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Science Panel Technology Conference

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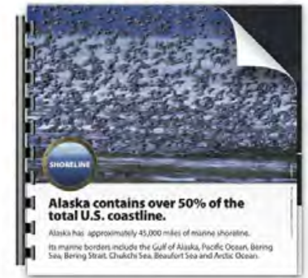

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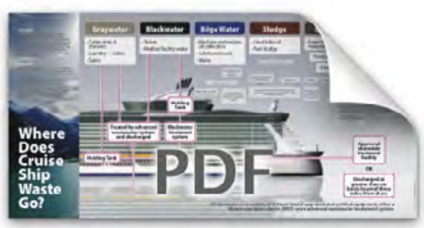


Where Does Cruise Ship Waste Go?

Questions & Answers

68.7% OF THE FRESH WATER ON EARTH IS TRAPPED IN GLACIERS.

ONLY 3% OF EARTH'S WATER IS FRESH WATER. 97% OF THE WATER ON EARTH IS SALT WATER.

A RUNNING TOILET CAN WASTE UP TO 200 GALLONS OF WATER PER DAY

WATER MAKES UP BETWEEN 55-78% OF A HUMAN'S BODY WEIGHT.

APPROX. 400 BILLION GALLONS OF WATER ARE USED IN THE UNITED STATES PER DAY.

AT 50 GALLONS PER DAY, RESIDENTIAL EUROPEANS USE ABOUT HALF OF THE WATER THAT RESIDENTIAL AMERICANS USE.

AMERICANS USE MORE WATER EACH DAY BY FLUSHING THE TOILET THAN THEY DO BY SHOWERING OR ANY OTHER ACTIVITY.

AMERICAN RESIDENTS USE ABOUT 100 GALLONS OF WATER PER DAY.

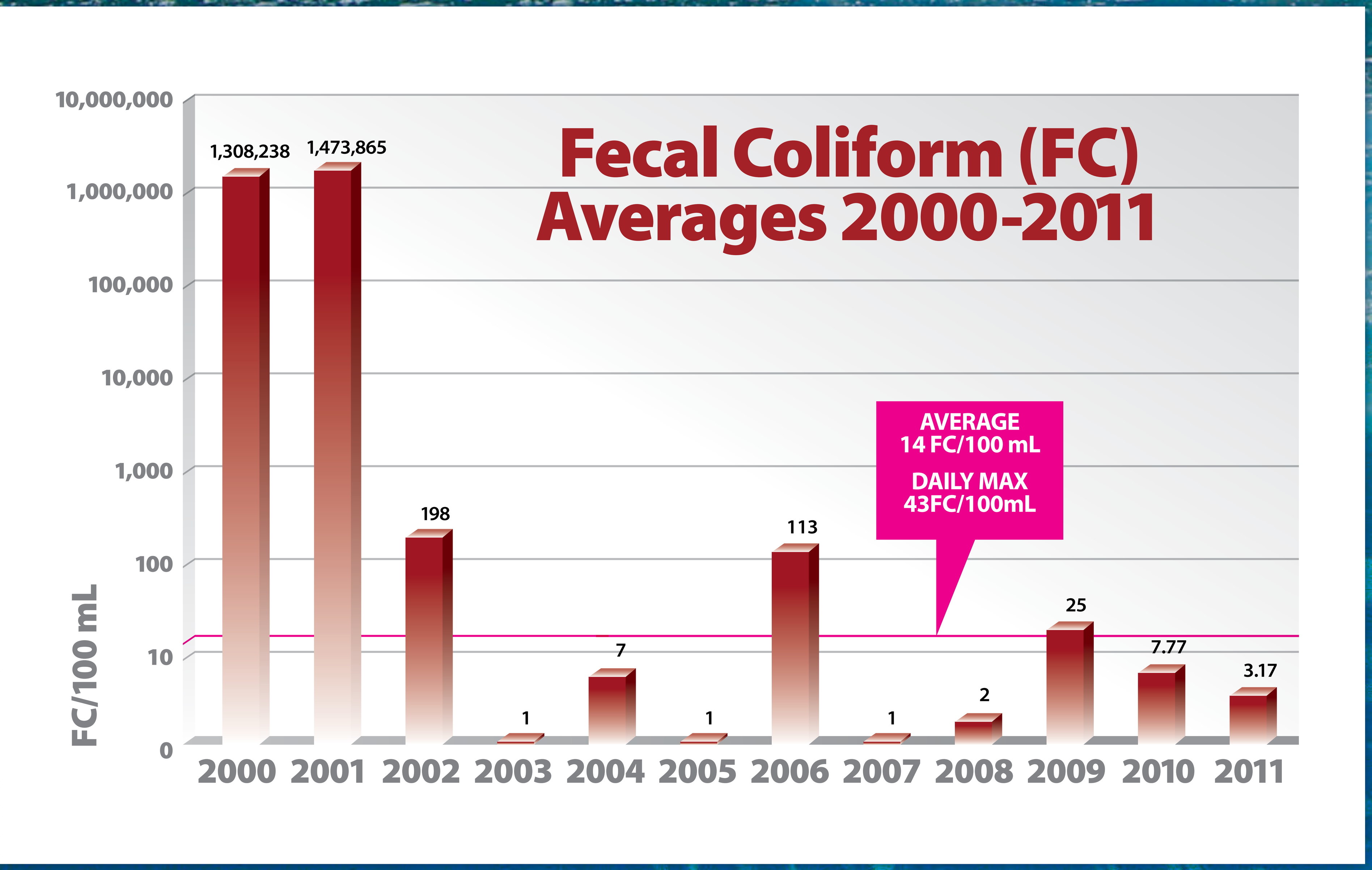
IT TAKES 7.5 YEARS FOR THE AVERAGE AMERICAN RESIDENCE TO USE THE SAME AMOUNT OF WATER THAT FLOWS OVER THE NIAGARA FALLS IN ONE SECOND (750,000 GALLONS).

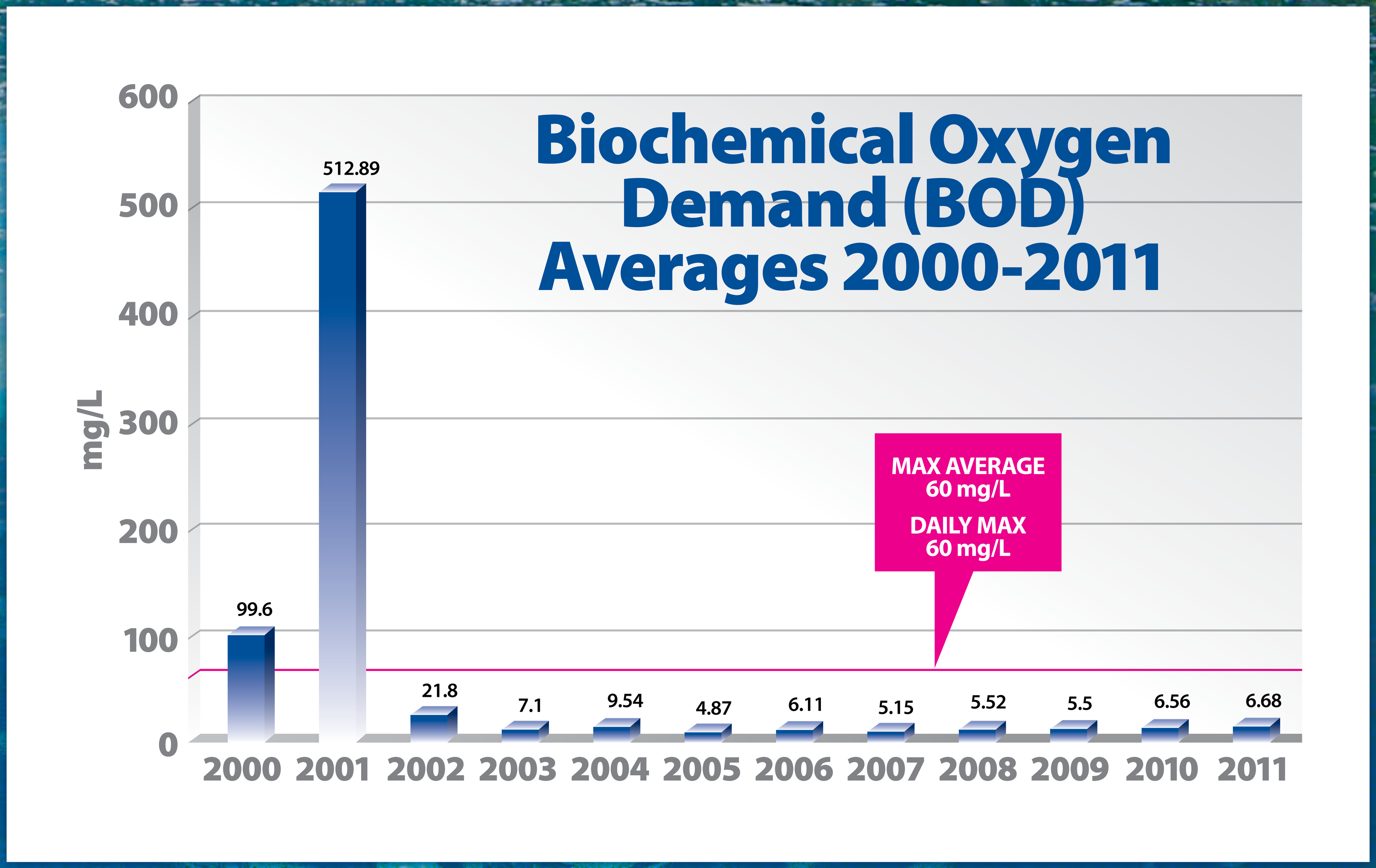
IT TAKES 6.5 YEARS FOR THE AVERAGE AMERICAN RESIDENCE TO USE THE AMOUNT OF WATER REQUIRED TO FILL AN OLYMPIC-SIZED SWIMMING POOL (660,000 GALLONS).

