STATE OF ALASKA
Department of Environmental Conservation
Division of Water
410 Willoughby Ave,
Juneau, AK 99811-1800

Informal Request for Proposals (IRFP) 190000124

Cruise Ship Wastewater Discharge Modeling Project

Date of Issue: June 3, 2019

Purpose of the IRFP: The Department of Environmental Conservation (DEC), Division of Water (DOW), is soliciting proposals for a wastewater discharge modeling technical review and support for the Large Commercial Passenger Vessel Discharge General Permit.

Offerors Are Not Required To Return This Form.

Important Notice: If you received this solicitation from the State of Alaska's "Online Public Notice" web site, you must register with the procurement officer listed in this document to receive notification of subsequent amendments. Failure to contact the procurement officer may result in the rejection of your offer.

Sarena E. Hackenmiller
Procurement Officer
Department of Environmental Conservation
Phone: 907-465-5037
Email: decdasprocurement@alaska.gov

Return Mailing Address, Contact Person, Telephone, Fax Numbers and Deadline for Receipt of Proposals

Offerors must submit one hard copy of their proposal, in writing, to the procurement officer in a sealed package. The cost proposal included with the package must be sealed separately from the rest of the proposal and must be clearly identified. Oral proposals, faxed, or emailed proposals are not acceptable. The sealed proposal package(s) must be addressed as follows:

Department of Environmental Conservation, Division of Water
Attention: Sarena Hackenmiller
Informal Request for Proposal (IRFP) Number: **190000124**

If using a delivery service, please use the following address: 410 Willoughby Ave Suite 303
Juneau, AK 99801

Proposals must be received no later than **4:00 P.M. Alaska Time on Thursday, June 13, 2019.**

An offeror's failure to submit its proposal prior to the deadline will cause the proposal to be disqualified. Late proposals or amendments will not be opened or accepted for evaluation.

All questions concerning this IRFP must be directed to the procurement officer:

PROCUREMENT OFFICER: Sarena Hackenmiller
EMAIL decdasprocurement@alaska.gov
PHONE 907-465-5037 – TDD 711 (Alaska Relay)

Purpose of the IRFP

The Department of Environmental Conservation, Division of Water**,** is soliciting proposals for wastewater discharge modeling technical review and support for the Large Commercial Passenger Vessel Discharge General Permit.

Contract Type

This is a Firm Fixed Price contract.

Contract Budget

The Department of Environmental Conservation Division of Water, estimates a budget of between $15,000.00 and $35,000.00 for completion of this project. Proposals priced at more than $35,000.00 will be considered non-responsive and rejected.

Please review the Insurance requirements in Attachment 5 when considering the cost proposal.

Contract Term and Work Schedule

The contract term and work schedule set out herein represents the State of Alaska's best estimate of the schedule that will be followed. If a component of this schedule, such as the opening date, is delayed, the rest of the schedule will be shifted by the same number of days.

The length of the contract will be from the date of award, approximately ***June 24, 2019*** until completion, approximately ***July 31, 2019.***

Unless otherwise provided in this IRFP, the State and the successful offeror/contractor agree: (1) that any holding over of the contract excluding any exercised renewal options, will be considered as a month-to-month extension, and all other terms and conditions shall remain in full force and effect and (2) to provide written notice to the other party of the intent to cancel such month-to-month extension at least 30-days before the desired date of cancellation.

The approximate contract schedule is as follows:

- Issue IRFP *Monday, June 3, 2019*
- Pre-Proposal Conference *Thursday, June 6, 2019 at 10:00 A.M. Alaska Time*
- Deadline for Receipt of Proposals *Thursday, June 13, 2019 at 4:00 P.M. Alaska Time*
- State of Alaska issues Notice of Award approximately *June 20, 2019*
- Contract start approximately the week of *June 24, 2019*

Location of Work

The state WILL NOT provide workspace for the contractor. The contractor must provide its own workspace.

By signature on their proposal, the offeror certifies that all services provided under this contract by the contractor and all subcontractors shall be performed in the United States.

If the offeror cannot certify that all work will be performed in the United States, the offeror must contact the procurement officer in writing to request a waiver at least 10 days prior to the deadline for receipt of proposals.

The request must include a detailed description of the portion of work that will be performed outside the United States, where, by whom, and the reason the waiver is necessary.

Failure to comply with this requirement or to obtain a waiver may cause the state to reject the proposal as non-responsive, or cancel the contract.

Prior Experience

In order for offers to be considered responsive offerors must meet these minimum prior experience requirements: The Department requires that the Contractor have at least one year of prior experience with wastewater mixing zone modeling and permit development and review. Documentation of prior experience shall be submitted with the proposal.

An offeror's failure to meet these minimum prior experience requirements will cause their proposal to be considered non-responsive and their proposal will be rejected.

Subcontractors

Subcontractors may be used to perform work under this contract. If an offeror intends to use subcontractors, the offeror must identify in the proposal the names of the subcontractors and the portions of the work the subcontractors will perform.

If a proposal with subcontractors is selected, the offeror must provide the following information concerning each prospective subcontractor within five working days from the date of the state's request:

(a) complete name of the subcontractor;

(b) complete address of the subcontractor;

(c) type of work the subcontractor will be performing;

(d) percentage of work the subcontractor will be providing;

(e) evidence that the subcontractor holds a valid Alaska business license; and

(f) a written statement, signed by each proposed subcontractor that clearly verifies that the subcontractor is committed to render the services required by the contract.

An offeror's failure to provide this information, within the time set, may cause the state to consider their proposal non-responsive and reject it. The substitution of one subcontractor for another may be made only at the discretion and prior written approval of the project director.

Joint Ventures

Joint ventures are acceptable. If submitting a proposal as a joint venture, the offeror must submit a copy of the joint venture agreement which identifies the principals involved and their rights and responsibilities regarding performance and payment.

Pre-proposal Conference

A pre-proposal conference will be held on **Thursday, June 6, 2019 at 10:00 a.m. Alaska Time.** This will be a call-in meeting. The purpose of the conference is to discuss the work to be performed with the prospective offerors and allow them to ask questions concerning the IRFP. Questions and answers will be and sent to prospective offerors as soon as possible after the meeting.

To join by teleconference dial: **1-800-315-6338, Access Code: 55177#**

Offerors with a disability needing accommodation should contact the procurement officer prior to the date set for the pre-proposal conference so that reasonable accommodation can be made.

Questions Received Prior to Opening of Proposals

All questions must be in writing and directed to the issuing office, addressed to the procurement officer identified in this IRFP. The interested party must confirm telephone conversations in writing.

Two types of questions generally arise. One may be answered by directing the questioner to a specific section of the IRFP. These questions may be answered over the telephone. Other questions may be more complex and may require a written amendment to the IRFP. The procurement officer will make that decision.

If an amendment is issued, it will be provided to all who were provided a copy of the IRFP and to those who have registered with the procurement officer after receiving the IRFP from the State of Alaska Online Public Notice web site.

Amendments to Proposals

Amendments to or withdrawals of proposals will only be allowed if acceptable requests are received prior to the deadline that is set for receipt of proposals. No amendments or withdrawals will be accepted after the deadline unless they are in response to the state's request.

Alternate Proposals

Offerors may only submit one proposal for evaluation. In accordance with 2 AAC 12.830, alternate proposals (proposals that offer something different than what is asked for) will be rejected.

Evaluation of Proposals

Proposals will be evaluated based on the evaluation factors set out in this IRFP. After receipt of proposals, if there is a need for any substantial clarification or material change in the IRFP, an amendment will be issued. The amendment will incorporate the clarification or change, and a new date and time established for new or amended proposals. Evaluations may be adjusted as a result of receiving new or amended proposals.

Site Inspection

Not applicable.

F.O.B. Point

Not applicable.

Federal Requirements

Not applicable.

Contract Approval

This IRFP does not, by itself, obligate the state. The state's obligation will commence when the contract is approved by the Commissioner of the Department of Environmental Conservation or the Commissioner's designee. Upon written notice to the contractor, the state may set a different starting date for the contract. The state will not be responsible for any work done by the contractor, even work done in good faith, if it occurs prior to the contract start date set by the state.

Proposed Payment Procedures

The state will make a single payment when all of the deliverables are received and the contract is completed and approved by the project director.

Contract Payment

No payment will be made until the contract is approved by the Commissioner of the Department of Environmental Conservation or the Commissioner's designee. Under no conditions will the state be liable for the payment of any interest charges associated with the cost of the contract.

The state is not responsible for and will not pay local, state, or federal taxes. All costs associated with the contract must be stated in U.S. currency.

Right to Inspect Place of Business

Not applicable.

Contract Changes - Amendments

During the course of this contract, the contractor may be required to perform additional work. That work will be within the general scope of the initial contract and cannot exceed the small procurement limits established under AS 36.30.320.

When additional work is required, the state will provide the contractor a description of the additional work and request the contractor to submit a firm time schedule for accomplishing the additional work and a firm price for the additional work. Cost and pricing data must be provided to justify the cost of such amendments per AS 36.30.400.

The contractor will not commence additional work until the procurement officer has secured any required state approvals necessary for the amendment and a written contract amendment has been issued.

Alaska Business License and Other Required Licenses

In order to receive the Alaska Bidder Preference and other related preferences, such as the Alaska Veteran and Alaska Offeror Preference, an offeror must hold a valid Alaska business license prior to the deadline for receipt of proposals. Offerors should contact the Department of Commerce, Community and Economic Development, Division of Corporations, Business, and Professional Licensing, P. O. Box 110806, Juneau, Alaska 99811-0806, for information on these licenses. Acceptable evidence that the offeror possesses a valid Alaska business license may consist of any one of the following:

(a) copy of an Alaska business license;

(b) certification on the proposal that the offeror has a valid Alaska business license and has included the license number in the proposal;

(c) a canceled check for the Alaska business license fee;

(d) a copy of the Alaska business license application with a receipt stamp from the state's occupational licensing office; or

(e) a sworn and notarized affidavit that the offeror has applied and paid for the Alaska business license.

You are not required to hold a valid Alaska business license at the time proposals are opened if you possess one of the following licenses and are offering services or supplies under that specific line of business:

- fisheries business licenses issued by Alaska Department of Revenue or Alaska Department of Fish and Game,
- liquor licenses issued by Alaska Department of Revenue for alcohol sales only,
- insurance licenses issued by Alaska Department of Commerce, Community and Economic Development, Division of Insurance, or
- Mining licenses issued by Alaska Department of Revenue.

Prior the deadline for receipt of proposals, all offerors must hold any other necessary applicable professional licenses required by Alaska Statute.

