Sources of Environmental Contaminants

- **Local**
  - Natural Geologic sources, forest fires
  - Cities and Industrial production
  - Military Sites
  - Resource Extraction - mines, oil exploration

- **Long Range Transport**
  - Atmospheric
  - Ocean Currents
  - Animal migration
  - Commercial transport
Fish Monitoring Program:

- General Survey of Alaskan Fishes:
  - Commercial, Subsistence, Recreational species
  - Collaborative Effort for sample collection
    - Federal and State agencies, commercial, recreational and subsistence fish harvest

- Selected coastal sites:
  - Remote communities and villages
  - Adjacent to anthropogenic activities
    - cities, discharges/runoff
  - Historic mining sites
Evaluate Alaskan fish and invertebrates:

- Measure contaminant levels in skinless fillet and whole fish from freshwater, estuaries and marine environments

- **Data is used to:**
  - Determine if there are any areas, species, or contaminants that warrant more in-depth sampling and evaluation.
  - Provide Alaskan residents with information to make an informed dietary decision based on Risks and Benefits of eating Alaskan Fish

- **2014 Updated Fish Consumption Advice for Alaskans**
2014 FDA Testing of Alaskan Fish for Fukushima Radiation
2011 Initial Response

- Japan and International Agencies Monitor local discharges from the site:
  - Air, Water, Agricultural and Marine Products

- Primary concern:
  - Long Range transport by Atmospheric Transport

- Monitor Atmospheric Deposition
  - Collections Sites:
    - Across West Coast of the US,
    - Canada,
    - Alaska
Emergency Steps – Fukushima

- In 2011 state and federal agencies in Alaska issued joint press release indicating safety of wild foods
- Concerns remained of fish contaminated with Fukushima-related radiation
- State websites discussed radiation monitoring, exposure, and health risk
  - communicated safety of fish, air, water, etc.
  - media
Other Long Range Transport Concerns

- Migrating wildlife:
  - Birds
  - Fish
  - Marine mammal

- Ocean Currents:
  - Fish
  - Water
  - Marine Debris
Fukushima

- Initiated an interagency call with all Pacific states, Canada, federal agencies, tribal agencies, and academics
  - Compile public concerns
  - Compare biota and other media for radionuclides
- Worked with the FDA to test Alaska fish for radionuclides
- Communicated information via press releases, tribal calls, and citizen calls
- Continue to communicate information at conferences and conference calls
Fish Species

- FDA evaluation of species:
  - Important commercial species – consumption rate
  - Volume of harvest - economical
    - Two species of Tuna (Pacific Albacore, Pacific Bluefin)
    - North Pacific Salmon – from the Pacific Northwest

- Alaskan Species (> half of US catch from the North Pacific)
  - Commercial importance: consumption and harvest
    - Pollock 2 million metric tons
    - Pacific cod 65,000 metric ton
    - Sablefish 30,000-40,000 metric tons
    - Halibut 24.5 million pounds of
    - Salmon > 146 million fish
Fish: collection & analysis

- 20 Samples from Alaska
- Fish collected using FDA statistical protocols by ADEC Staff from commercial processors
- Composites samples (4 – 10 fish per sample) of 4 pounds
- FDA Winchester Laboratory – specialized lab
  - Testing of commercial foods- domestic, imports
  - FDA Standard analytical techniques
    - High resolution gamma spectrometry
Alaskan Radionuclide Monitoring

• **Selection of 8 Species of fish:**
  - Pollock, Cod, Halibut, Sablefish
  - Salmon: Chinook, Chum, Sockeye, Pink

• **4 regions covering Alaska Coastal Waters**
  - Aleutian Islands/Bering Sea
  - Bristol Bay
  - Gulf of Alaska
  - Southeast

• **Collection at start and at the end of 2014 fishing season**
Where were samples collected?

- Southeast Alaska
- Gulf of Alaska
- Bristol Bay
- Cook Inlet
- Prince William Sound
- Bering Sea
- Aleutian Islands

- North Pacific
- Halibut, Pollock, Cod
- Chinook, Sockeye
- Sablefish, Halibut, Pollock, Chum
- Halibut, Chinook, Chum, Pink
What was measured?