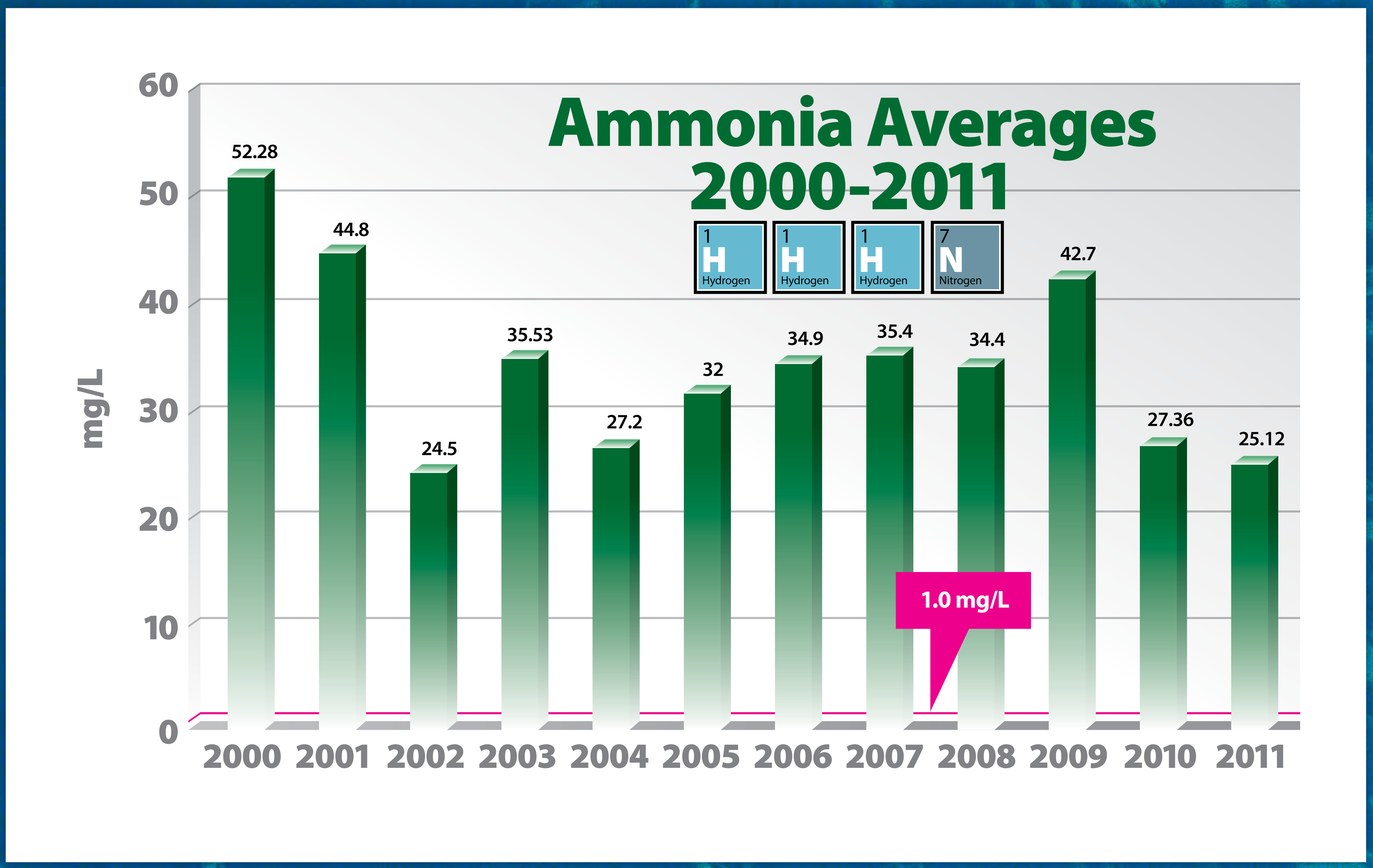
IN ONE YEAR, THE AVERAGE AMERICAN RESIDENCE USES OVER 100,000 GALLONS (INDOORS AND OUTSIDE).