Preferences

The Alaska Bidder, Alaska Veteran, and Alaska Offeror preferences are the most common preferences involved in the IRFP process. Additional preferences that may apply to this procurement are listed below. Guides that contain excerpts from the relevant statutes and codes, explain when the preferences apply and provide examples of how to calculate the preferences are available at the Department of Administration, Division of General Service's web site:

http://doa.alaska.gov/dgs/policy.html

Alaska Products Preference - AS 36.30.332
Recycled Products Preference - AS 36.30.337
Local Agriculture and Fisheries Products Preference - AS 36.15.050
Employment Program Preference - AS 36.30.321(b)
Alaskans with Disabilities Preference - AS 36.30.321(d)
Alaska Veteran's Preference - AS 36.30.321(f)

The Division of Vocational Rehabilitation in the Department of Labor and Workforce Development keeps a list of qualified employment programs and individuals who qualify as persons with a disability. As evidence of a business' or an individual's right to the Employment Program or Alaskans with Disabilities preferences, the Division of Vocational Rehabilitation will issue a certification letter. To take advantage of these preferences, a business or individual must be on the appropriate Division of Vocational Rehabilitation prior to the time designated for receipt of proposals. Offerors must attach a copy of their certification letter to the proposal. An offeror's failure to provide this certification letter with their proposal will cause the state to disallow the preference.

Alaska Bidder Preference

An Alaska Bidder Preference of five percent will be applied prior to evaluation. The preference will be given to an offeror who:

(1) holds a current Alaska business license prior to the deadline for receipt of proposals;

(2) submits a proposal for goods or services under the name appearing on the offeror's current Alaska business license;

(3) has maintained a place of business within the state staffed by the offeror, or an employee of the offeror, for a period of six months immediately preceding the date of the proposal;

(4) is incorporated or qualified to do business under the laws of the state, is a sole proprietorship and the proprietor is a resident of the state, is a limited liability company (LLC) organized under AS 10.50 and all members are residents of the state, or is a partnership under AS 32.06 or AS 32.11 and all partners are residents of the state; and

(5) if a joint venture, is composed entirely of ventures that qualify under (1)-(4) of this subsection.

Alaska Veteran Preference

An Alaska Veteran Preference of five percent will be applied prior to evaluation. The preference will be given to an offeror who qualifies under AS 36.30.990(250) as an Alaska bidder and is a:

(a) sole proprietorship owned by an Alaska veteran;

(b) partnership under AS 32.06 or AS 32.11 if a majority of the partners are Alaska veterans;

(c) limited liability company organized under AS 10.50 if a majority of the members are Alaska veterans; or

(d) corporation that is wholly owned by individuals, and a majority of the individuals are Alaska veterans.

Alaska Offeror Preference

Alaska offerors will be provided a 10 percent overall evaluation point preference. Alaska bidders, as defined in AS 36.30.990(25), are eligible for this preference. Each Alaska offeror will receive 10 percent of the total available points added to their overall evaluation score as a preference.

Standard Contract Provisions

The contractor will be required to sign and submit the attached State's Standard Agreement Form for Professional Services Contracts (form 02-093/Appendix A). The contractor must comply with the contract provisions set out in this attachment. No alteration of these provisions will be permitted without prior written approval from the Department of Law. Objections to any of the provisions in Appendix A must be set out in the offeror's proposal.

Insurance Requirements

The successful offeror must provide proof of workers' compensation insurance prior to contract approval.

The successful offeror must secure the insurance coverage required by the state. The coverage must be satisfactory to the Department of Administration Division of Risk Management. An offeror's failure to provide evidence of such insurance coverage is a material breach and grounds for withdrawal of the award or termination of the contract.

Offerors must review form APPENDIX B2, attached, for details on required coverage. **Professional Liability insurance is required for this contract.** No alteration of these requirements will be permitted without prior written approval from the Department of Administration, Division of Risk Management. Objections to any of the requirements in APPENDIX B2 must be set out in the offeror's proposal.

Required Review

Offerors should carefully review this solicitation for defects and questionable or objectionable material. Comments concerning defects and objectionable material must be made in writing and received by the procurement officer prior to the deadline for receipt of proposals. This will allow issuance of any necessary amendments. It will also help prevent the opening of a defective solicitation and exposure of and offeror's proposal upon which award could not be made. Protests based on any omission or error, or on the content of the solicitation, will be disallowed if these faults have not been brought to the attention of the procurement officer, in writing, prior to the deadline for receipt of proposals.

Right of Rejection

Offerors must comply with all of the terms of the IRFP, the State Procurement Code (AS 36.30), and all applicable local, state, and federal laws, codes, and regulations. The procurement officer may reject any proposal that does not comply with all of the material and substantial terms, conditions, and performance requirements of the IRFP.

Offerors may not qualify the proposal nor restrict the rights of the state. If an offeror does so, the procurement officer may determine the proposal to be a non-responsive counter-offer and the proposal may be rejected.

Minor informalities that:

- do not affect responsiveness;
- are merely a matter of form or format;
- do not change the relative standing or otherwise prejudice other offers;
- do not change the meaning or scope of the IRFP;
- are trivial, negligible, or immaterial in nature;
- do not reflect a material change in the work; or
- do not constitute a substantial reservation against a requirement or provision;

may be waived by the procurement officer.

The state reserves the right to refrain from making an award if it determines that to be in its best interest. **A proposal from a debarred or suspended offeror shall be rejected.**

Assistance to Offerors with a Disability

Offerors with a disability may receive accommodation regarding the means of communicating this IRFP or participating in the procurement process. For more information, contact the procurement officer prior to the deadline for receipt of proposals.

State Not Responsible for Preparation Costs

The state will not pay any cost associated with the preparation, submittal, presentation, or evaluation of any proposal.

Disclosure of Proposal Contents

All proposals and other material submitted become the property of the State of Alaska and may be returned only at the state's option. AS 40.25.110 requires that public records to be open to reasonable inspection. All proposal information, including detailed price and cost information, will be held in confidence during the evaluation process and prior to the time an Award or Notice of Award is issued. Thereafter, proposals will become public information.

Trade secrets and other proprietary data contained in proposals may be held confidential if the offeror requests, in writing, that the procurement officer does so, and if the procurement officer agrees, in writing, to do so. Material considered confidential by the offeror must be clearly identified and the offeror must include a brief statement that sets out the reasons for confidentiality.

Authorized Signature

All proposals must be signed by an individual authorized to bind the offeror to the provisions of the IRFP. Proposals must remain open and valid for at least 90-days from the opening date.

Offeror's Certification

By signature on the proposal, offerors certify that they comply with the following:

(a) the laws of the State of Alaska;

(b) the applicable portion of the Federal Civil Rights Act of 1964;

(c) the Equal Employment Opportunity Act and the regulations issued thereunder by the federal government;

(d) the Americans with Disabilities Act of 1990 and the regulations issued thereunder by the federal government;

(e) all terms and conditions set out in this IRFP;

(f) a condition that the proposal submitted was independently arrived at, without collusion, under penalty of perjury;

(g) that the offers will remain open and valid for at least 90 days; and

(h) that programs, services, and activities provided to the general public under the resulting contract conform with the Americans with Disabilities Act of 1990, and the regulations issued thereunder by the federal government.

If any offeror fails to comply with (a) through (h) of this section, the state reserves the right to disregard the proposal, terminate the contract, or consider the contractor in default.

Conflict of Interest

Each proposal shall include a statement indicating whether or not the firm or any individuals working on the contract has a possible conflict of interest (e.g., currently employed by the State of Alaska or formerly employed by the State of Alaska within the past two years) and, if so, the nature of that conflict. The Commissioner of the Department of *Environmental Conservation* reserves the right to **consider a proposal non-responsive and reject it or** cancel the award if any interest disclosed from any source could either give the appearance of a conflict or cause speculation as to the objectivity of the program to be developed by the offeror. The Commissioner's determination regarding any questions of conflict of interest shall be final.

Assignment

Per 2 AAC 12.480, the contractor may not transfer or assign any portion of the contract without prior written approval from the procurement officer.

Disputes

Any dispute arising out of this agreement will be resolved under the laws of the State of Alaska. Any appeal of an administrative order or any original action to enforce any provision of this agreement or to obtain relief from or remedy in connection with this agreement may be brought only in the Superior Court for the State of Alaska.

Severability

If any provision of the contract or agreement is declared by a court to be illegal or in conflict with any law, the validity of the remaining terms and provisions will not be affected; and, the rights and obligations of the parties will be construed and enforced as if the contract did not contain the particular provision held to be invalid.

Supplemental Terms and Conditions

Proposals must comply with **Right of Rejection** section. However, if the state fails to identify or detect supplemental terms or conditions that conflict with those contained in this IRFP or that diminish the state's rights under any contract resulting from the IRFP, the term(s) or condition(s) will be considered null and void. After award of contract:

a) if conflict arises between a supplemental term or condition included in the proposal and a term or condition of the IRFP, the term or condition of the IRFP will prevail; and
b) if the state's rights would be diminished as a result of application of a supplemental term or condition included in the proposal, the supplemental term or condition will be considered null and void.

Vendor Tax ID

A valid Vendor Tax ID must be submitted to the issuing office with the proposal or within five days of the state's request.

Formula Used to Convert Cost to Points

The distribution of points based on cost will be determined by the method set out below. The lowest cost proposal will receive the maximum number of points allocated to cost.

Cost will be converted to points using the following formula:

$$\frac{[(\text{Price of Lowest Cost Proposal}) \times (\text{Maximum Points for Cost})]}{(\text{Cost of Each Higher Priced Proposal})} = \text{POINTS}$$

Clarification of Offers

In order to determine if a proposal is reasonably susceptible for award, communications by the procurement officer or the proposal evaluation committee (PEC) are permitted with an offeror to clarify uncertainties or eliminate confusion concerning the contents of a proposal. Clarifications may not result in a material or substantive change to the proposal. The evaluation by the procurement officer or the PEC may be adjusted as a result of a clarification under this section.

Failure to Negotiate

If the selected offeror

- fails to provide the information required to begin negotiations in a timely manner; or
- fails to negotiate in good faith; or
- indicates they cannot perform the contract within the budgeted funds available for the project; or
- if the offeror and the state, after a good faith effort, simply cannot come to terms,

the state may terminate negotiations with the offeror initially selected and commence negotiations with the next highest ranked offeror.

Notice of Award (NOA) — Offeror Notification of Selection

After the completion of contract negotiation the procurement officer will issue a written Notice of Award (NOA) and send copies to all offerors. The NOA will set out the names of all offerors and identify the proposal selected for award.

Protest

2 AAC 12.695 provides that an interested party may protest the content of the IRFP or the award of a contract.

An interested party is defined in 2 AAC 12.990(a) (7) as "an actual or prospective bidder or offeror whose economic interest might be affected substantially and directly by the issuance of a contract solicitation, the award of a contract, or the failure to award a contract."

An interested party must first attempt to informally resolve the dispute with the procurement officer. If that attempt is unsuccessful, the interested party may file a written protest. The written protest must be filed with the Commissioner of the purchasing agency or the Commissioner's designee. The protester must also file a copy of the protest with the procurement officer. A protester must have submitted a proposal in order to have sufficient standing to protest the award of a contract. Written protests must include the following information:

a. the name, address, and telephone number of the protester;

b. the signature of the protester or the protester's representative;

c. identification of the contracting agency and the solicitation or contract at issue;

d. a detailed statement of the legal and factual grounds of the protest including copies of relevant documents; and

e. the form of relief requested.

If the protestor agrees, the Commissioner of the purchasing department or the Commissioner's designee may assign the protest to the procurement officer or other state official for alternate dispute resolution. In other cases, the Commissioner or the Commissioner's designee may issue a decision sustaining or denying the protest, or may conduct a hearing using procedures set out in AS 36.30.670(b).

