SENATE FINANCE COMMITTEE
March 24, 2009
1:41 p.m.

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CALL TO ORDER

Co-Chair Stedman called the Senate Finance Committee meeting to order at 1:41 p.m.

MEMBERS PRESENT

Senator Lyman Hoffman, Co-Chair
Senator Bert Stedman, Co-Chair
Senator Charlie Huggins, Vice-Chair
Senator Johnny Ellis
Senator Donny Olson
Senator Joe Thomas

MEMBERS ABSENT

None

ALSO PRESENT

Lynn Kent, Director, Division of Water, Department of Environmental Conservation; Denise Koch, Cruise Ship Program Manager, Division of Water, Department of Environmental Conservation; John Binkley, President, Alaska Cruise Ship Association.

PRESENT VIA TELECONFERENCE

Brian Rappoli, Ocean and Coastal Protection Division, Office of Water, Environmental Protection Agency.

SUMMARY

^Presentation: EPA Cruise Ship Dilution Study

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Co-Chair Stedman stated that on February 25, 2009, the Environmental Protection Agency (EPA) released a report on the cruise ship plume dilution study conducted in Skagway in July 2008.

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BRIAN RAPPOLI, OCEAN AND COASTAL PROTECTION DIVISION, OFFICE OF WATER, ENVIRONMENTAL PROTECTION AGENCY (testified via teleconference), provided an overview.

Dr. Rappoli remarked on collaborative efforts between the EPA and the Department of Environmental Conservation (DEC) in cooperation with the owners and operators of three cruise lines. He described the study as an investigation into how cruise ship discharge plumes dilute in close proximity to the vessel, also referred to as “near field dilution.” The scientists accomplished their research by using a combination of equipment installed aboard the vessels and equipment external to the ships located on a small boat operated by members of a sampling team.

Dr. Rappoli described the precision metering system, which pumps an accurately known amount of rhodamine dye into the discharge lines aboard a ship. He commented that this action was performed well upstream of the discharge port to ensure complete mixing of the dye with treated water. A fluorometer located downstream measured the dye’s concentration prior to leaving the ship and subsequently helped to determine the solution as it moved away from the vessel.

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Dr. Rappoli explained that in order to track the plume concentration, the small boat operated on a predetermined set of transects. He informed the committee that the sampling crew towed an instrument package to measure the temperature gradient, depth and salinity of the water column. A specially tailored portable fluorometer made up the heart of the system and measured rhodamine concentration using a correct set of filters and excitational lamps. The very sensitive instrument required a minimum amount of dye and recorded concentrations in the part per billion range.

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Dr. Rappoli noted the advantages to collecting samples and recording data in real time.

Dr. Rappoli restated that the purpose of the study was to give both EPA and DEC a better understanding of how cruise ship discharges dilute in a receiving body of water. The agencies chose Skagway as a port with relatively low flushing. The Department of Environmental Conservation intended to use the information collected in further analysis.

Dr. Rappoli voiced that the sampling episode report’s major purpose was to present a very large volume of broad data. The sponsors published early thinking the findings important and have made the results publicly available on their website. Dr. Rappoli observed that the report contained only a very brief and narrative description of an extensive data set. He clarified DEC’s part in carrying out a true technical analysis.

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Senator Huggins asked for insight into dye calculations particularly at the higher degree transects and a brief look into the experiment's overall conclusions. Dr. Rappoli replied that the EPA had never intended to conduct hydrodynamic analysis of the plumes. The highly variable descriptions are typically done using computational models in academic and regulatory circles. The Department of Environmental Conservation will perform that part of the analysis.

Senator Olson wondered at the correlation between a dye of specific molecular weight and microorganisms. He persisted that microbes would have a different settling component or coefficient of spread-ation throughout the water.

Dr. Rappoli agreed that the rhodamine dye is a relatively large molecule; however it is miscible with water. Scientists assume the dye remains homogeneous and does not physically associate with the water column. The dye has been used for a number of years in everything from detecting leaks in delivery systems to oceanographic studies. He knew of no instances where there had been problems.

