eggs (Franson 2004), Eiders (Stout 2002) Zooplankton (Hoekstra 2002) Mussels (Reese 2012)				

	1997) Kodiak Island (Krummel 2008) Cook Inlet and Eastern Chukchi Sea (Hoguet 2013) St. Lawrence Island and Little Diomede Island (Wiig 2000) St. George Island and St. Paul Island (Loughlin 2002) St. George Island (Beckmen 1999) Beaufort, Chukchi, and Beaufort Seas (Kannan 2005, McKinney 2011, Verreault 2005, McKinney 2011b, Bentzen 2008) Northwest Alaska (Garbarino 2002)					
Toxaphene	Barrow (Hoekstra 2002 and 2003) Barrow and Kaktovik (Hoekstra 2002) Yukon River Basin (Hinck 2006 and 2007)	Fish (Hinck 2006 and 2007) Terrestrial Mammals: Arctic Fox (Hoekstra 2003) Marine Mammals: Bowhead whales (Hoekstra 2002) Zooplankton (Hoekstra 2002)	No	Yes - agriculture	Stay the same or decrease	Yes – No exceedances in Alaska to date

Table 2. Media previously used for air toxics monitoring in the Alaska.

Media	Which Air Toxics Can Be Measured?	Advantages	Disadvantages
Air (Active and Passive Air Sampling Devices)	• Pesticides • PCBs • Mercury	• Uniformly made • Can calculate atmospheric concentration directly • Active–accumulates episodic (24 hr) transport • Passive–accumulation over 1 to 12 month deployment periods	• 2 trips/sample–deploy and collect • Passive-low concentrations and samples only gas phase pollutants • Active–requires electricity
Vegetation (Lichen and Conifer Needles)	• Pesticides • PCBs • Mercury	• Part of terrestrial ecosystem • Conifer needles may be dated • High concentrations • Accumulation over life-span	• Cannot directly calculate an atmospheric concentration • Difficult to measure in matrix • Species differences in accumulation
Snow and Glacial Ice	• Pesticides • PCBs • Mercury	• Net deposition to ecosystem • Major route of deposition in Fall/Winter/Spring • Accumulation over snow accumulation period	• Low concentrations • Large volumes (50L) needed for low detection limits
Surface Water	• Pesticides • PCBs • Mercury	• Exposure route to aquatic organisms	• Very low concentrations • Large volumes needed (>50L or long SPMD exposure periods) for low detection limits • Accumulation over residence time of lake

Media	Which Air Toxics Can Be Measured?	Advantages	Disadvantages
Lake Sediment Cores	• Pesticides • PCBs • Brominate flame retardants • Mercury	• Historical and present day deposition comparison possible • Higher concentrations	• Difficult to collect • Must be dated
Surficial Lake Sediment	• Pesticides • PCBs • Brominated flame retardants • Mercury	• Easy to collect • Exposure route to aquatic organisms • Higher concentrations	• Mix of historical and present deposition (no dating)
Fish	• Pesticides • PCBs • Brominated flame retardants • Mercury	• Part of aquatic ecosystem • Higher concentrations • Fish consumption advisories for HUPs, some CUPs and Mercury • Standard methods and more routine measurement • Accumulation over organism life-span	• Variability in bioaccumulation due to species and ecosystem differences
Birds	• Pesticides • PCBs • Brominated flame retardants • Mercury	• Part of terrestrial and/or aquatic ecosystem • Blood is relatively easy to collect and can be measured for Mercury • Accumulation over organism life-span	• Potential for migration and exposure in different geographic locations • Variability in bioaccumulation due to species and ecosystem differences

Media	Which Air Toxics Can Be Measured?	Advantages	Disadvantages
Marine Mammals	• Pesticides • PCBs • Brominated flame retardants • Perfluorinated Chemicals • Mercury	• Part of marine ecosystem • Accumulation over organism life-span	• Potential for migration and exposure in different geographic locations • Variability in bioaccumulation due to species and ecosystem differences • Often relies on harvested or stranded animals
Terrestrial Mammals	• Pesticides • PCBs • Mercury	• Part of terrestrial ecosystem • Accumulation over organism life-span	• Potential for migration and exposure in different geographic locations • Variability in bioaccumulation due to species and ecosystem differences • Often relies on harvested or stranded animals

Table 3. Mercury health thresholds for humans and piscivorous wildlife used in WACAP (Schwindt 2008).