A written protest of the content of the solicitation must be received by the Commissioner or Commissioner's designee prior to the deadline for receipt of proposals. A written protest of the award of a contract must be received by the Commissioner or Commissioner's designee within ten days after the date the Notice of Award is issued.

Nondisclosure and Confidentiality

Contractor agrees that all confidential information shall be used only for purposes of providing the deliverables and performing the services specified herein and shall not disseminate or allow dissemination of confidential information except as provided for in this section. The contractor shall hold as confidential and will use reasonable care (including both facility physical security and electronic security) to prevent unauthorized access by, storage, disclosure, publication, dissemination to and/or use by third parties of, the confidential information. "Reasonable care" means compliance by the contractor with all applicable federal and state law, including the Social Security Act and HIPAA. The contractor must promptly notify the state in writing if it becomes aware of any storage, disclosure, loss, unauthorized access to or use of the confidential information.

Confidential information, as used herein, means any data, files, software, information or materials (whether prepared by the state or its agents or advisors) in oral, electronic, tangible or intangible form and however stored, compiled or memorialized that is classified confidential as defined by State of Alaska classification and categorization guidelines provided by the state to the contractor or a contractor agent or otherwise made available to the contractor or a contractor agent in connection with this contract, or acquired, obtained or learned by the contractor or a contractor agent in the performance of this contract. Examples of confidential information include, but are not limited to: technology infrastructure, architecture, financial data, trade secrets, equipment specifications, user lists, passwords, research data, and technology data (infrastructure, architecture, operating systems, security tools, IP addresses, etc).

If confidential information is requested to be disclosed by the contractor pursuant to a request received by a third party and such disclosure of the confidential information is required under applicable state or federal law, regulation, governmental or regulatory authority, the contractor may disclose the confidential information after providing the state with written notice of the requested disclosure (to the extent such notice to the state is permitted by applicable law) and giving the state opportunity to review the request. If the contractor receives no objection from the state, it may release the confidential information within 30 days. Notice of the requested disclosure of confidential information by the contractor must be provided to the state within a reasonable time after the contractor's receipt of notice of the requested disclosure and, upon request of the state, shall seek to obtain legal protection from the release of the confidential information.

The following information shall not be considered confidential information: information previously known to be public information when received from the other party; information freely available to the general public; information which now is or hereafter becomes publicly known by other than a breach of confidentiality hereof; or information which is disclosed by a party pursuant to subpoena or other legal process and which as a result becomes lawfully obtainable by the general public.

Background Information

The Commercial Passenger Vessel Environmental Compliance Program (CPVEC or Program) is requesting mixing zone modeling technical support associated with evaluating and refining the mixing zone model for wastewater discharge authorized by the Large Commercial Passenger Vessel General Permit (2014 GP) issued in 2014. The Program requests technical review to support the robust modeling for certain cruise ship discharge scenarios to develop future permits.

Cruise ships discharge treated wastewater through discharge ports in the side of the hull. Each ship has different characteristics, and ships visit different ports using docks or anchorages with a range of conditions. The types of source water in the wastewater vary considerably, as does the treatment systems used, and the effluent sample results. This is a General Permit, but each ship is modeled and may receive specific requirements under their individual authorization to discharge. Specific requirements may be added to meet mixing zone requirements. Each ship will have their own parameters to feed into the model. Mixing zones were established for three types of discharge in the General Permit: an underway mixing zone when over 6 knots, a stationary mixing zone, and a mixing zone for discharge at two docks in Skagway where a potential overlap would occur.

Scope of Work

The Department of Environmental Conservation, Division of Water, is soliciting proposals for technical support of mixing zone analysis. This project shall review existing uses of mixing zone analysis for the 2014 General Permit, determine what improvements are possible, model ships for permit development, and provide improvements to the existing model or use of alternative models. The scope of work is separated into the following tasks.

Task 1 – The contractor shall host a kick off meeting with DEC.

Task 2 – The contractor shall develop and provide to DEC a review of the 2014 General Permit modeling, review of the appropriate models or modifications needed to models for future work, and information on the cost and time of implementing recommendations based on the review. A sensitivity analysis shall be completed to document how uncertainty in any of the input parameters could affect the recommended or modified model.

Task 3- The Contractor shall use the review and recommendations developed in Task 2 to implement an appropriate mixing zone model.

Task 4 - The Contractor shall model large commercial passenger vessel discharges permitted to discharge in 2019 using the model from task 3 in preparation of the next general permit.

Task 1 Contract Kickoff Meeting

The contractor shall coordinate and conduct a kickoff meeting within ten days of the service commencement date. The purpose of the kickoff meeting is to establish effective planning, communications, and collaboration strategies. Meeting by teleconference is allowed. At the meeting, the contractor shall identify the roles and responsibilities of key participants for this project. Participants will discuss expectations, project schedule, and methods of communication. A project overview based on the items discussed at the meeting with minutes of the meeting shall include the project schedule, and an outline of project communications and main elements. The contractor shall submit minutes of the meeting and a project overview to DEC within five business days after the kickoff meeting.

DEC will provide an overview of the general permit including past modeling data to the contractor prior to the kickoff meeting. This must include information on past modeling questions and issues, a copy of the General Permit and fact sheet, and input data for the modeling. The Program has compiled the models used, we have about 30 for each discharge condition. We can supply Cormix project files (.cmx) for all ships modeled, we also have .prd and .ses files for some ships. The Program will also provide spreadsheets summarizing data inputs and ship-provided Notice of Intent forms with discharge port information.

Task 2 Review and provide recommendations on wastewater discharge modeling for commercial passenger vessel underway and stationary discharges.

The contractor shall review CORMIX wastewater mixing zone modeling completed on the 2014 Large Commercial Passenger Vessel General Permit (2014 GP). This includes those completed during 2014 GP development, revised during informal and formal administrative challenges, and in later authorizations for individual ships. Review mixing zone comments received during 2014 GP development, staff responses to technical or legal challenges, and staff questions and reviews of modeling use for technical accuracy. Review technical questions from Department staff regarding the use of CORMIX in the 2014 GP. Requested modeling will be limited to modeling runs completed after the 2014 General Permit was issued. The Program has compiled the models used; we have about 30 for each discharge condition. Ships are modeled using Cormix for three discharge scenarios: underway discharge of over six knots (modeled only at six knots speed), stationary discharge using Juneau harbor ambient conditions, and Skagway Harbor discharge. Skagway Harbor has two potential mixing zones but modeling is completed once for each ship. In addition some ships are modeled under different discharge types and not all ships apply for all discharge conditions. Modeling was completed using available ambient information. The Program is asking that models be run with the 2014 ambient data. The Program has collected additional ambient data and can provide that if it would be useful in evaluating the modeling.

A sensitivity analysis shall be completed to identify how any of the input parameters could affect the model. The analysis and review of the model used shall address issues such as tide reversal, discharge towards shore, ship and shore boundary interactions while stationary, discharge in mid-water depth in a harbor, discharge through two nearby discharge ports, discharge at angles not supported by CORMIX, discharge from a moving ship, discharge from a drag minimized discharge port, and other issues identified in the review of modeling use.

The contractor shall review and provide recommendations on the appropriate model or system to use for underway and stationary Large Commercial Passenger Vessel wastewater discharges. Identify if the appropriate model would be an alternative model, modifications to the existing model, or other alternative. As part of this model review compare the models and identify potential issues with using with underway and stationary ships. A report shall be created documenting the review and recommendations. This report shall include a list of deviations from CORMIX modeling instructions in the 2014 GP, a list of recommendation to improve the modeling, the results of the sensitivity analysis, and review of alternative models. The report shall include estimates of time and cost to modify CORMIX or use an alternative model.

The draft review and recommendations report shall be submitted to the Department for review within 25 days after the Kickoff Meeting. The Department will review the report and provide comments. The contractor shall respond to questions from the DEC Project Manager regarding the report and update the review as needed based on those questions. A final report is due 15 days after Department review is completed.

Task 3 Commercial Passenger Vessel Discharge Mixing Zone Model Development

The Contractor shall implement recommendations developed in Task 2 to implement an appropriate mixing zone model for use by the Division of Water for large commercial passenger vessels.

A sensitivity analysis shall be completed to see how uncertainty in any of the input parameters could affect the model. The model shall address issues such as tide reversal, discharge towards shore, ship and shore boundary interactions while stationary, discharge in mid-water depth in a harbor, discharge through two nearby discharge ports, discharge at angles not supported by Cormix, discharge from a moving ship, discharge from a drag minimized discharge port, and other issues identified in Task 2.

The Contractor shall document the steps taken to implement the model.

Task 4 Modeling of 2018 and 2019 Large Commercial Passenger Vessels using the Model in Task 3

The Contractor shall use the ship specific information provided by the Division of Water to conduct modeling on ships expected to discharge in 2019 using the model from Task 3. Modeling will be conducted on stationary discharge while docked for both the ports of Skagway and Juneau for each ship, and for underway discharge at six knots of speed. Five ships will be selected by the Department to examine mixing zone size at other speeds (3, 12, 20 knots).

Deliverables

The contractor shall be required to provide the following deliverables:

1) Coordinate and conduct kick-off meeting within ten days of service commencement date:
   a) Identify the roles and responsibilities of key participants for this project;
   b) Hold discussion on expectations, project schedule, and methods of communication;
   c) Provide minutes of kick-off meeting and project overview to DEC within five days of the meeting.

2) Provide draft summary report of review and recommendation within twenty-five days of the kick-off meeting. This report must provide recommendations on the appropriate model or system to use for underway and stationary Large Commercial Passenger Vessel wastewater discharges. This report shall:
   a) Identify if the appropriate model would be an alternative model, modifications to the existing model, or other alternative;
   b) Compare the models and identify potential issues with using with underway and stationary ships;
   c) Include a list of deviations from CORMIX modeling instructions in the 2014 General Permit;
   d) Include a list of recommendation to improve the modeling;
   e) Include the results of the sensitivity analysis;
   f) Include a review of alternative models; and
   g) Include estimates of time and cost to modify CORMIX or use an alternative model.

3) Within 30 days of completion of Task 2, the Contractor shall provide:
   a) Documentation of the model used;
   b) Access to the model for the completion of the 2020 large commercial passenger vessel general permit;
   c) Documentation of the sensitivity analysis completed; and
   d) Documentation of the process of implementing and using an appropriate mixing zone model.

4) Within 30 days of the completion of Task 2, Contractor shall provide:
   a) Mixing zone models for each ship stationary while docked in Juneau and Skagway and underway (over six knots in speed);
   b) Description of each input and where data was obtained;
   c) Documentation including all files generated by the model of all inputs and outputs; and
   d) Graphical representation of selected discharges as both a surface mixing zone, and a three dimensional mixing zone showing a cross section of the water body.

5) Provide final summary report within fifteen days of DEC draft review.

Proposal Format and Content

In order for the state to evaluate proposals fairly and completely, offerors must provide all information requested. Proposals must include the complete name and address of offeror's firm and the name, mailing address, and telephone number of the person the state should contact regarding the proposal. Proposals must also confirm that the offeror will comply with all provisions in this IRFP; and, if applicable, provide notice that the firm qualifies as an Alaskan bidder. Proposals must be signed by a company officer empowered to bind the company. An offeror's failure to include these items in the proposals may cause the proposal to be determined to be non-responsive and the proposal may be rejected.