- **Cs-134 (Cesium)** (2-year half life – usually indicates fresh release)
- **Cs-137 (Cesium)** (30-year half life – can indicate old or fresh release)
- **I-131 (Iodine)**
- **K-40 (Potassium)**
### Results

- No detections of Fukushima-related radionuclides (I-131, Cs-134, Cs-137)
- Detections of only naturally occurring radionuclide Potassium-40 (K-40)

<table>
<thead>
<tr>
<th>Area</th>
<th>Species</th>
<th>I-131</th>
<th>MDC*</th>
<th>Cs-134</th>
<th>MDC*</th>
<th>Cs-137</th>
<th>MDC*</th>
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</thead>
<tbody>
<tr>
<td>Aleutian / Bering Sea</td>
<td>Pollock</td>
<td>ND</td>
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<td>Cod</td>
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</table>

*Minimum Detectable Concentrations = analytical detection limits
## Results

<table>
<thead>
<tr>
<th>Area</th>
<th>Species</th>
<th>I-131</th>
<th>MDC*</th>
<th>Cs-134</th>
<th>MDC*</th>
<th>Cs-137</th>
<th>MDC*</th>
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<tr>
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<td>Halibut</td>
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<td>1.94</td>
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<td>Chinook</td>
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<td>Pink</td>
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<td>10.61</td>
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<td>ND</td>
<td>2.05</td>
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</tbody>
</table>
Cs-137 and Cs-134 Not Detected

Derived Intervention Level (FDA Level of Concern) 1,200

Not Detected. Average Minimum Detection Concentration 1.9 Bq/kg
What are the risks?

Is the FDA DIL protective of subsistence or upper end fish consumers?

- We assumed
  - 273 pounds (124 Kg) consumption of a variety of fish over a 70-year period
  - Radionuclide level was at the limit of detection of FDA analytical method

- We found
  - Excess cancer risk = 1 - 10 cancers in every 10,000,000 persons exposed (i.e., very low)

There is no appreciable risk to Alaskans’ health from Fukushima-related radionuclides in Alaska Fish
### Marine Mammal Testing

<table>
<thead>
<tr>
<th>Sample</th>
<th>Location</th>
<th>Analysis Result</th>
<th>Bq/Kg dry weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ringed Seal</td>
<td>North Slope, AK</td>
<td>&lt;MDA</td>
<td>1.07</td>
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<tr>
<td>Bearded Seal</td>
<td>Little Diomede, AK</td>
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<td>Ringed Seal</td>
<td>Point Lay, AK</td>
<td>&lt;MDA</td>
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<tr>
<td>Ringed Seal</td>
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<tr>
<td>Ringed Seal</td>
<td>Shishmaref, AK</td>
<td>&lt;MDA</td>
<td>1.34</td>
</tr>
</tbody>
</table>

**Historical data (1996-97)** (Cooper et al., 2000)

<table>
<thead>
<tr>
<th>Sample</th>
<th>Location</th>
<th>Analysis Result</th>
<th>Bq/Kg dry weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bearded Seal</td>
<td>North Slope+Canada</td>
<td>Not analyzed</td>
<td>0.8</td>
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<tr>
<td>Ringed Seal</td>
<td>North Slope+Canada</td>
<td>Not analyzed</td>
<td>0.6</td>
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<tr>
<td>Spotted Seal</td>
<td>North Slope, AK</td>
<td>Not analyzed</td>
<td>1.23</td>
</tr>
</tbody>
</table>

Dasher et al., 2011
What about Water?

Wood’s Hole Crowd Sourcing efforts
• Collect a container of water, ship to California, get radiation test result for water
  • 5 Alaskan locations
    (St Lawrence Is., Kodiak Is., Cook Inlet, Seward, Prince William Sound)
  • Dozens of other locations, mostly from Pacific Coast
• Detection Limits
  • 0.1 Bq/m³ for 137Cs
  • 0.2 Bq/m³ for 134Cs
• EPA maximum acceptable level in drinking water = 7,400 Bq/m³
Water Results

- Nondetect for Cs-134
- Background levels for Cs-137
KelpWatch

- California researchers test kelp samples for radiation
  - Mostly samples from the Pacific Coast states, including Alaska
- Marine brown seaweeds are known to concentrate Cesium (Cs) and Iodine (I) into their tissues among many other elements.
  - *Macrocystis* tissue Cs levels are 20x that of its concentration in seawater
- If you send them a kelp sample, they will analyze it for free
KelpWatch
Results

- 80 samples with no detection for Cs-134 (sign of fresh release like Fukushima).
- Very Low detection of Cs-137 (old and new releases) – background
- Some samples had detectable I-131 – possibly from medical waste in California
Going Forward...

- No additional testing is planned at this time
- DHSS and ADEC continue to do public outreach & education
- Continued assessment of the situation
  - Federal agencies - NRC, NOAA, EPA, & FDA
  - Alaska state agencies - ASMI, DHSS, DF&G, NSB, DEC
  - Pacific States
  - Academic and Private Institutions
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Fish Consumption

Risks
- Contaminants
  - Mercury
  - Persistent Organic Pollutants
  - Other metals

Benefits
- Omegas-3 fatty acids
- Protein
- Selenium
- Numerous other nutrients
- Sport
- Culture
- Subsistence