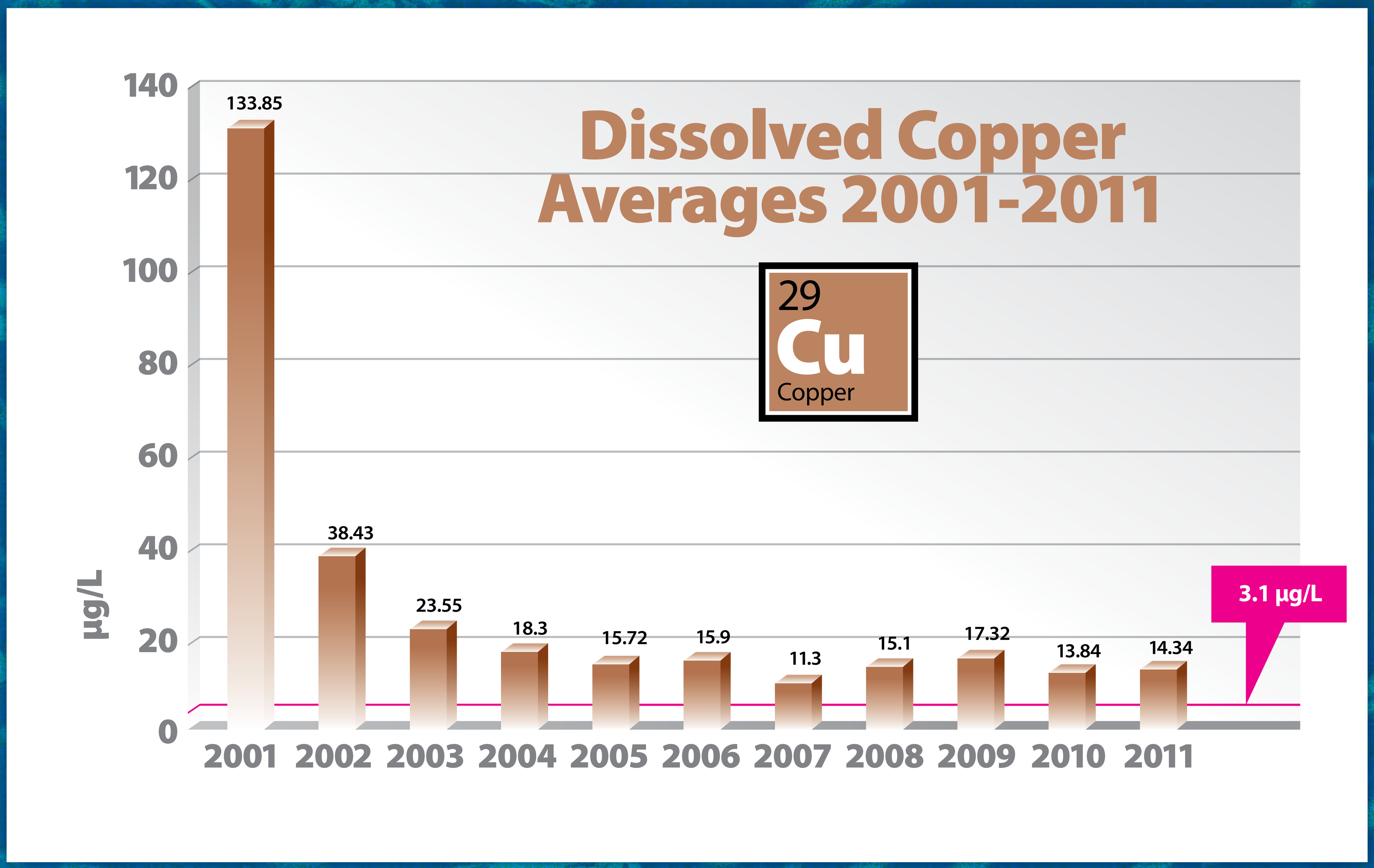
2000-2011 Averages

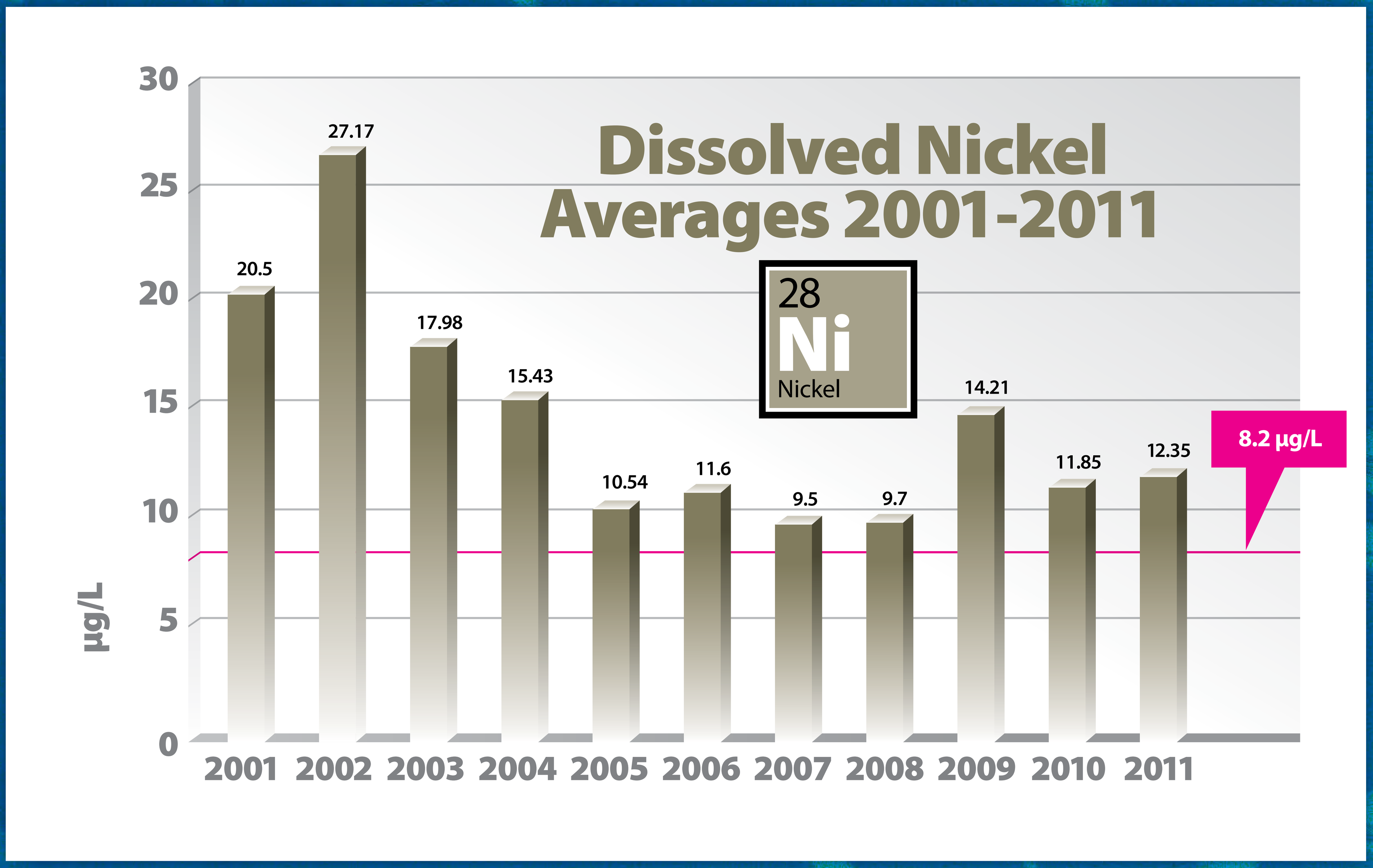
CONTAMINANTS OF CONCERN

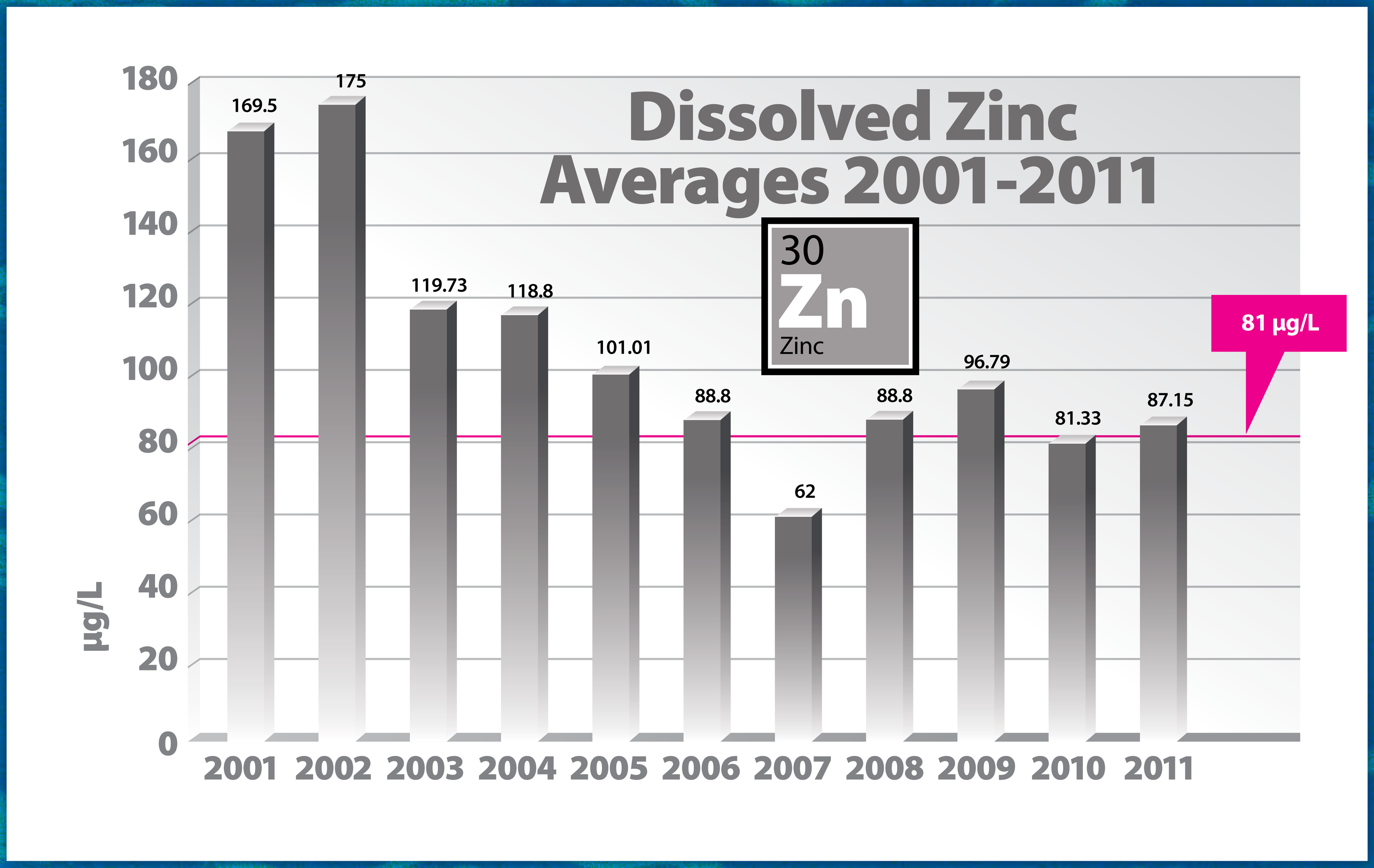












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In December 1999, Alaska Department of Environmental Conservation (DEC) convened a forum to review the cruise industry's waste management and disposal practices in Alaska.

DEC asked the U.S. Coast Guard (USCG), the U.S. Environmental Protection Agency (EPA), and the Southeast Conference (a group representing Southeast Alaska communities) to join industry representatives and local concerned citizens in a public discussion. This initial effort, along with subsequent follow-on work has become known as the Alaska Cruise Ship Initiative (ACSI).

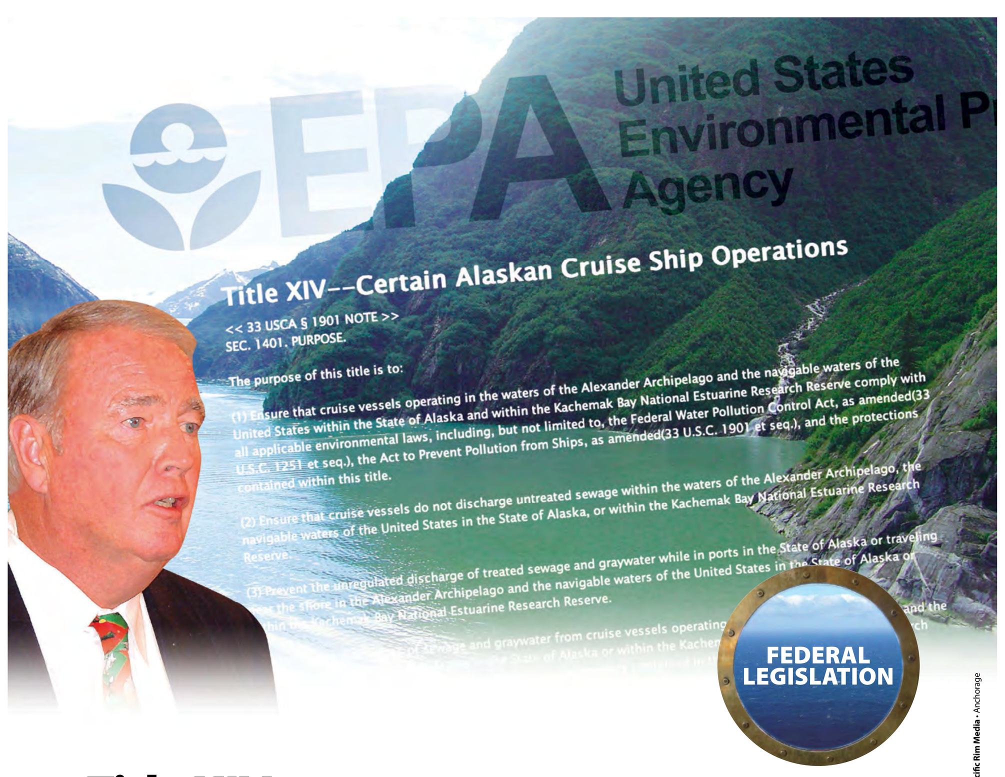
***"In short,** there are shocking and alarming results from the wastewater sampling conducted so far. This is the most significant finding to date. Treated blackwater exceeded federal standards for fecal coliform in 75% of the samples, and exceeded standards for total suspended solids in 86% of the samples.*

No ship tested to date has been in full compliance with all standards. In addition, graywater, which is not regulated by federal standards, also showed dramatically high levels of fecal coliform which it should not contain."