Dr. Rappoli addressed how a chemical molecule might behave relative to a small microbe. Considering the high kinetic energy in the proximity of the plume, he thought it unlikely that observers would see gravitational effects due to the small differential in the density and buoyancy of a microbe. He conceived that larger particulates would need to be used before showing significant effect.

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Dr. Rappoli reassured committee members of the very low fecal coliform release rates of vessel systems.

Senator Olson wanted to know the validity of the study as related to issues of disease. Dr. Rappoli declared that the sampling crew was not in these early kinetic stages seeing effects of discharge upon the receiving environment.

LYNN KENT, DIRECTOR, DIVISION OF WATER, DEPARTMENT OF ENVIRONMENTAL CONSERVATION, provided background information. The Legislature appropriated capital money to DEC last year to fund a study of "the effect of providing for dilution of effluent from cruise ships." A project partnership with the EPA allowed use of their research vessel, "The Bold", which served as the mother ship for studies.

Ms. Kent said that DEC continues to work with EPA to characterize the results of the experiment. She delineated

EPA's share of the labor and its agreement to write certain reports. She disclosed additional DEC goals, such as using the data to validate computer modeling of plume behavior in water. She informed that the department provided a preliminary report to the Legislature in January.

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Ms. Kent directed attention to a handout, "An Assessment of the Cruise Ship Plum Dilution Study Performed in Skagway, Alaska, July 2008" (Copy on File).

DENISE KOCH, CRUISE SHIP PROGRAM MANAGER, DIVISION OF WATER, DEPARTMENT OF ENVIRONMENTAL CONSERVATION, summarized the findings using a PowerPoint presentation, "Cruise Ship Stationary Dilution Study Presentation, Senate Finance Committee, March 24, 2009" (Copy on File).

Slide 1 – "What is a dilution factor?"

Ms. Koch explained that researchers put a known concentration of a dye into treated wastewater aboard a participating vessel. The cruise ship discharges the mixture into marine waters where a sampling team measures the dye's concentration in the receiving environment.

Ms. Koch demonstrated dilution factor. For example:

> "If the concentration of dye in a ship's treated wastewater equaled 100 and the measured concentration of dye in the receiving waters came to 5, then the result would amount to a dilution factor of 20."

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Slide 2 – Why is a dilution factor important?

Ms. Koch said that DEC must evaluate both the pollutant sample results and the dilution of the wastewater in the environment to estimate whether wastewater exceeds water quality standards (WQS) in marine waters.

Slide 3 – Dilution of Wastewater while Vessel is Moving

Ms. Koch referenced a 2001 study conducted by the EPA, which concluded that: wastewater is subject to a tremendous amount of instantaneous, turbulent dilution behind a moving cruise ship, and that based upon field studies, the Science Advisory Panel estimated a conservative dilution factor of 50,000.

Senator Huggins solicited a framework for the parenthetical "(min speed of 6 knots and discharge at 200 cubic meters/hour)".

Ms. Koch explained that it is the customary procedure for cruise ships to discharge wastewater one nautical mile from shore, while traveling at 6 knots. Researchers arrived at the volume as a standard for a reasonable amount of wastewater discharged from a vessel's holding tank after a ship has been in port, drawn anchor and is underway.

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Slide 4 - Dilution of Wastewater while Vessel is Stationary:

Ms. Koch referenced DEC's partnership with EPA in the present study to collect field data and examine dilution factors (mixing) for a stationary cruise ship. She elucidated the "worst case" selection of the port of Skagway as a representative location with ample cruise ship traffic and limited flushing.

Slide 5 - Methods Used to Collect Dilution Data for Stationary Cruise Ships:

- This is a near field dilution study.
- Measurements were taken in the receiving water between the hull of the vessel at intervals up to 15 meters (49 feet; 1 meter = 3.28 feet) away.
- Six cruise ships volunteered to participate.

Ms. Koch outlined the above slide highlighting usable data from only four of the six vessels because of weather and instrument issues.