Cost Proposal

Please use attachment three for completion of the cost proposal. The amount proposed in each category of the cost proposal must include all direct and indirect costs associated with the performance of the contract, including, but not limited to, total number of hours at various hourly rates, direct expenses, payroll, supplies, overhead assigned to each person working on the project, percentage of each person's time devoted to the project, and profit.

Evaluation Criteria and Contractor Selection

All proposals will be reviewed to determine if they are responsive. They will then be evaluated using the criterion that is set out below.

An evaluation may not be based on discrimination due to the race, religion, color, national origin, sex, age, marital status, pregnancy, parenthood, disability, or political affiliation of the offeror.

A proposal shall be evaluated to determine whether the offeror responds to the provisions, including goals and financial incentives, established in the IRFP in order to eliminate and prevent discrimination in state contracting because of race, religion, color, national origin, sex, age, marital status, pregnancy, parenthood, or disability.

Proposals will be evaluated against the questions set out in Attachment 1 Proposal Evaluation Form.

Evaluation Criteria (100 points)

Understanding of the Project: 5 points

How well has the offeror demonstrated a thorough understanding of the purpose and scope of the project? How well has the offeror identified pertinent issues and potential problems related to the project? To what degree has the offeror demonstrated an understanding of the deliverables the state expects it to provide? Has the offeror demonstrated an understanding of the state's time schedule and can meet it?

Methodology used for the Project: 10 points

How comprehensive is the methodology and does it depict a logical approach to fulfilling the requirements of the IRFP? How well does the methodology match and achieve the objectives set out in the IRFP? Does the methodology interface with the time schedule in the proposal?

Management Plan for this Project: 15 points

How well does the management plan support all of the project requirements and logically lead to the deliverables required in the IRFP? How well is accountability completely and clearly defined? Is the organization of the project team clear? How well does the management plan illustrate the lines of authority and communication? To what extent does the offeror already have the hardware, software, equipment, and licenses necessary to perform the contract? Does it appear that offeror can meet the schedule set out in the IRFP? Has the contractor gone beyond the minimum tasks

necessary to meet the objectives of the IRFP? To what degree is the proposal practical and feasible? To what extent has the offeror identified potential problems?

Experience and Qualifications: 20 points

Do the individuals assigned to the project have experience on similar projects? Are resumes complete and do they demonstrate backgrounds that would be desirable for individuals engaged in the work the IRFP requires? How extensive is the applicable education and experience of the personnel designated to work on the project? Has the firm demonstrated experience in completing similar projects on time and within budget? How successful is the general history of the firm regarding timely and successful completion of projects? Has the firm provided documentation of prior experience? If a subcontractor will perform work on the project, how well do they measure up to the evaluation used for the offeror?

Cost: 40 points

The offeror must include a cost proposal per the requirements on page 17 of this solicitation and Attachment 3. A maximum of 40 points will be given to the offeror with the lowest bid. DEC will use the following formula to convert costs to points:

$$\frac{[(\text{Price of Lowest Cost Proposal}) \times (\text{Maximum Points for Cost})]}{(\text{Cost of Each Higher Priced Proposal})} = \text{POINTS}$$

Alaska Offeror Preference: 10 points

Alaska bidders receive a 10 percent overall evaluation point preference.
Point value for Alaska bidders in this section -- 10 Points
100 Points x 10 Percent = 10 Points

If an offeror qualifies for the Alaska Bidder Preference, the offeror will receive an Alaska Offeror Preference. The preference will be 10 percent of the total available points. This amount will be added to the overall evaluation score of each Alaskan offeror.

ATTACHMENTS

Attachments

1. Proposal Evaluation Form (five pages);
2. Definitions and Acronyms (one page);
3. Cost Proposal (one page);
4. Standard Agreement Form - Appendix A (sample, three pages);
5. Appendix B2 (one page);
6. Notice of Award (sample, one page);
7. Mixing zone information from General Permit Fact Sheet (36 pages).

PROPOSAL EVALUATION FORM

All proposals will be reviewed for responsiveness and then evaluated using the criteria set out herein.

Person or Firm Name _____

Name of Proposal Evaluation (PEC) Member _____

Date of Review _____

IRFP Number **190000124**

EVALUATION CRITERIA AND SCORING

THE TOTAL NUMBER OF POINTS USED TO SCORE THIS PROPOSAL IS 100

Understanding of the Project - 5 Percent

Maximum Point Value for this Section - 5 Points
100 Points x 5 Percent = 5 Points

Proposals will be evaluated against the questions set out below.

[a] How well has the offeror demonstrated a thorough understanding of the purpose and scope of the project?

EVALUATOR'S NOTES _____

_____

[b] How well has the offeror identified pertinent issues and potential problems related to the project?

EVALUATOR'S NOTES _____

_____

[c] To what degree has the offeror demonstrated an understanding of the deliverables the state expects it to provide?

EVALUATOR'S NOTES _____

_____

[d] Has the offeror demonstrated an understanding of the state's time schedule and can meet it?

EVALUATOR'S NOTES _____

_____

EVALUATOR'S POINT TOTAL FOR UNDERSTANDING OF THE PROJECT: _____

Methodology Used for the Project - 10 Percent

Maximum Point Value for this Section - 10 Points
100 Points x 10 Percent = 10 Points

Proposals will be evaluated against the questions set out below.

[a] How comprehensive is the methodology and does it depict a logical approach to fulfilling the requirements of the IRFP?

EVALUATOR'S NOTES _____

_____

[b] How well does the methodology match and achieve the objectives set out in the IRFP?

EVALUATOR'S NOTES _____

_____

[c] Does the methodology interface with the time schedule in the proposal?

EVALUATOR'S NOTES _____

_____

EVALUATOR'S POINT TOTAL FOR METHODOLOGY: _____

Management Plan for the Project - 15 Percent

Maximum Point Value for this Section - 15 Points
100 Points x 15 Percent = 15 Points

Proposals will be evaluated against the questions set out below.

[a] How well does the management plan support all of the project requirements and logically lead to the deliverables required in the IRFP?

EVALUATOR'S NOTES _____

_____

[b] How well is accountability completely and clearly defined?

EVALUATOR'S NOTES _____

_____

[c] Is the organization of the project team clear?

EVALUATOR'S NOTES _____

_____

[d] How well does the management plan illustrate the lines of authority and communication?

EVALUATOR'S NOTES _____

_____

[e] To what extent does the offeror already have the hardware, software, equipment, and licenses necessary to perform the contract?

EVALUATOR'S NOTES _____

_____

[f] Does it appear that offeror can meet the schedule set out in the IRFP?

EVALUATOR'S NOTES _____

_____

[g] Has the contractor gone beyond the minimum tasks necessary to meet the objectives of the IRFP?

EVALUATOR'S NOTES _____

_____

[h] To what degree is the proposal practical and feasible?

EVALUATOR'S NOTES _____

_____

[i] To what extent has the offeror identified potential problems?

EVALUATOR'S NOTES _____

_____

EVALUATOR'S POINT TOTAL FOR <u>MANAGEMENT PLAN</u>: _____

<u>Experience and Qualifications</u> - 20 Percent

Maximum Point Value for this Section - 20 Points
100 Points x 20 Percent = 20 Points

Proposals will be evaluated against the questions set out below.

Questions regarding the personnel.

[a] Do the individuals assigned to the project have experience on similar projects?

EVALUATOR'S NOTES _____

_____

[b] Are resumes complete and do they demonstrate backgrounds that would be desirable for individuals engaged in the work the IRFP requires?

EVALUATOR'S NOTES _____

_____

[c] How extensive is the applicable education and experience of the personnel designated to work on the project?

EVALUATOR'S NOTES _____

_____

Questions regarding the firm.

[d] Has the firm demonstrated experience in completing similar projects on time and within budget?

EVALUATOR'S NOTES _____

_____

[e] How successful is the general history of the firm regarding timely and successful completion of projects?

EVALUATOR'S NOTES _____

_____

[f] Has the firm provided documentation of prior experience?

EVALUATOR'S NOTES _____

_____

[g] If a subcontractor will perform work on the project, how well do they measure up to the evaluation used for the offeror?

EVALUATOR'S NOTES _____

_____

EVALUATOR'S POINT TOTAL FOR <u>EXPERIENCE AND QUALIFICATIONS</u>: _____

<u>Contract Cost</u> - 40 Percent

Maximum Point Value for this Section - 40 Points
100 Points x 40 Percent = 40 Points

Overall, a minimum of 40 percent of the total evaluation points will be assigned to cost. The cost amount used for evaluation may be affected by one or more preferences.

Converting Cost to Points

The lowest cost proposal will receive the maximum number of points allocated to cost. The point allocations for cost on the other proposals will be determined through the method set out in the solicitation.

EVALUATOR'S POINT TOTAL FOR CONTRACT COST: _____

Alaska Offeror Preference - 10 Percent

Alaska bidders receive a 10 percent overall evaluation point preference.
Point value for Alaska bidders in this section -- 10 Points
100 Points x 10 Percent = 10 Points

If an offeror qualifies for the Alaska Bidder Preference, the offeror will receive an Alaska Offeror Preference. The preference will be 10 percent of the total available points. This amount will be added to the overall evaluation score of each Alaskan offeror.

EVALUATOR'S POINT TOTAL FOR ALASKA OFFEROR PREFERENCE: _____

EVALUATOR'S COMBINED POINT TOTAL FOR ALL SECTIONS: _____

Attachment 2:
Definitions and Acronyms

CORMIX: Modeling software used by the Division. It is licensed and distributed by MixZon Inc.

CPVEC: Commercial Passenger Vessel Environmental Compliance Program

Cruise Ship: Large Commercial Passenger Vessel (250 or more lower berths)

Department or DEC: Alaska Department of Environmental Conservation.

Project Manager: The person(s) designated by the Alaska Department of Environmental Conservation to monitor the operations and performance of the contractor for contract compliance, and to coordinate actions and communications between the DEC and the contractor.

State: The State of Alaska or the Alaska Department of Environmental Conservation as a State Contracting Agency

Wastewater General Permit: the 2014 Alaska Large Commercial Passenger Vessel Wastewater General Permit

Attachment 3:
Cost Proposal

Offeror Name

The amount proposed in each category below must include all direct and indirect costs associated with the performance of the contract, including, but not limited to, total number of hours at various hourly rates, direct expenses, payroll, supplies, overhead assigned to each person working on the project, percentage of each person's time devoted to the project, and profit.

Cost Proposed as a Single Fully Burdened Rate per Project Category as noted below:

Project Category	Rate in USD ($)
Task #1	
Task #2	
Task #3	
Task #4	
TOTAL COMBINED COST* = Task 1 + Task 2 + Task 3 + Task 4	

Authorized Representative (Print)
Signature
Date

*The Total Combined Cost is the sum of all 4 Tasks added together. If there is an arithmetic error, the total calculated by the Procurement Officer shall prevail.