From DEC Commissioner Michele Brown's report to the Governor Sept. 2000

Title XIV ***"Certain Alaskan Cruise Ship Operations"***

Introduced by Senator Frank Murkowski, and passed by Congress December 21, 2000, this title applies to all cruise vessels authorized to carry 500 or more passengers for hire. It closed "Donut Holes" in Southeast Alaska and Kachemak Bay.



Title XIV ***"Certain Alaskan Cruise Ship Operations"***

Introduced by Senator Frank Murkowski, and passed by Congress December 21, 2000, this title applies to all cruise vessels authorized to carry 500 or more passengers for hire. It closed "Donut Holes" in Southeast Alaska and Kachemak Bay.

SEC. 1404. LIMITATIONS ON DISCHARGE OF TREATED SEWAGE OR GRAYWATER.

(a) No person shall discharge any treated sewage or graywater from a cruise vessel into the waters of the Alexander Archipelago or the navigable waters of the United States within the State of Alaska or within the Kachemak Bay National Estuarine Research Reserve unless,

(1) the cruise vessel is underway and proceeding at a speed of not less than six knots;

(2) the cruise vessel is not less than one nautical mile from the nearest shore, except in areas designated by the Secretary, in consultation with the State of Alaska;

(3) the discharge complies with all applicable cruise vessel effluent standards established pursuant to this title and any other applicable law; and

(4) the cruise vessel is not in an area where the discharge of treated sewage or graywater is prohibited.

July 2001 **Commercial Passenger Vessel Environmental Compliance (Cruise Ship) Program was established by AS 46.03.460 - AS 46.03.490**

- Wastewater sampling
- Enforcement of standards
- Ship record keeping of wastes
- Additional scientific study

LAW

	2001 Alaska State	2000 Federal
Number of overnight passengers	50+	500+
DISCHARGE LIMITS	One mile from shore @ minimum six knots	
	BLACKWATER & GRAYWATER	BLACKWATER ONLY
Fecal Coliform/100 mL	200	200
Total Suspended Solids (TSS)/mg/L	150	150
DISCHARGE LIMITS	Continuous discharge (in port)	
	BLACKWATER & GRAYWATER	BLACKWATER ONLY
Fecal Coliform/100 mL	Refers to Federal Law	20
Chlorine (mg/L		10
Total Suspended Solids (TSS)/mg/L		30

Environmental Provisions

- Vessel Tracking
- Ocean Rangers
- Wastewater Discharge Permit

Other Provisions

- $46 head tax
- Tax on cruise ship gambling
- Disclosure requirements for the on-ship promotion of shore-based business
- Change in cruise ship corporate income tax calculation

Because cruise ships were not able to meet WQS at the point of discharge for ammonia, and dissolved copper, dissolved nickel and dissolved zinc, the permit contained interim effluent limits for 2008 and 2009.

The interim limits were designed to allow ships to discharge in Alaska while providing them additional time to meet the new effluent limits (WQS at the point of discharge) by 2010.

- Required DEC to issue new permit for 2010
- Limits may be less stringent than WQS if ships are using "technologically effective and economically feasible treatment options"
- Effluent limits are based upon the manufacture of the treatment system. There are separate limits for continuous and underway discharges.

LETTER FROM THE COMMISSIONER

"The Alaska Department of Environmental Conservation (DEC) is recruiting experts in existing and emerging wastewater treatment technology to serve on a science advisory panel. The volunteer panel will look at current and innovative wastewater technologies and evaluate installation and economic issues associated with the application of these technologies on cruise ships.

I look forward to receiving the findings of this science advisory panel. The panel's work will inform DEC reporting to the Legislature and influence future policy decisions."

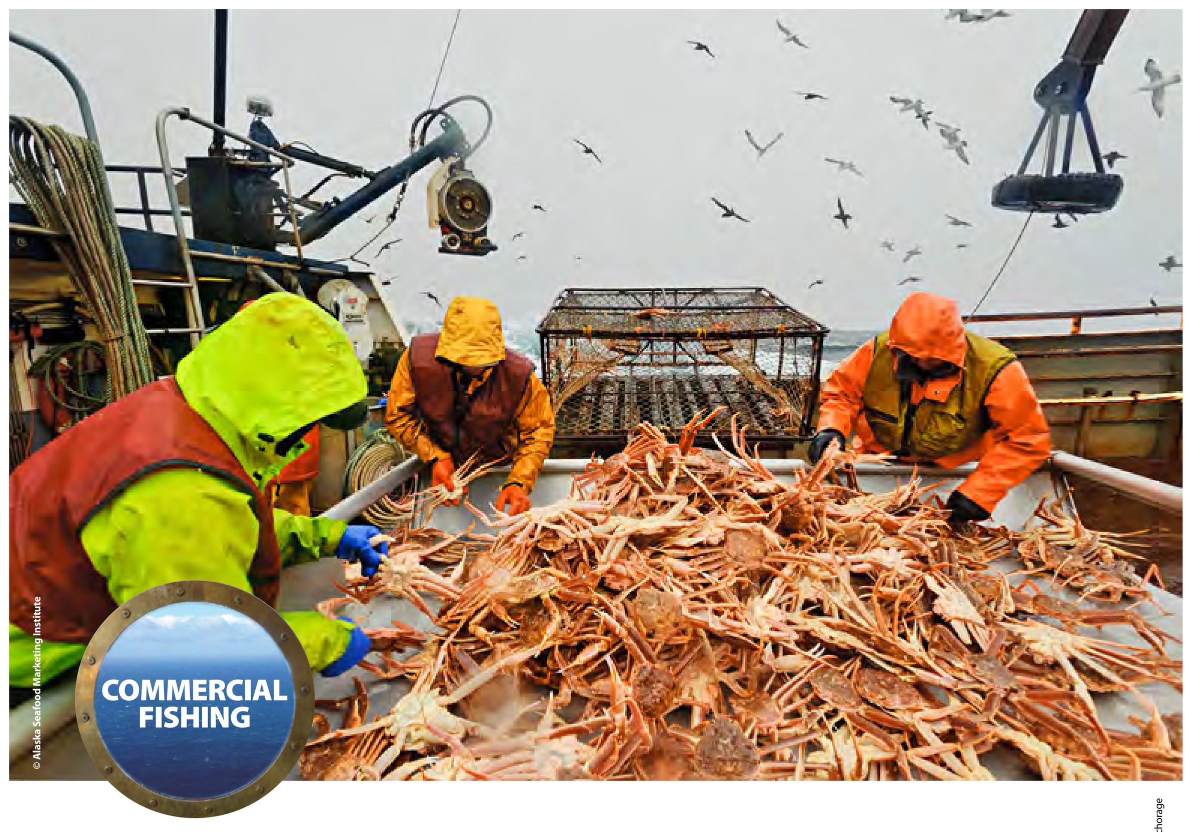
LARRY HARTIG - COMMISSIONER

Alaska contains over 50% of the total U.S. coastline.

Alaska has approximately 45,000 miles of marine shoreline.

Its marine borders include the Gulf of Alaska, Pacific Ocean, Bering Sea, Bering Strait, Chukchi Sea, Beaufort Sea and Arctic Ocean.

Alaska's marine waters are among the most productive ecosystems on Earth



Alaska's waters support the largest fisheries in the United States.

Over half the total U.S. production — 4.35 billion pounds of seafood, providing approximately $1.6 billion to fisherman and a wholesale value of $3.6 billion.

The seafood industry is the largest private sector employer in the state.

Alaska's seafood industry contributes 89,915 jobs to Alaska's economy.

The 2010 salmon season was one of the best on record.

Almost 170 million fish were harvested in Alaska; the 11th highest number since statehood.

Visitor Industry Spending

October 2008-September 2009

Visitor spending	$1.5 billion
Cruise line spending, cruise line labor income, and crew spending	$328.4 million
Air and ferry tickets	$282.2 million
Total spending	$2.1 billion

Economic Impact of Sportfishing in Alaska

In 2007, 475,534 resident and nonresident licensed anglers spent nearly $1.4 billion on licenses, stamps, and fishing related expenditures in Alaska. Angler spending resulted in economic activity that supported 15,879 jobs in Alaska, provided $545 million of income, and resulted in $123 million in state/local tax revenues.

There are many subsistence salmon fisheries in Prince William Sound, Southeast Alaska and Yakutat (outside of the Juneau and Ketchikan non-subsistence use areas). Halibut may be harvested by residents of rural communities through the Federal subsistence halibut program. Other subsistence fisheries include herring spawn-on-kelp, shellfish and groundfish. In addition, eulachon, Dolly Varden, trout, and smelt are all taken for subsistence purposes in Southeast Alaska.

The volume of treated wastewater discharge varies from vessel to vessel.

It ranges from a minimum of 91,711 gallons per day (approximately 366 cubic meters/day) to a maximum of 330,000 gallons per day (approximately 1,250 cubic meters per day).

Do Alternatives result in Cruise Ships meeting WQS in Alaska Waters?