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Ms. Koch called attention to a picture of dye being released from a cruise ship and measurements being taken in receiving waters (Slide 7). A small boat connected to the vessel with a magnet used a yellow line to measure distance from the hull. A shorter line dropped into the water from the small boat had an instrument that recorded the concentrations of the dye. The bottom half of the photograph showed the red rhodamine dye. General observation of the plume revealed that the roughly circular packet of dye water moved cohesively away and became diluted as it moved out.

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Ms. Koch turned to results (Slide 8). She re-emphasized the largeness and complexity of the 1400 page data set and DEC's attempt to summarize and present it in the best way.

Ms. Koch directed members to a visual on the next slide (Slide 9) that illustrated a 'Time Lapse' plot of plume on

the cruise ship the Norwegian Star over the course of a day on July 16, 2008.

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Ms. Koch posed the question "How do you apply the dilution results to cruise ship sample data to determine where Water Quality Standards are met in the harbor?" (Slide 10)

Ms. Koch reiterated that WQS protect aquatic life and public health. The cruise ship general permit sets the effluent limits for wastewater at the point of discharge as the WQS; the two are one and the same. She noted that the department has a full data set from all cruise ships that discharged in Alaska waters in 2008 because vessels must give the information as part of the permit.

Ms. Koch furthered that cruise ships systems do very well meeting the standards for fecal coliform, ph or chlorine, but have a difficult time with the stringent requirements for ammonia, copper, nickel and zinc at the "end of pipe."

Slide 11 – (continuation of Slide 10.)

Ms. Koch illustrated standard scientific approach to complex data as looking first at the potential worst case scenario. If no problem exists under worst case scenario conditions, then the researcher can feel confident extrapolating the results to milder cases.

Ms. Koch demonstrated the worst case scenario equation used in the study: "Skagway + max[imum] conc[entration] of pollutants + lowest dilution factor = worst case scenario."

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Ms. Koch reported that researchers found a range of dilution factors from about 4 to 12 at 2.5 meters (9 feet) from the ship. (Slide 12) Dilution factors vary based upon velocity of the wastewater discharged, the diameter of the pipe, and the shape of the port, etc. In a worst case scenario using the maximum amount of pollutant concentration divided by 4 (the least dilution), ammonia, copper, nickel and zinc all exceed WQS in the receiving water.

Slide 13 – (continuation of Slide 12.)

Ms. Koch analyzed the results at 2.5 meters using a best case dilution factor of 12. She summarized that nickel and zinc meet WQS in the receiving water, but ammonia and copper do not.

Ms. Koch reviewed the dilution factor at the outermost circular transect of 15 meters from the ship (Slide 14):

- The lowest dilution factor (i.e. the least dilution or "worst case") was 28.
- The highest dilution factor (i.e. best case – most dilution) was 63.

Co-Chair Stedman requested clarification as to whether the results referred to a boat traveling at 6 knots or tied to a dock. Ms. Koch affirmed that this most recent study took place while the boat was stationary.

Senator Olson wondered why the study targeted the four pollutants when ammonia is a natural byproduct of most living organisms and the others are elements in the periodic table.

Ms. Koch pointed out that DEC has had a cruise ship program since 2001 part of which involved vessels taking samples of their wastewater effluent. After 2006, when law required DEC to establish a permit for cruise ships, the department had a large body of sample data. The administration compared actual data to WQS and chose the most stringent regulations.

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Ms. Koch saw a problem in that ships were exceeding standards for ammonia, copper, nickel and zinc. Ammonia comes from urine; copper, nickel and zinc come from potable water bought in towns. Sometimes soft water generated by evaporators picks up metals in the piping systems.

Senator Huggins asked if same thing happened in homes.

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Ms. Koch commented that sewage from a home would contain lesser concentrations of ammonia because domestic systems generally have more water. Homes do not have the water saving mechanisms that a cruise ship employs. She explained that even a plant delivering fresh drinking water from the utility to an individual's home will pick up some metals from the plumbing. She pointed out that 1,300 parts per billion is the WQS for copper in drinking water safe for human consumption. Fish display a high sensitivity to copper and the WQS set to protect aquatic life registers much lower at 3.1 parts per billion.