STANDARD AGREEMENT FORM FOR PROFESSIONAL SERVICES

The parties' contract comprises this Standard Agreement Form, as well as its referenced Articles and their associated Appendices

1. Agency Contract Number	2. Contract Title	3. Agency Fund Code	4. Agency Appropriation Code
5. Vendor Number	6. IRIS GAE Number (if used)	7. Alaska Business License Number	

This contract is between the State of Alaska,

8. Department of Environmental Conservation	Division	hereafter the State, and

9. Contractor

hereafter the contractor

Mailing Address	Street or P.O. Box	City	State	ZIP+4

10.

ARTICLE1. Appendices: Appendices referred to in this contract and attached to it are considered part of it.

ARTICLE2. Performance of Service:

2.1 Appendix A (General Provisions), Articles 1 through 16, governs the performance of services under this contract.
2.2 Appendix B sets forth the liability and insurance provisions of this contract.
2.3 Appendix C sets forth the services to be performed by the contractor.

ARTICLE3. Period of Performance: The period of performance for this contract begins _____, and ends _____.

ARTICLE4. Considerations:

4.1 In full consideration of the contractor's performance under this contract, the State shall pay the contractor a sum not to exceed _____ in accordance with the provisions of Appendix D.
4.2 When billing the State, the contractor shall refer to the Authority Number or the Agency Contract Number and send the billing to:

11. Department of	Attention: Division of
Mailing Address	Attention:

12. CONTRACTOR		14. **CERTIFICATION:** I certify that the facts herein and on supporting documents are correct, that this voucher constitutes a legal charge against funds and appropriations cited, that sufficient funds are encumbered to pay this obligation, or that there is a sufficient balance in the appropriation cited to cover this obligation. I am aware that to knowingly make or allow false entries or alternations on a public record, or knowingly destroy, mutilate, suppress, conceal, remove or otherwise impair the verity, legibility or availability of a public record constitutes tampering with public records punishable under AS 11.56.815-.820. Other disciplinary action may be taken up to and including dismissal.
Name of Firm		
Signature of Authorized Representative	Date	
Typed or Printed Name of Authorized Representative		
Title		

13. CONTRACTING AGENCY		Signature of Head of Contracting Agency or Designee	Date
Department/Division	Date		
Signature of Project Director		Typed or Printed Name	
Typed or Printed Name of Project Director		Title	
Title			

NOTICE: This contract has no effect until signed by the head of contracting agency or designee.

APPENDIX A

GENERAL PROVISIONS

Article 1. Definitions.

1.1 In this contract and appendices, "Project Director" or "Agency Head" or "Procurement Officer" means the person who signs this contract on behalf of the Requesting Agency and includes a successor or authorized representative.

1.2 "State Contracting Agency" means the department for which this contract is to be performed and for which the Commissioner or Authorized Designee acted in signing this contract.

Article 2. Inspections and Reports.

2.1 The department may inspect, in the manner and at reasonable times it considers appropriate, all the contractor's facilities and activities under this contract.

2.2 The contractor shall make progress and other reports in the manner and at the times the department reasonably requires.

Article 3. Disputes.

3.1 If the contractor has a claim arising in connection with the contract that it cannot resolve with the State by mutual agreement, it shall pursue the claim, if at all, in accordance with the provisions of AS 36.30.620 – 632.

Article 4. Equal Employment Opportunity.

4.1 The contractor may not discriminate against any employee or applicant for employment because of race, religion, color, national origin, or because of age, disability, sex, marital status, changes in marital status, pregnancy or parenthood when the reasonable demands of the position(s) do not require distinction on the basis of age, disability, sex, marital status, changes in marital status, pregnancy, or parenthood. The contractor shall take affirmative action to insure that the applicants are considered for employment and that employees are treated during employment without unlawful regard to their race, color, religion, national origin, ancestry, disability, age, sex, marital status, changes in marital status, pregnancy or parenthood. This action must include, but need not be limited to, the following: employment, upgrading, demotion, transfer, recruitment or recruitment advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training including apprenticeship. The contractor shall post in conspicuous places, available to employees and applicants for employment, notices setting out the provisions of this paragraph.

4.2 The contractor shall state, in all solicitations or advertisements for employees to work on State of Alaska contract jobs, that it is an equal opportunity employer and that all qualified applicants will receive consideration for employment without regard to race, religion, color, national origin, age, disability, sex, marital status, changes in marital status, pregnancy or parenthood.

4.3 The contractor shall send to each labor union or representative of workers with which the contractor has a collective bargaining agreement or other contract or understanding a notice advising the labor union or workers' compensation representative of the contractor's commitments under this article and post copies of the notice in conspicuous places available to all employees and applicants for employment.

4.4 The contractor shall include the provisions of this article in every contract, and shall require the inclusion of these provisions in every contract entered into by any of its subcontractors, so that those provisions will be binding upon each subcontractor. For the purpose of including those provisions in any contract or subcontract, as required by this contract, "contractor" and "subcontractor" may be changed to reflect appropriately the name or designation of the parties of the contract or subcontract.

4.5 The contractor shall cooperate fully with State efforts which seek to deal with the problem of unlawful discrimination, and with all other State efforts to guarantee fair employment practices under this contract, and promptly comply with all requests and directions from the State Commission for Human Rights or any of its officers or agents relating to prevention of discriminatory employment practices.

4.6 Full cooperation in paragraph 4.5 includes, but is not limited to, being a witness in any proceeding involving questions of unlawful discrimination if that is requested by any official or agency of the State of Alaska; permitting employees of the contractor to be witnesses or complainants in any proceeding involving questions of unlawful discrimination, if that is requested by any official or agency of the State of Alaska; participating in meetings; submitting periodic reports on the equal employment aspects of present and future employment; assisting inspection of the contractor's facilities; and promptly complying with all State directives considered essential by any office or agency of the State of Alaska to insure compliance with all federal and State laws, regulations, and policies pertaining to the prevention of discriminatory employment practices.

4.7 Failure to perform under this article constitutes a material breach of contract.

Article 5. Termination.

The Project Director, by written notice, may terminate this contract, in whole or in part, when it is in the best interest of the State. In the absence of a breach of contract by the contractor, the State is liable only for payment in accordance with the payment provisions of this contract for services rendered before the effective date of termination.

Article 6. No Assignment or Delegation.

The contractor may not assign or delegate this contract, or any part of it, or any right to any of the money to be paid under it, except with the written consent of the Project Director and the Agency Head.

Article 7. No Additional Work or Material.

No claim for additional services, not specifically provided in this contract, performed or furnished by the contractor, will be allowed, nor may the contractor do any work or furnish any material not covered by the contract unless the work or material is ordered in writing by the Project Director and approved by the Agency Head.

Article 8. Independent Contractor.

The contractor and any agents and employees of the contractor act in an independent capacity and are not officers or employees or agents of the State in the performance of this contract.

Article 9. Payment of Taxes.

As a condition of performance of this contract, the contractor shall pay all federal, State, and local taxes incurred by the contractor and shall require their payment by any Subcontractor or any other persons in the performance of this contract. Satisfactory performance of this paragraph is a condition precedent to payment by the State under this contract.

Article 10. Ownership of Documents.
All designs, drawings, specifications, notes, artwork, and other work developed in the performance of this agreement are produced for hire and remain the sole property of the State of Alaska and may be used by the State for any other purpose without additional compensation to the contractor. The contractor agrees not to assert any rights and not to establish any claim under the design patent or copyright laws. Nevertheless, if the contractor does mark such documents with a statement suggesting they are trademarked, copyrighted, or otherwise protected against the State's unencumbered use or distribution, the contractor agrees that this paragraph supersedes any such statement and renders it void. The contractor, for a period of three years after final payment under this contract, agrees to furnish and provide access to all retained materials at the request of the Project Director. Unless otherwise directed by the Project Director, the contractor may retain copies of all the materials.

Article 11. Governing Law; Forum Selection
This contract is governed by the laws of the State of Alaska. To the extent not otherwise governed by Article 3 of this Appendix, any claim concerning this contract shall be brought only in the Superior Court of the State of Alaska and not elsewhere.

Article 12. Conflicting Provisions.
Unless specifically amended and approved by the Department of Law, the terms of this contract supersede any provisions the contractor may seek to add. The contractor may not add additional or different terms to this contract; AS 45.02.207(b)(1). The contractor specifically acknowledges and agrees that, among other things, provisions in any documents it seeks to append hereto that purport to (1) waive the State of Alaska's sovereign immunity, (2) impose indemnification obligations on the State of Alaska, or (3) limit liability of the contractor for acts of contractor negligence, are expressly superseded by this contract and are void.

Article 13. Officials Not to Benefit.
Contractor must comply with all applicable federal or State laws regulating ethical conduct of public officers and employees.

Article 14. Covenant Against Contingent Fees.
The contractor warrants that no person or agency has been employed or retained to solicit or secure this contract upon an agreement or understanding for a commission, percentage, brokerage or contingent fee except employees or agencies maintained by the contractor for the purpose of securing business. For the breach or violation of this warranty, the State may terminate this contract without liability or in its discretion deduct from the contract price or consideration the full amount of the commission, percentage, brokerage or contingent fee.

Article 15. Compliance.
In the performance of this contract, the contractor must comply with all applicable federal, state, and borough regulations, codes, and laws, and be liable for all required insurance, licenses, permits and bonds.

Article 16. Force Majeure:
The parties to this contract are not liable for the consequences of any failure to perform, or default in performing, any of their obligations under this Agreement, if that failure or default is caused by any unforeseeable Force Majeure, beyond the control of, and without the fault or negligence of, the respective party. For the purposes of this Agreement, Force Majeure will mean war (whether declared or not); revolution; invasion; insurrection; riot; civil commotion; sabotage; military or usurped power; lightning; explosion; fire; storm; drought; flood; earthquake; epidemic; quarantine; strikes; acts or restraints of governmental authorities affecting the project or directly or indirectly prohibiting or restricting the furnishing or use of materials or labor required; inability to secure materials, machinery, equipment or labor because of priority, allocation or other regulations of any governmental authorities.

APPENDIX B[2]
INDEMNITY AND INSURANCE

Article 1. Indemnification

The Contractor shall indemnify, hold harmless, and defend the contracting agency from and against any claim of, or liability for error, omission or negligent act of the Contractor under this agreement. The Contractor shall not be required to indemnify the contracting agency for a claim of, or liability for, the independent negligence of the contracting agency. If there is a claim of, or liability for, the joint negligent error or omission of the Contractor and the independent negligence of the Contracting agency, the indemnification and hold harmless obligation shall be apportioned on a comparative fault basis. "Contractor" and "Contracting agency", as used within this and the following article, include the employees, agents and other contractors who are directly responsible, respectively, to each. The term "independent negligence" is negligence other than in the Contracting agency's selection, administration, monitoring, or controlling of the Contractor and in approving or accepting the Contractor's work.

Article 2. Insurance

Without limiting contractor's indemnification, it is agreed that contractor shall purchase at its own expense and maintain in force at all times during the performance of services under this agreement the following policies of insurance. Where specific limits are shown, it is understood that they shall be the minimum acceptable limits. If the contractor's policy contains higher limits, the state shall be entitled to coverage to the extent of such higher limits. Certificates of Insurance must be furnished to the contracting officer prior to beginning work and must provide for a notice of cancellation, non-renewal, or material change of conditions in accordance with policy provisions. Failure to furnish satisfactory evidence of insurance or lapse of the policy is a material breach of this contract and shall be grounds for termination of the contractor's services. All insurance policies shall comply with and be issued by insurers licensed to transact the business of insurance under AS 21.