	Alternative	Technologically Effective?[1]	Environmental Benefit
Pollution Prevention	• Implement pollution prevention methods	• No • Methods may improve effluent quality, but not to WQS	
Pollution Control	• Hold all effluent for discharge outside State waters	• Yes • Standard current practice for some ships	• No overall environmental benefit; wastewater discharged to marine environment in different location • Some require increased fuel consumption and raise carbon emissions • Could result in lower volumes of wastewater being treated
	• Treat and discharge selected waste streams within State waters and hold others for discharge outside State waters	• Potentially • Standard current practice for some ships • Treating and discharging select graywater wastestreams could potentially result in meeting WQS for ammonia	
	• Discharge wastewater to municipal wastewater treatment plants	• No • Would not result in improved effluent quality	
Pollution Treatment	• Replace AWTS with new systems	• No • No systems were identified that currently meet WQS	• Panel determined there is no environmental benefit of treatment above and beyond that which current advanced wastewater treatment systems provide
	• Install add-on technologies, such as Ion Exchange or Reverse Osmosis, to remove ammonia and dissolved metals from treated effluent	• Unknown • Potential treatment technologies exist • Extensive testing by developers needed to identify feasible applications that can be operated on-board and consistently meet WQS	
	• Discharge treated effluent to an on-shore facility that treats effluent to WQS at point of discharge	• Unknown • There are no known systems under development • Presents significant logistical issues, such as who would build, own, and operate facilities	

[1] Technological effectiveness defined as: *"alternative will cause effluent to meet WQS at point of discharge within State waters"*

WQS = Water Quality Standards
AWTS = Advanced Wastewater Treatment

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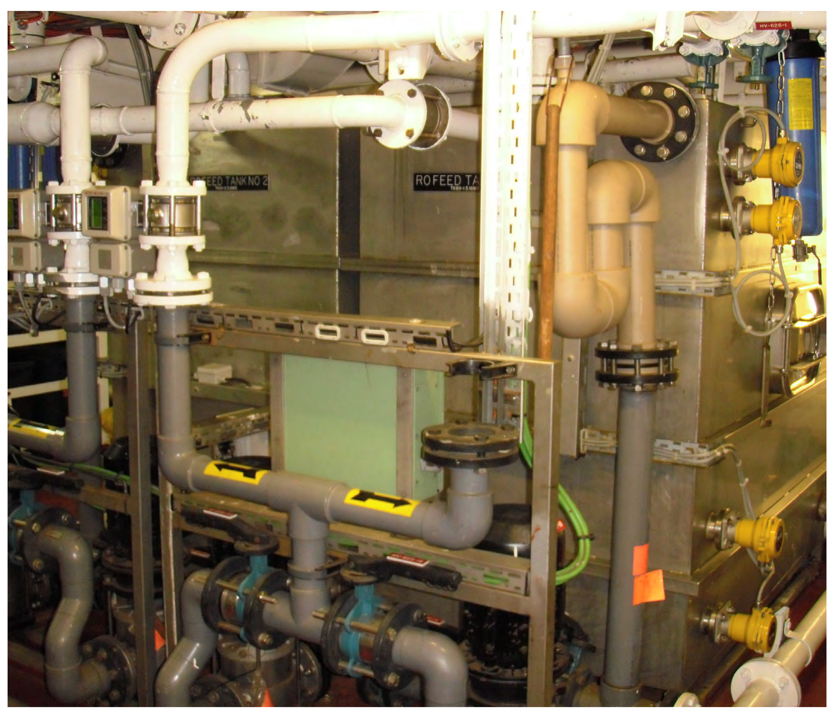
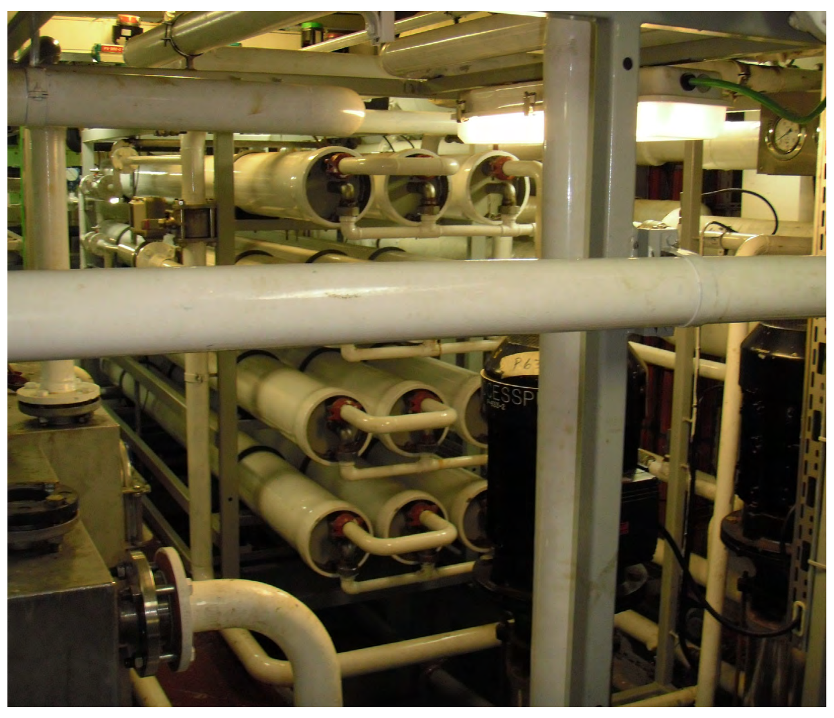
AWTS Technologies

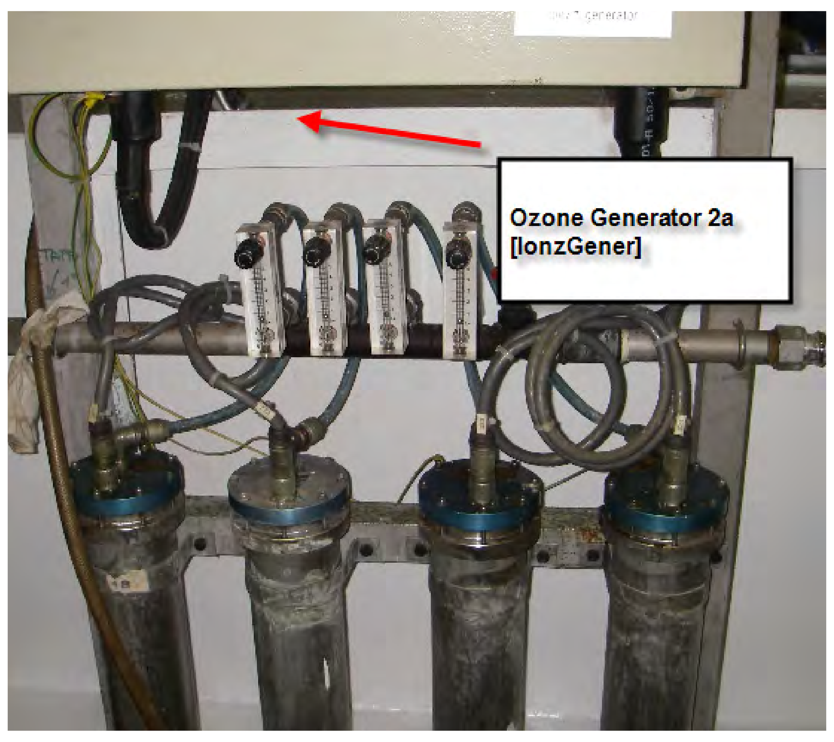
USED ON VESSELS IN 2008 TO 2012 DISCHARGING IN ALASKA FOR SHIPBOARD WASTEWATER TREATMENT