Senator Huggins asked where Ms. Koch went to school. Ms. Koch said that she received her Masters degree from the University of Washington.

Ms. Koch returned to the range of dilution factors at 15 meters.

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Ms. Koch recounted that ammonia and copper exceeded WQS at 2.5 meters, which prompted the crew to test the water further out.

Slide 15 –Dilution Factor at 15 meters from Ship

Ms. Koch detailed that applying the maximum concentration for a pollutant in the 2008 season and dividing by the highest dilution will yield the best case scenario in which all four parameters meet WQS at 15 meters. In a worst case combination of a maximum pollutant with minimum dilution, ammonia and copper still exceed WQS at the 15 meter distance.

Ms. Koch approached the data as relative to the current general permit for cruise ships. She acknowledged that DEC knew cruise ships would have a difficult time meeting parameter limits. The department solved the problem by initiating two levels of standards. More lenient interim limits apply only to the 2008 and 2009 season. In 2010, more stringent effluent limits equaling WQS take effect. The department wished to give the industry time to move towards compliance.

Slide 16 – Comparison with Interim Limits in Cruise Ship Permit

Ms. Koch used the same dilution factor equation and compared the calculations to the interim limits set in permit. In a worst case dilution, 2.5 meters from the hull, ammonia, copper, nickel and zinc all exceed WQS.

Slide 17 – (continuation of Slide 16.)

Ms. Koch applied the same procedure using a worst case dilution at 15 meters and all four parameters met WQS. Based upon data from the four ships, a ship whose wastewater complies with interim limits will also meet WQS at 15 meters.

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Slide 18 – Validation of Computer Models

Ms. Koch revealed an achieved goal of DEC’s to use actual field data in testing a computer model. She pleasantly reported that in close proximity, computer models were fairly accurate in predicting the dilution factor. Modeling estimated a lower dilution factor than researchers observed. If researchers relied solely on computer software, the results would appear more protective of the environment.

Co-Chair Stedman asked for comparative evaluation of the two reports done by EPA and DEC.

Ms. Koch said DEC wanted to validate the computer modeling. The department also tried to add value to EPA's endeavors by relating the dilution factors to both Alaska WQS and interim limits in the general cruise ship permit.

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Co-Chair Hoffman asked if under a worst case scenario of maximum concentration and minimum dilution factor of 28, ammonia and copper would pass WQS in Washington, Oregon and California at 15 meters from the ship.

Ms. Koch imagined the standards would be met. She mentioned that states oftentimes look to EPA to set WQS and then adopt the federal agency's limits. She offered to verify the information.

Co-Chair Hoffman sought to reaffirm that researchers conducted no studies at speeds of 6 knots and discharges at a rate of 200 cubic meters/hour.

Ms. Koch confirmed that the earlier study carried out on moving cruise ships did rely on field data. The stationary ship study had similar components.

Co-Chair Hoffman asked if the 2010 minimum WQS are set for Alaska only.

Ms. Koch replied that the general permit only applies to Alaska. Alaska has the most stringent standards for cruise ship wastewater discharge in the country.

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Senator Huggins asked if DEC planned on applying the standards to the state ferry system.

Ms. Koch replied that the "Commercial Passenger Vessel Program" has a component for looking at smaller vessels, including ferries and small ships with an overnight capacity of between 50 and 249 passengers. The 2006 law required DEC to write a permit for large ships, and it does not apply to the small ships. Instead, established standards regulate substances such as fecal coliform, chlorine and the total amount of suspended solids in the wastewater. Standards do not exist for ammonia, copper, nickel and zinc.

Senator Huggins asked if tides and currents factored into the study.

Ms. Koch responded that researchers collected data surrounding weather conditions, temperature, wind speed and direction, the tides, currents and speed of the tides in addition to dye concentration. These factors become evident in the time lapse pictures of plume distribution for all four cruise ships found in the draft report, "An Assessment of the Cruise Ship Plume Dilution Study." Scientists observed that the plumes themselves do not always move in a particular orientation, and that tides and currents certainly affect plume direction.

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Senator Huggins pondered whether some WQS are beyond modern engineering capabilities.