Species	**Mercury Concentration in Fish–wet wt**	**Source of Health Threshold**
Humans	300 ng/g fillet, 185 ng/g whole	USEPA
Piscivorous Wildlife	270 ng/g fillet, 150 ng/g whole	USEPA
Piscivorous Fish	~500 ng/g muscle, 200 ng/g whole	Beckvar et al., Dillon et al., Sandheinrich et al.
River Otter	100 ng/g whole 660 ng/g whole	Lazorchak et al. Hinck 2006
Mink	70 ng/g whole 210 ng/g whole	Lazorchak et al., Walters et al. Hinck 2006
Belted Kingfisher	30 ng/g whole 2 ng/g whole	Lazorchak et al., Walters et al. Hinck 2006
Bald Eagle	270 ng/g whole	Hinck 2006
Osprey	50 ng/g whole	Hinck 2006

Table 4. Contaminant health thresholds for humans (whole fish) used in WACAP and based on USEPA thresholds (Ackerman 2008)

Contaminant	Recreational Fishing*	Recreational Fishing*	Subsistence Fishing	Subsistence Fishing
	Cancer Threshold	Chronic Threshold	Cancer Threshold	Chronic Threshold
	ng/g ww	ng/g ww	ng/g ww	ng/g ww
alpha HCH	9.3		0.78	
gamma HCH (Lindane)	45	1800	3.8	150
HCB	37	4700	3.1	390
Dieldrin	3.7	290	0.31	25
Chlordanes	170	2900	14	250
ppDDE	170		14	
Chlorpyrifos		18000		1500
PBDEs		12000		990
Methoxychlor		29000		2500
Endosulfans		35000		3000
Dacthal		59000		4900

*Thresholds adjusted up (32%) accounting for contaminant loss from filleting/cooking.

Table 5. Contaminant health thresholds for piscivorous wildlife (whole fish) used in WACAP (Ackerman 2008).

POP	Species	Concentration in Fish–wet wt (ng/g)
Dieldrin	Mink	20
	River Otter	30
	Kingfisher	360
Chlordanes	Mink	830
	River Otter	1140
	Kingfisher	4.5
DDTs	Mink	360
	River Otter	490
	Kingfisher	20
PCBs	Mink	130
	River Otter	180
	Kingfisher	440

Table 6. Summary of non-lethal biomonitoring for toxics.

Animal	What was used	Toxics measured
Birds	Blood (Evers 2008, Bustnes 2013, Eulaers 2014, Goutte 2015, Franson 2004, Matz 2007)	Hg, Pesticides, PCBs, Flame retardants
	Feathers (Evers 2008, Eulaers 2014, Garcia-Fernandez 2013, Summers 2010, Eulaers 2014)	Hg, Pesticides, PCBs, Flame retardants, Perfluorinated chemicals
	Eggs (Evers 2008, Fox 2005, Franson 2004, Wang 2005, Schmutz 2009, Anthony 1999 and 2007, Matz 2007, Vander Pol 2004, 2009 and 2011, Christopher 2002, Day 2006)	Hg, Pesticides, PCBs
	Guano (Joshi 2013)	Pesticides
Terrestrial Mammals	Blood (Mateo 2012, Sonne 2014, Bentzen 2008)	Hg, Pesticides, PCBs, Flame retardants, Perfluorinated chemicals
	Hair (Jaspers 2010, D'Have 2006, Dunlap 2007, Lokken 2009)	Hg, Pesticides, PCBs, Flame retardants
	Adipose or liver tissue biopsy (Bentzen 2008, Allen-Gil 1997, Verreault 2005)	Hg, Pesticides, PCBs, Flame retardants, Perfluorinated chemicals
Marine Mammals	Blood (Nomiyama 2010, Beckmen 1999, Myers 2008, Jessup 2010)	Pesticides, PCBs
	Earwax (Robinson 2013, Trumble 2013)	Pesticides, PCBs, Flame retardants
	Biopsy (Elfes 2010, Wiig 2000)	Pesticides, PCBs
	Milk (Beckmen 1999)	Pesticides, PCBs