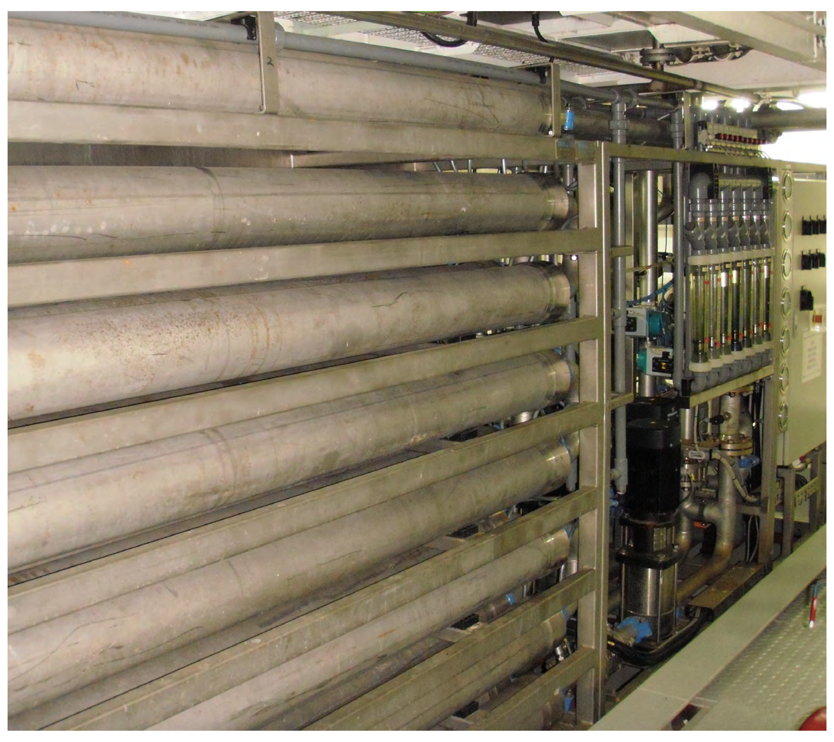
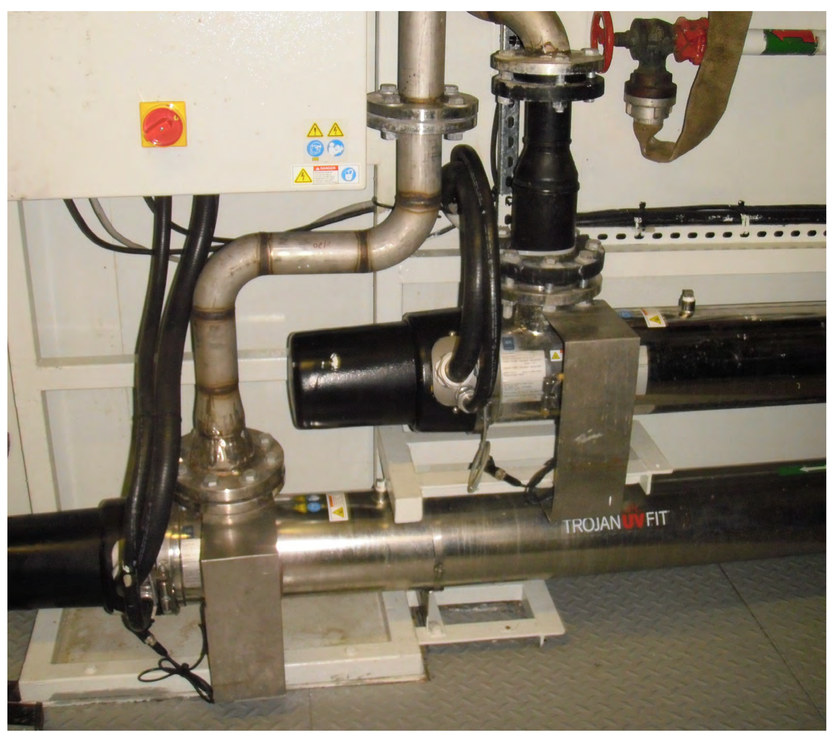
AWTS	Treatment			Disinfection	Vessels in 2008	Vessels in 2009	Vessels in 2010	Vessels in 2011	Vessels in 2012
	Primary *Primary Solids Separation*	Secondary *Microbial Oxidation*	Tertiary *Clarification*						
Hamworthy Bioreactor	Screen Press	Aerobic Biological Oxidation (Membrane Bioreactor)	Ultrafiltration Membranes	UV	9	9	7	7	9
Scanship	Wedgewire Screen	Aerobic Biological Oxidation (Moving Bed Bioreactor)	Dissolved Air Flotation (DAF)/ Polishing Filter	UV	3	4	3	3	3
Zenon	Coarse Screen	Aerobic Biological Oxidation (Membrane Bioreactor)	Ultrafiltration Membranes	UV	5	3	4	3	3
Rochem	Vibratory Screens	Low Pressure Reverse Osmosis (LPRO)	Reverse Osmosis Membranes	UV	1	1	1	1	1
Marisan 250	Coarse Screen	Chemical Coagulation	Dissolved Air Flotation (DAF)/ Microfiltration	Ozone	1	1	1*	1*	1*
Triton	Screening	Aerobic Biological Oxidation (Membrane Bioreactor)	Ultrafiltration Ion Exchange	UV	0	0	0	1	0
Hydroxyl Cleansea	Coarse Drum Filter	Aerobic Biological Oxidation (Moving Bed Bioreactor)	Dissolved Air Flotation (DAF)/ Polishing Filter	UV	1	0	0	0	0
Rochem Bio-Filt	Vibratory Screens	Aerobic Biological Oxidation (Membrane Bioreactor)	Ultrafiltration Membranes	UV	1	0	0	0	0

* Permitted to discharge but did not discharge





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Cruise Ship vs. Municipal Wastewater Treatment Plant Limits

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Monthly Bacterial Effluent Limits

	Fecal Coliform (per 100ml)[1]
Large Cruise Ship	14
Juneau-Douglas	400
Sitka	1,000,000
Skagway	1,000,000

[1] All municipal limits are monthly arithmetic averages. The cruise ship limit is a geometric mean.

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Daily Effluent Limits for Contaminants of Concern [1]

	Chronic WQS	Large Cruise Ship (Permit limits for stationary discharge)	Large Cruise Ship (Permit limits for discharge when moving)	Juneau-Douglas	Sitka	Skagway
Ammonia (mg/L)	1	12 to 28	12 to 143	No Limit. (Max Result = 11)	No limit. (Max Result = 22)	No Limit. (Max Result = 21)
Copper (ug/L)[2]	3.1	10 to 87	10 to 157	No Limit. (Max Result = 44)	354	210
Nickel (ug/L)	8.2	10 to 63	10 to 63	No Limit. (Max Result = 5.95)	No limit.	No Limit.
Zinc (ug/L)	81	112 to 395	112 to 395	No Limit. (Max Result = 82.7)	No limit.	No Limit.

[1] When there is no permit effluent limit, the maximum result from Discharge Monitoring Reports (DMRs) evaluated from January 2008 – June 2010 is provided for context. In some instances however, there are neither effluent limits nor requirements to provide monitoring data.

[2] Cruise ship effluent limits are for dissolved copper. The municipal effluent limits are for total recoverable copper.

Panel Preliminary Findings

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I **AWTS were designed to meet required criteria** for conventional pollutants and are the most advanced, technologically effective, and proven treatment systems in Alaska, the best technology available, especially compared to municipal treatment plants discharging to marine waters. Aquatic organisms, including fish and marine mammals, are protected through the cruise ship General Permit and effluent from existing AWTS generally meet these permit limits.

II **After evaluating all AWTS currently installed on cruise ships** operating in Alaskan waters, the Panel found that none of those treating mixed blackwater and graywater consistently meet Alaska's the WQC at the point of discharge for the constituents of concern (ammonia and dissolved copper, nickel, and zinc).

III **A dilution model and dye studies predicted concentrations lower than WQC would be attained rapidly following AWTS discharge** suggesting that acute and chronic exposures would not occur. Similarly, dilution modeling is used for permitting other wastewater discharges.

IV **The Panel was unable to identify technologically effective and economically feasible treatment methods,** expected to consistently meet the numeric water quality criteria at the point of discharge, that have been proven on cruise ships. Application of existing technologies in addition to AWTS, such as Nitrification, Ion Exchange (IX) and Reverse Osmosis (RO), is expected to further reduce ammonia and dissolved metal concentrations. In addition to adapting and combining existing technologies, modifying operational procedures and overall elevation of AWTS operations with additional staff and training appear to be strategies that will reduce effluent concentrations of ammonia and dissolved copper, nickel, and zinc.

V **Adaptation of emerging technologies from other industries to cruise ships presents significant feasibility challenges.**

VI **The Panel identified little additional environmental benefit to be gained by lowering the current permitted effluent limits to WQC at the point of discharge.**

VII **This panel recommends continued sampling and monitoring of cruise ship effluent.**

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Science Advisory Panel

Mark Buggins

An environmental superintendent of a coastal Alaska city for over 20 years, Mr. Buggins manages and supervises operations and maintenance of municipal water and wastewater utilities for an isolated island community of 8,800.

He is responsible for applying for NPDES wastewater permits, reporting and compliance, as well as upgrades to the wastewater treatment plant. He is certified by the State in Water and Wastewater treatment. Mr. Buggins filled the legislatively mandated coastal community domestic wastewater management seat on the Panel.

Kenneth J. Fisher, P.E.

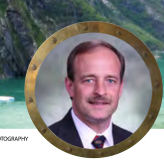

PHOTO: NELSON'S PHOTOGRAPHY

U.S. Public Health Service Engineer Officer who serves as the Senior Representative to the State of Alaska with the Environmental Protection Agency's, Alaska Operations Office, Captain Fisher brings a broad federal, state, tribal, and international background with 26 years of professional engineering, national program management, and senior legislative experience.

His diverse work experiences have taken him from Michigan to Africa, throughout Alaska, Arizona, California, Nevada, Washington D.C., and now back to Alaska. He has worked within both the legislative and executive branches of government.

Reinaldo A. González, Ph.D

An environmental engineer with more than 30 years experience managing water and wastewater projects, Dr. González was part of the team that investigated technologies that are able to meet Alaska water quality standards at land-based facilities and potential ways of adapting these technologies to cruise ships.

He presented his findings at the DEC sponsored technology workshop that was held on February 18, 2009.

Juha Kiukas

As managing director for a firm specializing in Marine Environmental Consulting to wastewater treatment system suppliers and cargo, ferries, and cruise ships operators, Mr. Kiukas has experience with research and development of advanced wastewater treatment systems.

He is familiar with conventional and innovative shipboard and land-based wastewater treatment technologies.

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Science Advisory Panel

Lincoln Loehr

An oceanographer employed in the law firm of Stoel Rives LLP in Seattle as an Environmental Compliance Analyst, his specialty is permitting of municipal and industrial wastewater discharges, and reviewing and commenting on regulatory developments related to such permitting.

Mr. Loehr also served on the first Alaska Cruise Ship Wastewater Discharges Science Advisory Panel in 2001-2002. Mr. Loehr filled the legislatively mandated cruise ship industry seat on the Panel.

Michelle Ridgway

A marine ecologist with over 25 years field research experience in Alaskan seas, Ms. Ridgway is the owner of Oceanus Alaska Marine Ecological Services. She is the co-founder of the non-governmental organization (NGO) Alaska Deep Ocean Science Institute.

She is a longstanding member of the Alaska Marine Conservation Council and networks with ocean-focused NGO organizations throughout Alaska. Ms. Ridgway filled the legislatively mandated NGO seat on the Panel.

Bert Sazon

A Senior Marine Inspector in Sector Juneau's Vessel Inspections Division, Mr. Sazon has worked for the U.S. Coast Guard for thirty-plus years, first on active duty, then as a civilian. He served in the engineering departments of several Coast Guard cutters before transitioning into Marine Inspections.

For the last eight years, he has served as an expert in both Federal and International regulations governing ships' wastewater discharge. He oversees wastewater compliance for the 30+ large cruise ships that visit Southeast Alaska annually.

Simon Véronneau, Ph.D.

Dr. Véronneau is an associate researcher at the HEC Montreal Supply Chain Research Group as well as at the inter-university research center on enterprise networks, logistics and transportation (CIRRELT) , Dr. Véronneau is a noted researcher on the cruise ship business. He holds a doctorate in operations management and a Chief Mate Foreign Going license.