Ms. Koch referred to another issue in the Commercial Passenger Vessel Program that looks at what technologies could be used to meet the stringent standards. She referenced a conference on February 18, 2009 between DEC, a contractor and a team of experts that began by looking at non-complying 2008 cruise ship systems. The symposium conducted a search into other vessels with on-board mechanisms that would meet WQS and found none. The group scouted land-based technologies with success.

Ms. Koch reported a number of factors to consider when adapting technologies to a marine environment. The department asked wastewater treatment vendors how long it would take to install adapted technologies on a cruise ship. Vendors gave a timeframe of about 1-2 years.

Co-Chair Stedman inquired into the prevalence of land-based technologies in compliance with WQS. He wondered if the systems exist in a testing stage or fully implemented in numerous locations around the country.

Ms. Koch delineated that vendors would consider the technologies to be high-end and found in places, like Silicon Valley, with metals in the effluent. A municipal sewage treatment plant would not include these technologies as a standard part of a system.

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Senator Huggins asked if the city of Juneau meets WQS.

Ms. Koch informed that Juneau has three municipal systems that generally meet secondary treatment standards. The plants need only to periodically report by taking a sample of the effluent but have no limits associated with metal concentration.

Senator Huggins asked if Juneau exceeds the pollutant limits. Ms. Koch summarized that sometimes the Juneau-Douglas plant exceeds WQS and sometimes it meets them.

Senator Ellis questioned whether cruise ships could achieve WQS required by the citizen's initiative in the relatively short period of 1-2 years.

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Ms. Koch verified that vendors thought the technologies would take a year or two to adapt. She noted the newness of the procedure and uncertainty in guaranteeing an outcome. She spoke of cruise ships trying to maximize existing technologies and conveying more confidence in meeting the standards for ammonia than for metals.

Senator Ellis thanked DEC for holding the technology conference, which has pushed the conversation forward.

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JOHN BINKLEY, PRESIDENT, ALASKA CRUISE SHIP ASSOCIATION (ACA), referenced ACA's participation in the original 1999 science panel convened to do definitive work on wastewater discharge. The panel brought about the moving cruise ship dilution study and made recommendations to the 2001 Legislature to adopt the highest standards for wastewater discharge in the world. The industry has spent over $200 million to install systems and achieve the best treatment aboard any vessels in Alaska. Mr. Binkley displayed a test tube containing cruise ship discharge. Because of the exceedingly high level of wastewater treatment, DEC allows ships to discharge continuously – while underway or docked. He applauded cooperation between the industry and regulators to find ways to do better.

Mr. Binkley emphasized the salient point mentioned in the executive summary:

> "Based upon the data from the four ships in this study, a ship whose wastewater complies with the interim limits will meet the WQS at 15 meters (49 feet)."

Mr. Binkley drew a parallel between the room and a swimming pool where water discharged at one end would meet standards at the other. He pointed out the achievement of exceedingly high levels of treatment in the space where aquatic life is most sensitive. He stressed the industry's current accomplishments.

Mr. Binkley brought attention to the 50,000 to 1 dilution that occurs "almost instantaneously" behind a moving ship.

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Mr. Binkley declared ACA's willingness to keep improving. He mentioned the association's present work on reducing the amount of ammonia. He added that the high concentration of ammonia exists because cruise ships consume very little water. Vessels deem water a precious commodity and water systems are expensive to operate and maintain.

Co-Chair Stedman asked for comment on the saying, "Dilution is no solution to pollution."

Mr. Binkley had a different view. He believed, "Dilution IS the solution to pollution." He expounded that Mother Nature deals with the contamination of air quality as well as water bodies in this manner; he found it to be a valid methodology.

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Senator Huggins requested a characteristic display of the industry working in conjunction with DEC to solve the problem.

Mr. Binkley thought the technology conference showed a good example. He took exception with DEC's conclusions of achievable technologies within 1-2 years. He thought this a tremendous stretch. He described systems that cannot be used on a ship. He urged an appropriate level of water treatment based on science coupled with the technologies.

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ADJOURNMENT

The meeting was adjourned at 3:01 PM.