2.1 Workers' Compensation Insurance: The Contractor shall provide and maintain, for all employees engaged in work under this contract, coverage as required by AS 23.30.045, and; where applicable, any other statutory obligations including but not limited to Federal U.S.L. & H. and Jones Act requirements. The policy must waive subrogation against the State.

2.2 Commercial General Liability Insurance: covering all business premises and operations used by the Contractor in the performance of services under this agreement with minimum coverage limits of $300,000 combined single limit per claim.

2.3 Commercial Automobile Liability Insurance: covering all vehicles used by the Contractor in the performance of services under this agreement with minimum coverage limits of $300,000 combined single limit per claim.

2.4 Professional Liability Insurance: covering all errors, omissions or negligent acts in the performance of professional services under this agreement. Limits required per the following schedule:

Contract Amount	**Minimum Required Limits**
Under $100,000	$300,000 per Claim / Annual Aggregate
$100,000-$499,999	$500,000 per Claim / Annual Aggregate
$500,000-$999,999	$1,000,000 per Claim / Annual Aggregate
$1,000,000 or over	Refer to Risk Management

NOTICE OF INTENT TO AWARD A CONTRACT

Department of Environmental
Conservation
Division of Administrative Services
Procurement Services Unit
410 Willoughby Ave Suite 303
Juneau, AK 99801

THIS IS NOT AN ORDER

DATE ISSUED:

IRFP NO.:

IRFP DEADLINE:

IRFP SUBJECT:

CONTRACTING OFFICER:

SIGNATURE: _____

This is notice of the state's intent to award a contract. The figures shown here are a tabulation of the offers received. The responsible and responsive offeror whose proposal was determined in writing to be the most advantageous is indicated. An offeror who wishes to protest this Notice of Intent must file the protest within ten calendar days following the date this notice is issued. If the tenth day falls on a weekend or holiday, the last day of the protest period is the first working day following the tenth day. **The offeror identified here as submitting the most advantageous proposal is instructed not to proceed until a contract, or other form of notice is given by the contracting officer**. A company or person who proceeds prior to receiving a contract, Contract Award, or other form of notice of Award does so without a contract and at their own risk. AS 36.30.365.

Offerors	Responsive	Total Score	Most Advantageous

LEGEND: @ -- MOST ADVANTAGEOUS
Y -- RESPONSIVE PROPOSAL
N -- NON-RESPONSIVE PROPOSAL

SUMMARY

Effluent Quality

The 2010 General Permit contained effluent limits for conventional pollutants (pH, biological oxygen demand (BOD), total suspended solids (TSS), and fecal coliform), non-conventional pollutants (ammonia and total residual chlorine (TRC)), and the priority pollutants dissolved copper, dissolved nickel, and dissolved zinc. Graphs illustrating trends from 2008 to 2012 for ammonia and the three dissolved metals can be found in Appendix D: Discharge Characterization Figures. The monitoring data from 2013 was not used as permit development and modeling efforts were initiated prior to the end of the 2103 cruise ship season and prior to receipt of all monitoring reports.

Table 1 and Table 2 below provide summary statistics for large cruise ship wastewater sample results for 2011 and 2012. Additional wastewater sample results can be found on the DEC Cruise Program website at: http://www.dec.state.ak.us/water/cruise_ships/reports.htm.

Table 1: Summary of 2011 Large Cruise Ship Sampling Results (15 ships, 183 sampling events).

Parameter	Ammonia as N	Dissolved Copper	Dissolved Nickel	Dissolved Zinc	pH	5-Day BOD[c]	Total Suspended Solids	Total Residual Chlorine	Fecal coliform (daily max).
Units	mg/l	µg/L	µg/L	µg/L	S.U.	mg/L	mg/L	mg/L	MPN/ 100 mL
Alaska Chronic WQC	1.0[a]	3.1	8.2	81	6.5-8.5	N/A[d]	N/A	0.0075	40
Minimum Reported	ND[b]	ND	ND	ND	5.24	ND	ND	ND	ND
Maximum Reported	160	370	75	400	8.23	90	46	ND	110
Median	19.5	6.1	9.5	79	7.11	2.8	ND	ND	ND

Notes:

a. Ammonia standard was based on temperature, pH and salinity. The ammonia chronic water quality criterion for the Permit is 1 mg/L based on the latest and most comprehensive Southeast Alaska ambient water data, with a pH of 8.2, a salinity of 20 g/kg, and a temperature of 10-15 degrees C.

b. ND = non-detect

c. BOD = biological oxygen demand

d. N/A = not applicable

Table 2: Summary of 2012 Large Cruise Ship Sampling Results (16 ships, 168 sampling events).

Parameter	Ammonia as N	Dissolved Copper	Dissolved Nickel	Dissolved Zinc	pH	5-Day BOD	Total Suspended Solids	Total Residual Chlorine	Fecal coliform (daily max).
Units	mg/l	µg/L	µg/L	µg/L	S.U.	mg/L	mg/L	mg/L	MPN/ 100 mL
Alaska Chronic WQC	1.0[a]	3.1	8.2	81	6.5-8.5	N/A	N/A	0.0075	40
Minimum Reported	ND[b]	ND	ND	7.78	6.05	ND	ND	ND	ND
Maximum Reported	110	160	210	330	8.7	110	39	0.25	TNTC[c]
Median	23	7.3	9.1	64	7.16	2.8	ND	ND	ND

Notes:

a. Ammonia standard was based on temperature, pH and salinity. The ammonia chronic water quality criterion for the Permit is 1 mg/L based on the latest and most comprehensive Southeast Alaska ambient water data, with a pH of 8.2, a salinity of 20 g/kg, and a temperature of 10-15 °C.
b. ND = non-detect
c. TNTC = Too Numerous to Count
d. N/A = not applicable

Water Quality-Based Effluent Limitations

Alaska Water Quality Standards

The water quality standards (WQS) applicable to the Permit are in 18 AAC 70, as amended through April 8, 2012. The WQS apply to State waters and specify the degree of degradation that may not be exceeded in a waterbody as a result of human actions (18 AAC 70.010(b)). WQS are composed of designated waterbody uses, numeric and/or narrative water quality criteria (WQC) to protect the designated waterbody uses, and an antidegradation policy. The WQS also include mixing zone regulations and consideration of whole effluent toxicity.

The receiving waters for discharges authorized by the Permit are marine waters that are classified in the WQS at 18 AAC 70.020(a)(2) as Classes (2)(A), (B), (C), and (D) for use in aquaculture, seafood processing, and industrial water supply; contact and secondary recreation; growth and propagation of fish, shellfish, other aquatic life, and wildlife; and harvesting for consumption of raw mollusks or other raw aquatic life, respectively.

Numeric and/or narrative WQC in 18 AAC 70.020(b) are those criteria deemed necessary by the State to support the designated waterbody use classifications. WQC often are established to protect against acute and chronic toxicity whether for human health protection or for aquatic life protection. Acute toxicity is a level of toxicity that demonstrates observable lethal or sublethal effects in aquatic organisms exposed for a short period of time, typically from 1 to 24 hours. Chronic toxicity includes levels of toxicity that effect things such as development, reproduction, growth, and survival over a longer period of time. Cook Inlet in the vicinity of the Point Woronzof has site specific criteria adopted in 18 AAC 70.236(b).

Mixing Zone Information

Most Restrictive Applicable Marine Water Quality Criteria for Pollutants of Concern.

Parameter	Units[a]	WQC Limits		Reference
Fecal Coliform (FC) Bacteria	FC/100 mL	14[b]	40[c]	18 AAC 70.20(b)(14)
Dissolved Oxygen (DO)	mg/L	may not be less than 6 or greater than 17		18 AAC 70.20(b)(15)
pH	S.U.	may not be less than 6.5 or greater than 8.5, may not vary more than 0.2 outside of the naturally occurring range		18 AAC 70.20(b)(18)
Parameter	**Units[a]**	**Chronic WQC**	**Acute WQC**	**Reference**
Total Residual Chlorine (TRC)[d]	mg/L	0.0075	0.013	18 AAC 70.20(b)(23) [e]
Ammonia	mg/L	1.0	6.2	18 AAC 70.20(b)(23) [e,f]
Dissolved Copper	µg/L	3.1	4.8	18 AAC 70.20(b)(23) [e]
Dissolved Nickel	µg/L	8.2	74	18 AAC 70.20(b)(23) [e]
Dissolved Zinc	µg/L	81	90	18 AAC 70.20(b)(23) [e]

Notes:

a. L (liter), mg (milligram), mL (milliliter), S.U. (standard pH units)
b. Monthly geometric mean
c. In a 30-day period, not more than 10% of the samples may exceed 40 FC/100 mL
d. The TRC effluent limits are not quantifiable. DEC will use the minimum level (ML) of 0.01 mg/L as the compliance evaluation level for this parameter.
e. Which adopts by reference *Alaska Water Quality Criteria for Toxics and Other Deleterious Organic and Inorganic Substances*, dated December 12, 2008
f. Ammonia WQC are based on a pH of 8.2, a salinity of 20 g/kg, and a temperature of 10-15 °C

Available Dilution and Mixing Zone Analysis

Applicable statutes and regulations for cruise ship mixing zones

In addition to requiring the Department to define systems that constitute AWTS, HB 80 treats cruise ships with AWTS as a class for the purposes of authorizing mixing zones. In accordance with State regulations at 18 AAC 70.240, as amended through April 8, 2012, and AS 46.03.462(e) and (j), the Department may authorize a mixing zone under a general permit for the class of ships that use AWTS or other ships that the Department finds will be comparable effluent quality to that achieved by one or more vessels employing AWTS. Per statute AS 46.03.462(e), if a cruise ship employs an AWTS under the Permit, then the cruise ship satisfies all state technology-based treatment requirements under 18 AAC 70.240(c)(1). Upon receipt of a complete application and a determination that mixing zone requirements are met, the Department may authorize a mixing zone.

An NOI serves as the application under a general permit and includes the information and available evidence necessary to determine consistency with 18 AAC 70.240. As the Permit is a re-issuance, there was substantial information that informed the Department's analysis, including information collected during previous permit development, historical effluent monitoring results, and the work of the Cruise Ship Wastewater Science Advisory Panel.

Mixing Zones

A mixing zone is a regulatory defined area where treated effluent mixes with receiving water (i.e., the waterbody that receives the discharge), and WQC are met beyond the boundaries. State regulations determine whether or not a mixing zone is allowed in a waterbody and, if authorized, mixing zone size limitations based on the waterbody, technological treatment, and necessity of a mixing zone.

The mixing that occurs after discharge can also be describe based on the physical mixing processes. It can be helpful to understand the physical mixing process before adding the regulatory overlay of authorized mixing zones. Physical mixing can be generalized into two zones. A smaller "zone of initial dilution," where the speed of the discharge pushes the effluent faster than the receiving water moves, and a larger zone where the effluent has lost speed from being discharged and mixes more slowly with and becomes transported by the receiving water. The second, larger zone is the far-field zone. Dilution occurs in both zones, but the mixing is quicker and the dilution is larger in the zone of initial dilution. These two zones are sometimes described in relation to the discharge point as near-field and far-field dilution/mixing, respectively.