He has practical experience as a senior officer onboard cruise ships, which includes sailings in Alaska. He has authored a number of book chapters and peer refereed science journal articles on cruise ship operations management and economics.

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Science Advisory Panel

Thomas Weigend

A naval architect who is member of the executive board and heads the Sales and Design Department of Meyer Werft, a German cruise ship design and construction company.

Mr. Weigend's firm specializes in constructing cruise vessels equipped with advanced wastewater treatment systems.

Steve Reifenstuhl

A fisheries professional serving as executive director for a fisheries conservation alliance, Mr. Reifenstuhl has worked as fleet manager for a large seafood company, operations manager for an aquaculture company, and a fisheries biologist for the U.S. Forest Service.

Mr. Reifenstuhl filled the legislatively mandated commercial fishing industry seat on the Panel.

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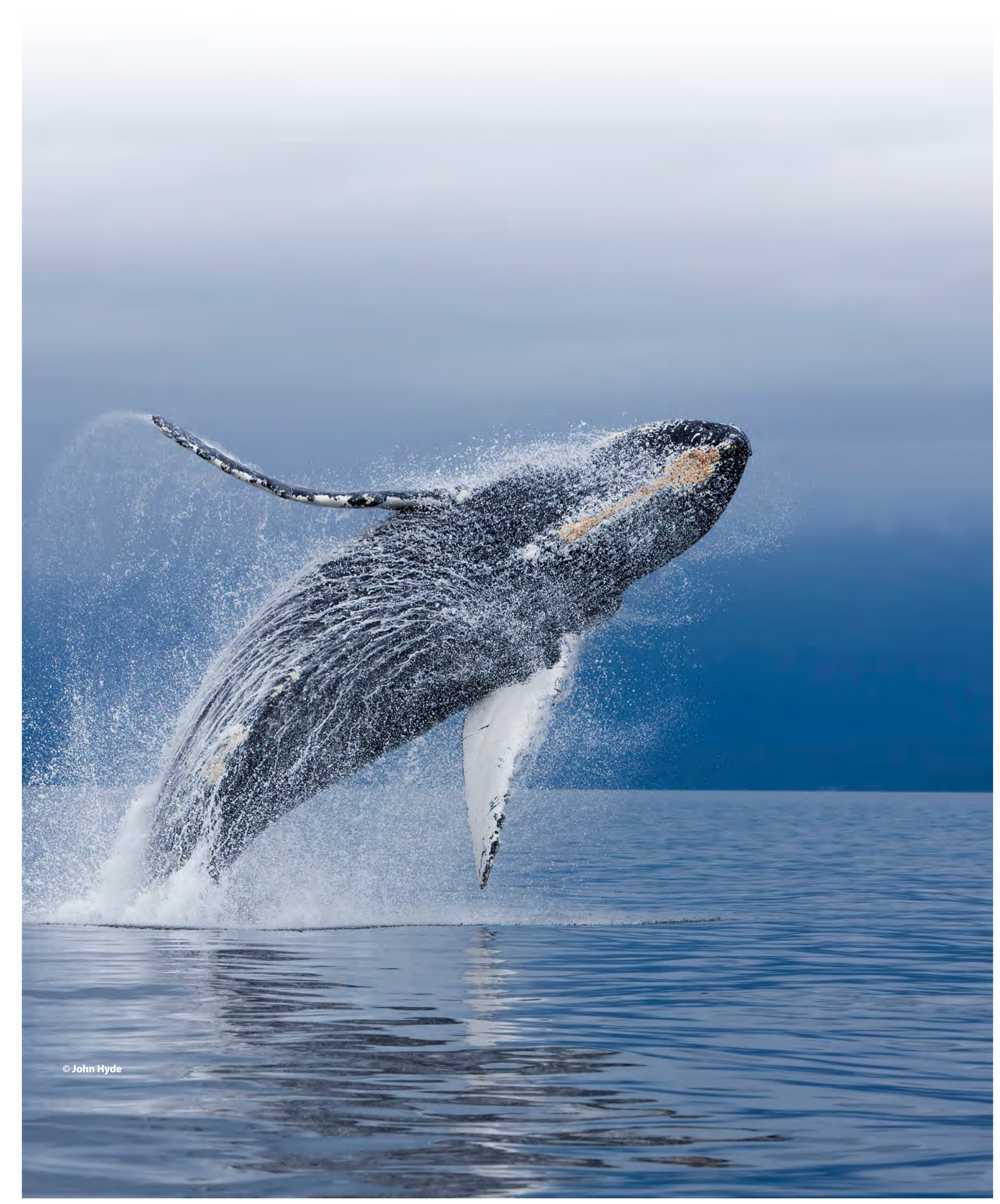
Silke Schiewer, Ph.D.

An associate professor in the Department of Civil and Environmental Engineering at the University of Alaska Fairbanks, Dr. Schiewer holds a doctorate in bio-environmental chemical engineering from McGill University.

Her current research centers on membrane processes for water and wastewater treatment, bioremediation of contaminated soils, and biosorption of heavy metals.



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Water Quality Standards

I. The Alaska water quality standards (WQS) are found in the state's regulations at 18 AAC 70.

II. WQS include implementation tools including mixing zones, site-specific criteria, and allowances for compliance schedules.

III. The Alaska numeric water quality criteria (which are commonly referred to as Water Quality Standards or WQS) for contaminants such as ammonia, copper, nickel, and zinc are derived from EPA's National Recommended Water Quality Criteria.[1]

IV. The acute WQS are based upon short-term exposure (e.g. 1 hour or 24 hour exposure) while chronic WQS are based upon longer term (e.g. 4 day) exposure.

V. It requires a higher concentration to cause an acute effect (e.g. death) than a chronic effect (e.g. respiratory problem).

VI. The wastewater discharged from cruise ship AWTS generally meets most requirements, with the exceptions of chronic WQS at the point of discharge for ammonia and dissolved copper, nickel and zinc. Therefore, the Science Advisory Panel focused on those four contaminants as "constituents of concern."

VII. **The chronic WQS for the constituents of concern are:**

	NH^3 AMMONIA (1 H Hydrogen, 7 N Nitrogen, 1 H Hydrogen, 1 H Hydrogen)	28 Ni Nickel	29 Cu Copper	30 Zn Zinc
	(mg/L)[2]	(µg/L)	(µg/L)	(µg/L)
Chronic water quality criterion	**1.0**	**3.1**	**8.2**	**81.0**

[2]Based upon a temperature of 10 to 15 degrees Celsius, 20 parts per thousand salinity, and a pH of 8.2

[1]For extensive EPA water quality data, visit: water.epa.gov/scitech/swguidance/standards/current/upload/nrwqc-2009.pdf

Application of WQS to Permitting

I. The permits for some Alaskan municipal discharges to marine waters have limits for copper. None require effluent limits for ammonia, nickel or zinc.

II. Most municipal dischargers to marine water are not required to monitor nickel or zinc.

III. No municipal wastewater treatment plant in Alaska that discharges to the marine waters meets WQS at the point of discharge for ammonia or dissolved copper.

IV. The permits for these municipal dischargers in Alaska include a mixing zone — a defined area where dilution of discharge with receiving water is allowed and numeric criteria may be exceeded.

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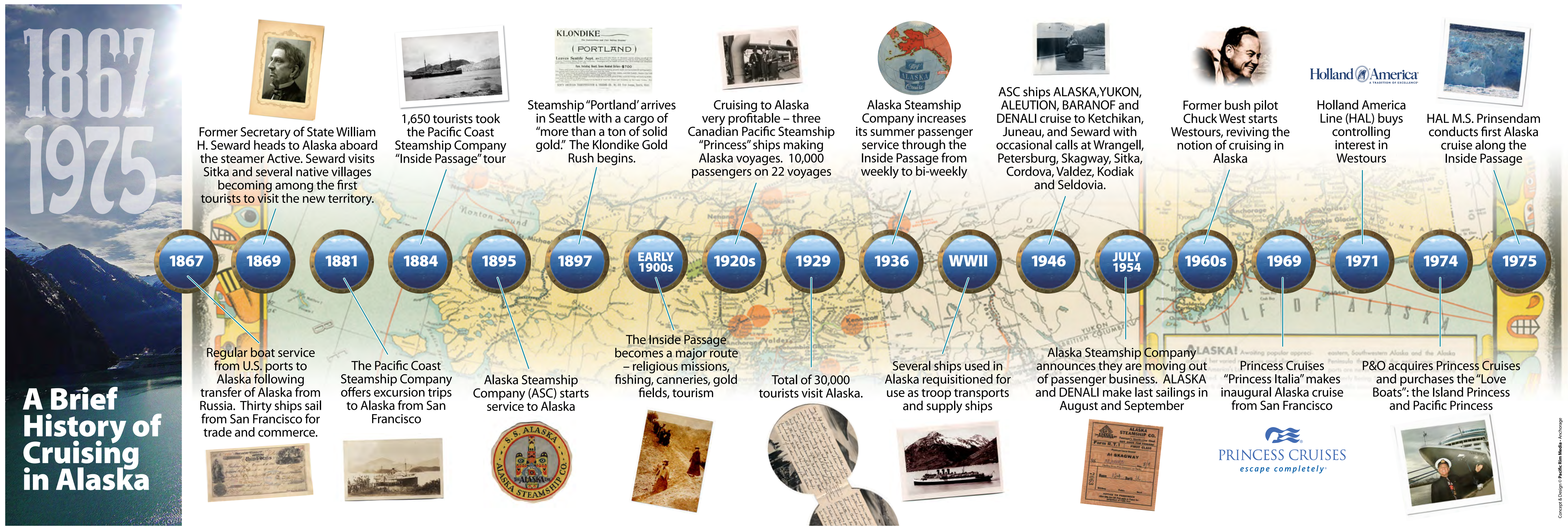