The mixing that occurs in the near-field zone usually determines whether acute aquatic life criteria will be met. Usually the mixing that occurs in the near-field zone determines whether chronic WQC will be met. The effluent mixes much more rapidly in the smaller initial mixing zone than in the near-field zone.

Through the evaluation of the factors in 18 AAC 70.240, the Department determines whether and how much of the available dilution will be considered, in determining the size of the authorized mixing zone, in the reasonable potential analysis, and in determining WQBELs. The evaluation factors required in 18 AAC 70.240 include the consideration of technology, existing uses of the waterbody, human consumption, spawning areas, human health, aquatic life, endangered species, and the necessity of the size of the mixing zone.

A cruise ship's effluent can exceed WQC at the point of discharge as long as it eventually meets acute and chronic WQC without causing acute or chronic impacts in the interim. Because the acute WQC are based on short exposure times, if a discharge does not meet acute WQC in the physical zone of initial dilution, then the discharge likely will not meet the acute toxicity regulatory requirements. Even if the cruise ship meets acute WQC within the smaller initial mixing zone, it must also meet the combined requirements for the waterbody and technological treatment for a chronic mixing zone. Applicable regulations also require mixing zones to be as small as practicable (18 AAC 70.240(k)). All factors must be met in order to authorize a mixing zone.

Mixing zone modeling

Modeling is a tool used to determine the mixing characteristics and available dilution that is reasonably expected to occur under a wide variety of environmental conditions (tides, temperatures, winds, etc.). Cornell Mixing Zone Expert System (CORMIX) version 8.0 is a modeling program frequently used by the state's APDES program, EPA, and other states.

CORMIX was used to analyze and predict the behavior of cruise ship wastewater discharge plumes as they mix with marine receiving waters. CORMIX determines equilibrium conditions in the near field and calculates available dilution and other regulatory endpoints such as mixing zone size for ships authorized to discharge under the Permit. Mixing zone sizes found to be as small as practicable were different for 1) ships traveling at speeds of 6 knots or greater and 2) ships traveling at speeds under 6 knots. Mixing zone shapes also differed for the two speed classifications. A detailed explanation is included in Appendix F: Available Dilution and Mixing Zone Modeling.

Mixing Zone Information

Available dilution is a function of ambient conditions, effluent quality, discharge characteristics, and waterbody mixing characteristics. When no mixing zone is authorized, then historical performance and effluent limitations are the primary means of ensuring WQC are met in the waterbody. When a mixing zone is authorized, the discharge characteristics can have as much or more importance in ensuring that WQC are met at the boundaries of the mixing zone. Figure 2 shows how this occurs for wastewater discharges from stationary cruise ships and provides an example of the differences in available dilution observed moving from the smaller zone of initial dilution through the near-field or chronic mixing zone. Figure 2 shows how available dilution changes from being determined by the discharge characteristics to being determined by waterbody mixing.

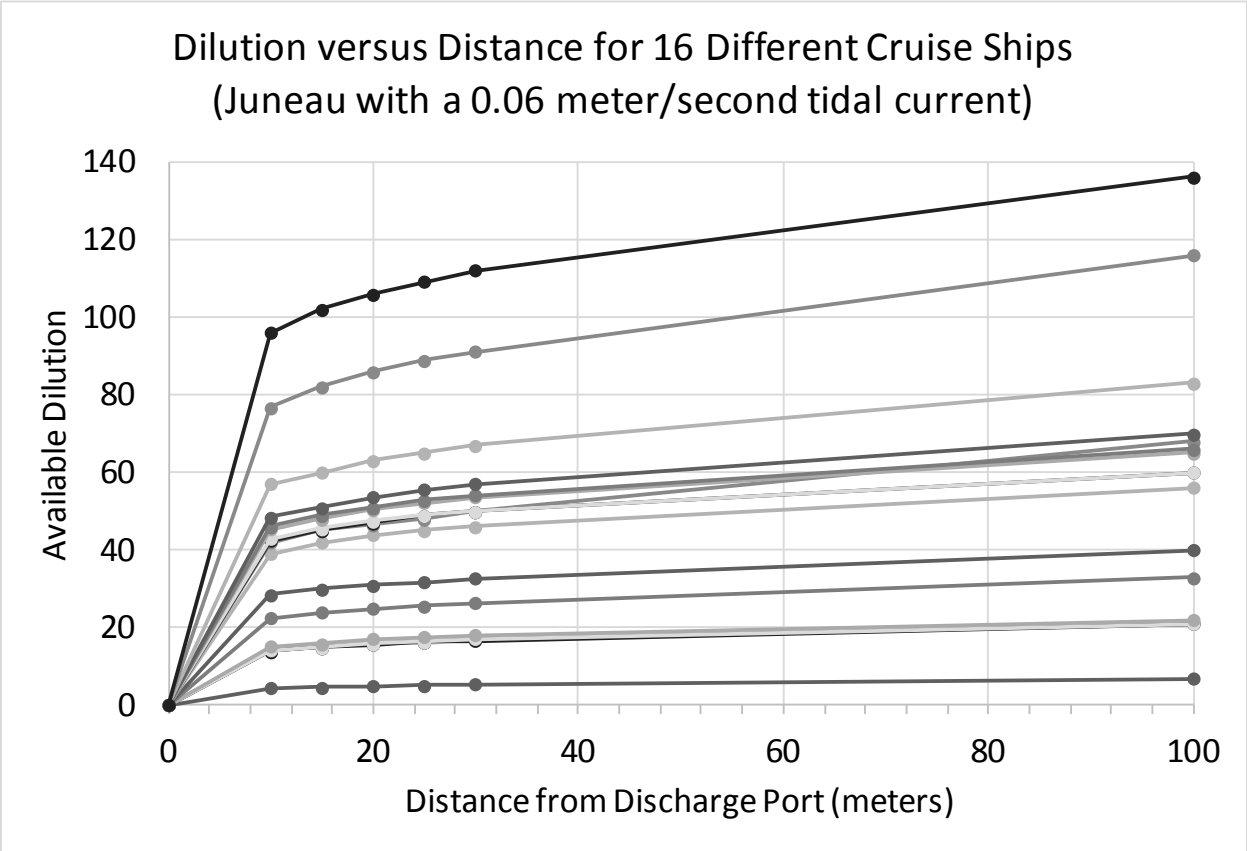


Figure 1: Available Dilution as a Function of Large Cruise Ship Characteristics and Distance from Discharge Port When Stationary

The vertical axis shows the available dilution and the horizontal axis shows the distance from the discharge port. The range of cruise ship-specific discharge characteristics results in significant differences in available dilution between the 16 cruise ships modeled by the Department within the first ten meters or within the smaller initial mixing zone. At 10 meters, the available dilution factors ranges from approximately 5 to 95, or a spread of 90 (i.e., the different curves spread apart rapidly during the initial dilution). As the distance from the discharge port increases, the differences between the cruise ships stops growing and becomes fairly constant. At 100 meters, the available dilution factors range from approximately 8 to 135, or a spread of 127. The additional 90 meters increased the spread in available dilution factors by an additional 37 compared to the spread of 90 that was achieved within the first ten meters. This shows the decreasing speed of the

discharge and the greater influence of the ambient environment once outside of the smaller initial mixing zone.

Initial mixing/acute zone

18 AAC 70.240(d)(8) requires that acute aquatic life criteria are not exceeded at and beyond the boundaries of the smaller initial mixing zone. The Department's *Implementation Guidance: 2006 Mixing Zone Regulation Revisions* (DEC 2009) provides guidance on how to determine whether the requirements of 18 AAC 70.240(d)(8) are met. If any one of four methods to limit the size of the smaller initial mixing zone are used, compliance is assumed. Method three requires an evaluation of whether a drifting organism reaches the boundaries of the smaller initial mixing zone in 15 minutes or less (acute aquatic life criteria are based on a one hour or greater exposure period). CORMIX is capable of modeling whether this will occur or not.

Table 5 lists the most restrictive, applicable WQC for acute and chronic endpoints. Of the pollutants of concern listed, the following acute WQC are based on aquatic life protection: TRC, ammonia, and dissolved copper, nickel, and zinc. If the pollutant that needs the greatest dilution factor can meet the requirements of method three then all acute aquatic life criteria will be met at and beyond the boundaries of the smaller initial mixing zone. Once the chronic mixing zone size is established, CORMIX is used, as necessary, to make this determination.

For discharges at speeds of 6 knots or greater, all WQC are met in less than 21 seconds after discharge. A drifting organism that was directly in the path of a moving cruise ship's discharge would have an exposure no greater than 21 seconds, and the requirements of 18 AAC 70.240(d)(8) are met. For discharges at speeds of under 6 knots, some ships may not meet acute aquatic life criteria at and beyond the boundary of the smaller initial mixing zone if not further restricted beyond the WQBELs established for the chronic mixing zone. This will be evaluated based on the information submitted with the NOI.

Chronic mixing zone driving parameter

After having determined that reasonable potential to exceed WQS exists and after ensuring that all acute aquatic life criteria are met at and beyond the boundaries of the smaller initial mixing zone (18 AAC 70.240(d)(8)), the size of the chronic mixing zone needs to be determined. When more than one pollutant would need a mixing zone to meet chronic WQC, the pollutant that needs the most dilution, which would correspond to the largest sized chronic mixing zone, is the "driving parameter." Once an allowable mixing zone size is determined, an effluent limitation must be calculated for the driving parameter since there is reasonable potential at the point of discharge and the boundaries of the mixing zone are based on driving parameter. All other pollutants were evaluated to determine whether they would meet water quality standards at the boundary of the authorized mixing zone. If any other pollutant(s) cannot meet chronic WQC before the boundaries of the authorized mixing zone, then an effluent limit must be calculated for that pollutant(s) as well. This situation occurs for ammonia and copper in wastewater discharge occurring when moving at speeds under 6 knots because ship-specific discharge characteristics needed to be considered.