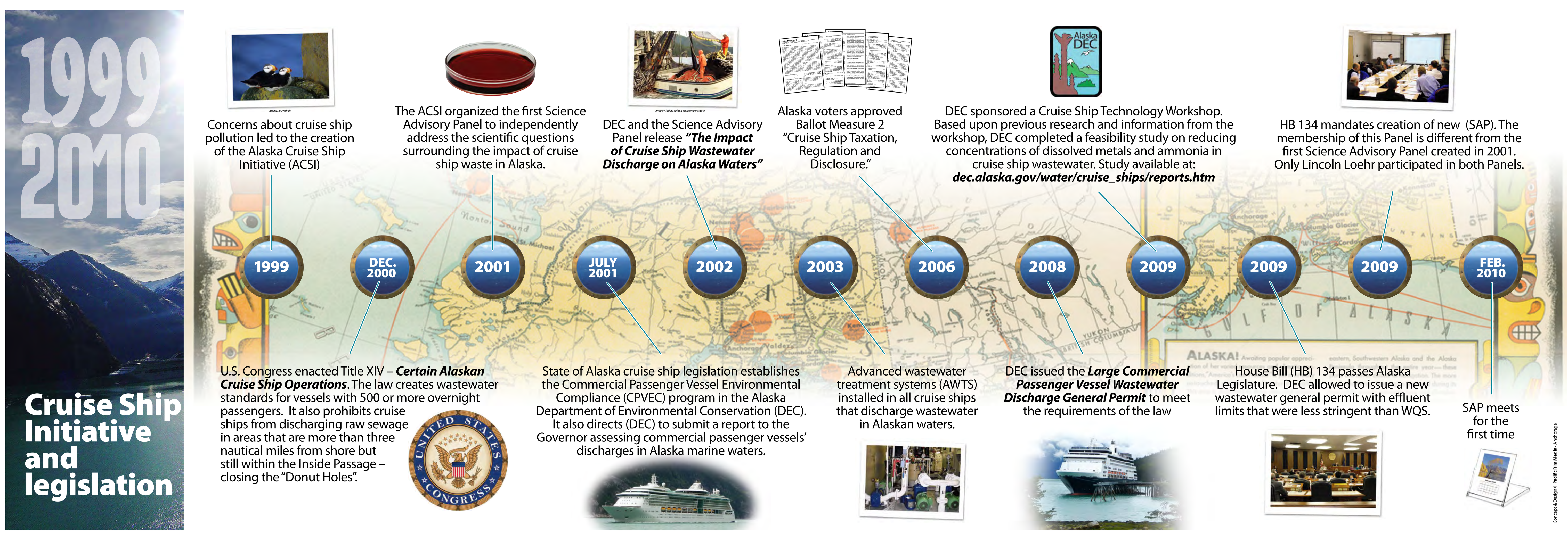

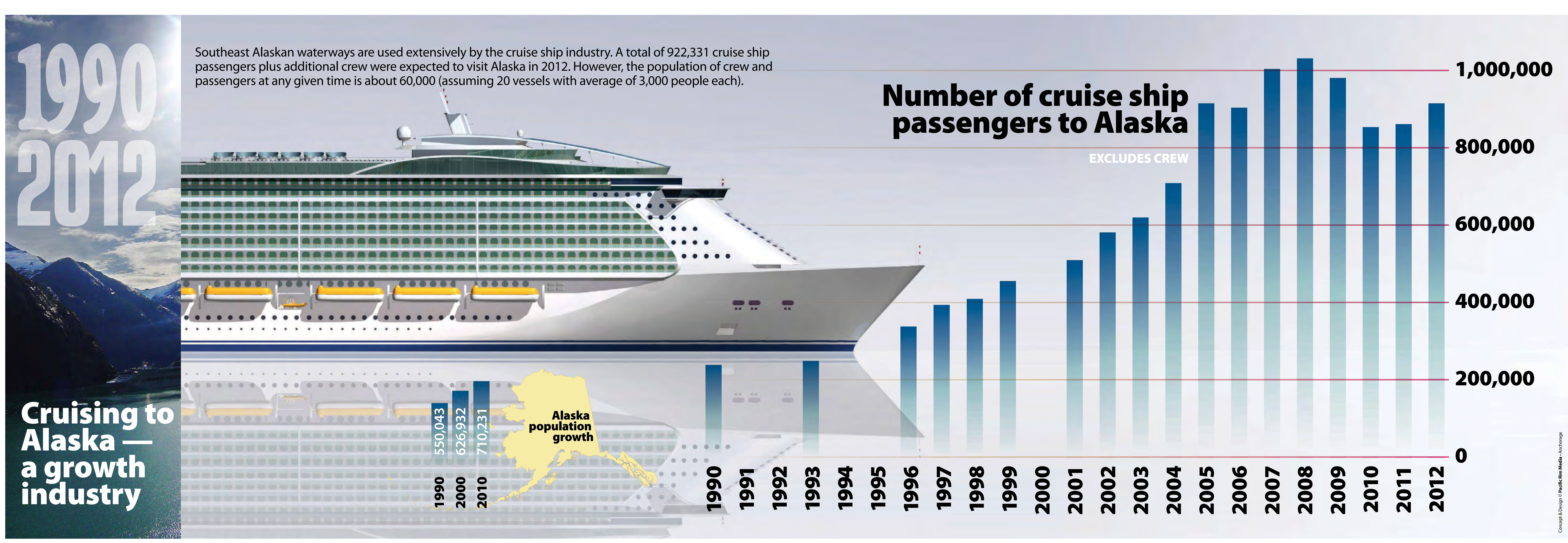

Science Advisory Panel

I. Since February 2010, Panel has held five meetings in Juneau and 10 teleconferences.

II. All meetings and teleconferences were open to the public.

III. Panel reviewed the legal framework of the cruise ship program and Panel mandate.

IV. Panel reviewed existing water quality standards, DEC cruise ship permits, and municipal wastewater permits.

V. Panel compared the effectiveness of existing on-board treatment systems.

VI. Panel reviewed the efforts that different cruise ships have taken to improve the quality of their wastewater discharge.

VII. Panel researched available technologies used in shore-based facilities to decrease concentrations of ammonia and dissolved metals in wastewater effluent.

VIII. Panel reviewed cruise ship basic lay-out and discussed space restrictions and engineering considerations associated with the installation of new types of wastewater treatment systems or add-on controls to existing advanced wastewater treatment systems.

IX. The Panel worked with DEC to prepare questionnaires about existing treatment systems, new technologies, and cost of installation and operation of current systems. Cruise operators responded to these questionnaires, providing data that allowed the Panel to evaluate economic feasibility and determine the Best Available Technology (BAT).

X. The Panel collaborated on a draft preliminary report that addresses: the sources of constituents of concern (ammonia and dissolved copper, nickel, and zinc); current and additional methods of pollution prevention, control, and treatment; environmental benefits and costs of implementing additional methods; and contains preliminary findings.

XI. The draft report is the subject of the Panel meeting being held in Juneau on September 19 from 10 a.m. until 6 p.m. and September 21 from 8 a.m. until 2 p.m. in the conference room of the Goldbelt Hotel.

XII. The Panel's preliminary report will be submitted to DEC in October 2012.

XIII. By January 1, 2013, DEC will provide a preliminary report to the Legislature based upon the Panel's research and recommendations.

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Graywater

Graywater consists of non-sewage wastewater, including drainage from dishwashers, showers, laundry, baths, galleys, and washbasins. Sometimes whirlpool waters are also plumbed into the graywater collecting system. Graywater represents the largest amount of fluid waste generated by cruise ships. The amount of wastewater depends on the ship type.

Graywater constitutes approximately 80-95% of the produced wastewater.

Blackwater

Blackwater generally means human body wastewater from toilets, bidets and urinals. On ships, medical sink and medical floor drain wastewater is combined with sewage for treatment.

The quantity of blackwater can be estimated to 7-8 toilet flushes per person per day, each at approximately 2 liters per flush. This creates approximately 15 liters of black water per person/day in total. The average home toilet uses 13 liters per flush. The amount of organic waste loading per person is at the same time slightly higher onboard a cruise ship due to high number of meals and activities.

Where Does Cruise Ship Waste Go?

All blackwater is treated by U.S. Coast Guard-approved and certified equipment; either a Marine sanitation device (MSD) or an advanced wastewater treatement system.

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Q **Are cruise ships that discharge wastewater in Alaska held to less strict permitting standards than municipal wastewater treatment systems?**

A No. Many Alaskan municipal wastewater treatment systems with marine outfalls provide only primary treatment. Cruise ships provide primary, secondary, and tertiary treatment of the wastewater they discharge into Alaska marine waters.

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Q **Are people more sensitive to copper than fish?**

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A No. Fish are more sensitive to copper than humans are. Levels of copper that cause no adverse health effects for humans in drinking water may be harmful to fish.

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Q **Are the dissolved metals in cruise ship wastewater largely coming from drinking water brought on-board from shore?**

A No. Potable water is likely a minor source of dissolved metals. Data show that different wastewater streams on board the same ship on the same dates have different metal concentrations. This data indicates that metal loads primarily originate on the ship itself (e.g. piping, valves, human waste, machinery, chemicals, etc.).

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Q **Does exceeding Water Quality Standards (WQS) always have an immediately harmful effect on the environment?**

A No. The duration of exposure to a pollutant is a critical factor in determining whether there is a harmful effect on the environment and the nature of the effect.

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