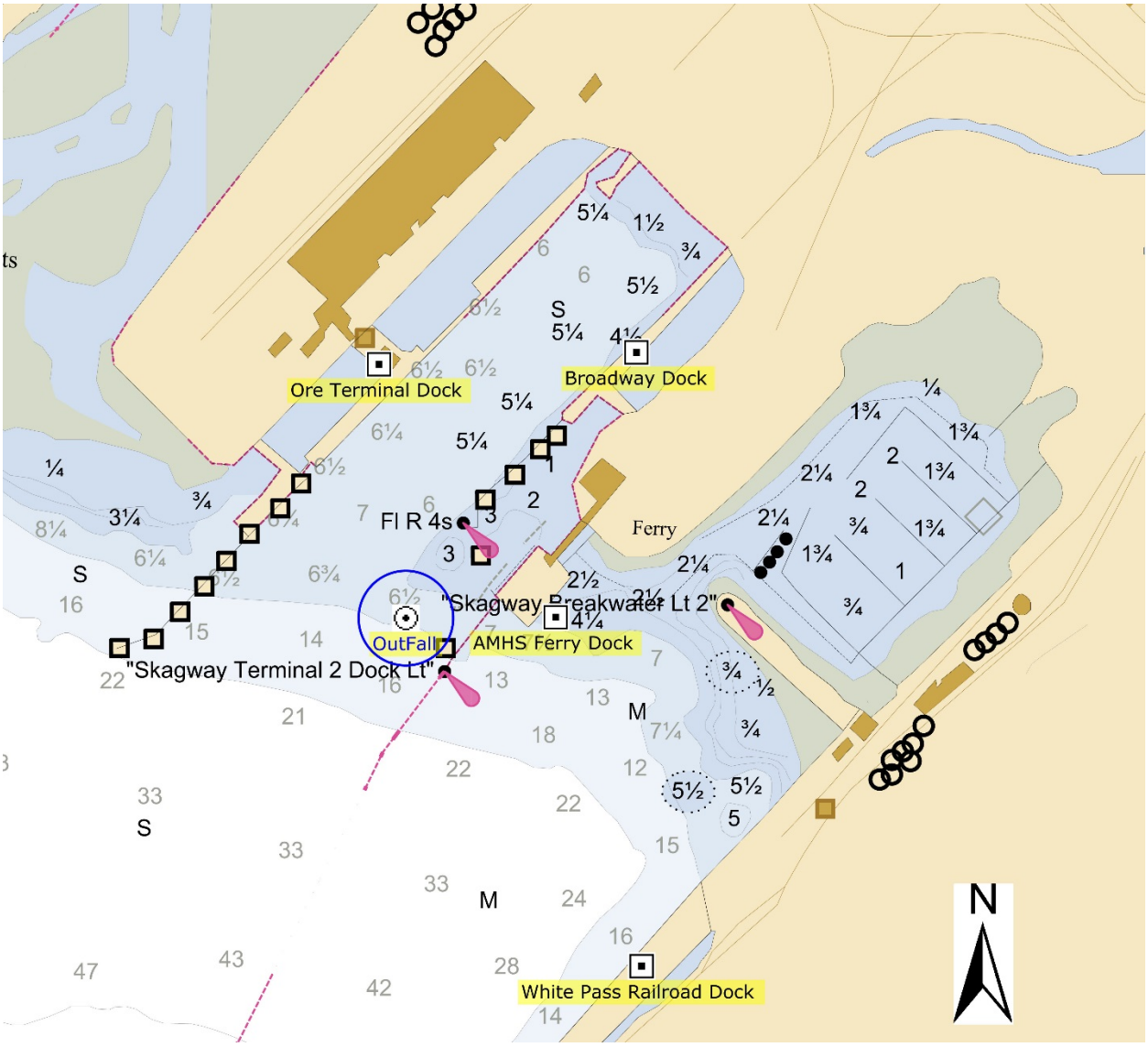
For wastewater discharges that occur from vessels moving at a speed of 6 knots or greater, the chronic ammonia WQC is the driving parameter. When discharging wastewater at speeds under 6 knots, the chronic WQC for ammonia and, on occasion, dissolved copper, would not be met at the boundaries of the mixing zone without effluent limitations constraining the concentration discharged. Therefore, both ammonia and dissolved copper are the driving parameters for determining the under 6 knots mixing zone size that is as small as practicable. No effluent limitation was needed to constrain dissolved nickel concentrations in the

effluent because dissolved nickel chronic WQC were met for all ships within 10 meters. This was true even at the conservative ambient concentrations used to determine dilution requirements. Details for this analysis are found in Appendix F: Available Dilution and Mixing Zone Modeling.

Appendix G: Mixing Zone Analysis Checklist provides greater detail on the factors the Department considered when analyzing whether a mixing zone can be authorized as well as the summary of findings for the mixing zones in the Permit.

Authorized mixing zone sizes

The results of the available dilution modeling were used to determine an authorized mixing zone size for cruise ships moving at speeds of 6 knots or greater and for cruise ships at speeds of under 6 knots. Mixing zone size for discharges while at speeds of 6 knots or greater was limited to a 63 meter by five meter rectangle. For discharges while at speeds under 6 knots the mixing zone size is a 83 meter radius unless discharging in Skagway at Broadway Dock or Ore Dock (See Figure 3) when the mixing zone size is a 15 meter radius.



Schematic of Skagway Harbor Showing the Locations of Broadway and Ore Docks. Harbor Depths are in fathoms.

Authorized mixing zone for discharge while moving at 6 knots or greater

With the discharge of the maximum observed historical effluent concentrations (2008 – 2012), the most restrictive WQC (ammonia chronic criterion) will be met in less than 21 seconds or 63 meters aft (to the rear of the ship) of the discharge port. As the discharge port of a large cruise ship is typically 100 meters from the stern (midship to a typical large cruise ship), this means the chronic WQC for ammonia will be met before the discharge reaches the stern. The width of the discharge plume will be 5 meters or less, and the depth is from the surface to 1 meter below the discharge port. The rectangular mixing zone moves with the ship and the size is fixed relative to the discharge port. The mixing zone represents the maximum size (63 meters long, 5 meters wide, and depth of the discharge port plus 1 meter) and time (21 seconds) that the pollutants of concern in the waterbody that could exceed WQC due to any one cruise ship discharge at one time. This size meets the "as small as practicable" requirement in 18 AAC 70.240 by limiting the 6 knots or greater mixing

zone size to be no larger than necessary to concurrently meet WQC and all other mixing zone requirements at the boundaries of the mixing zone. Additionally, once a discharged pollutant reaches the stern of the ship, the turbulent wake results in an additional 700:1 dilution factor.

Authorized mixing zone for discharge while moving at under 6 knots

As part of the Department's modeling for discharges at ship speeds under 6 knots, WQBELs for the driving parameters (chronic ammonia and dissolved copper WQC) were initially set at the maximum observed effluent concentrations for each ship (no effluent limitation was needed to constrain dissolved nickel concentrations in the effluent). However this approach did not result in mixing zones that met all the requirements in 18 AAC 70.240. For instance, mixing zone sizes of several hundred to nearly a thousand meters would have the potential to overlap with other mixing zones. In addition, such a large mixing zone size raises the possibility of adverse effects to resident species.

The 95th percentile of historical ammonia and dissolved copper effluent concentrations for each ship was a necessary limitation to calculate mixing zones that could meet chronic ammonia and dissolved copper WQC in less than 100 meters and generally avoid overlapping other mixing zones. CORMIX modeling results further showed all ships that could meet applicable WQC within 100 meters could also meet applicable WQC at or within 83 meters. Therefore, the mixing zone size suitable for most ships discharging at speeds under 6 knots was set at an 83 meter radius (relative to the discharge port) to account for the changing direction of tidal currents and depth of 1 meter below the discharge port in the Permit. The tidal current will change direction as it moves from a flood to an ebb tide and vice versa. The mixing zone size needs to be a radius of 83 meters to accommodate the shift in discharge plume to either side of the discharge port fore, aft, or any angle in between.

The mixing zone boundaries, which are based upon a docked ship discharging during the 10th percentile tidal current, were used to conservatively assess whether all existing and designated uses would be met for all wastewater discharges while moving at any speed under 6 knots. The actual mixing characteristics of discharge that occurs while moving at under 6 knots but not stationary will be intermediate between the moving mixing zone for 6 knots or greater and the stationary mixing zone for under 6 knots. The Department found that all existing marine water body uses will be maintained and protected. For example, the Douglas Island Pink and Chum fish hatchery net pens near the Thane-Sheep Creek estuary are outside the mixing zone boundaries for cruise ship discharges, even if a cruise ship was essentially stationary in the shipping channel. Cruise ship wastewater discharges would not expose the net pens to concentrations exceeding aquatic life criteria.

A finding of no overlap depends on the docking configuration, effluent concentrations, and discharge characteristics and frequency. After considering possible docking configurations, the Department determined that mixing zones no larger than 100 meters would generally prevent overlap of mixing zones in all ports except Skagway. For Skagway, there was significant potential for overlap if discharges were simultaneously permitted at Broadway Dock or Ore Dock. Simultaneous discharges from both docks can be prevented by restricting the mixing zone size further to a 15 meter radius when discharging at either Broadway Dock or Ore Dock if ships are present at the both docks. The department consulted with the Alaska Department of Fish & Game, Habitat Division in determining that the there are no salmon life history events in the harbor that would be affected by the proposed mixing zones. A determination of whether overlap is possible for an individual ship will be made based on the information submitted with the NOIs.

These sizes were determined to be as small as practicable for the ships modeled that would also not result in overlapping mixing zones for multiple docked ships. This size meets the "as small as practicable" requirement in 18 AAC 70.240 by limiting the under 6 knots mixing zone size to be no larger than the point when water quality criteria and all other mixing zone requirements can be concurrently met.

For modeling purposes, the aerial shape of the mixing zone while a ship is moored is considered to be a semicircle centered on the discharge port. However, the actual aerial shape seen depends on the ambient current velocity and direction. Unless a discharge occurs during a slack tide, the mixing zone will actually resemble a cone with the narrow end at the discharge port and a plume that widens and flattens out as it moves away from the discharge port. Therefore, the mixing zone should never fill the semicircle around the discharge port, but will constitute only a cone-shaped slice of the semicircle.

Mixing zone authorization process

Applicants seeking coverage under the Permit must submit a complete NOI to the Department. The NOI will indicate the type of mixing zone the applicant is applying for, if any:

- No mixing zone (vessel will meet applicable WQC at the point of discharge);
- Mixing zone for discharges at speeds of 6 knots or greater (63 meters);
- Mixing zone for discharges at speeds under 6 knots (83 meters); and/or
- Mixing zone for discharges in Skagway at Broadway Dock or Ore Dock.

The Department will review the submitted NOI and authorize a mixing zone for an applicant if:

- The acute aquatic life requirement is met in the smaller initial mixing zone; and
- The size of the mixing zone required to meet WQS for the listed pollutants of concerns (based on CORMIX modeling) meets the size restriction listed in the Permit.

Authorizations may include terms and conditions more restrictive than those outlined in the Permit when necessary to protect water quality (for example, see Section 6.3.6.1 WQBELs when no mixing zone is authorized). If a vessel can meet the acute aquatic life requirement, but the size of the mixing zone required to meet chronic WQC for the listed pollutants of concerns exceeds the size restriction listed in the Permit, then an authorization will only be granted if a more stringent effluent limitation, as part of the authorization, will ensure that WQS will be met.

WQBELs Calculations

WQBELs were calculated for each of the three authorized mixing zone discharge scenarios: 1) no mixing zone needed; 2) mixing zone needed for discharges at speeds of 6 knots or greater; and 3) mixing zone needed for discharges at speeds of under 6 knots. The available dilution varies with each scenario.

WQBELs when no mixing zone is authorized

Permittees requesting coverage under the Permit without a mixing zone are required to meet applicable WQC at the point of discharge. Upon review of the NOI and any historical effluent monitoring data, the Department will attach effluent limits, equal to the most restrictive applicable WQC, to the authorization under the Permit for all pollutants with reasonable potential to exceed WQS at the point of discharge.

WQBELs for speeds of 6 knots or greater

The ammonia chronic criterion for the protection of aquatic life is the parameter driving the authorized mixing zone size for speeds of 6 knots or greater. The ammonia WQBEL for discharges while moving at

speeds of 6 knots or greater was calculated by dividing the maximum observed effluent concentration across all ships (160 mg/L) by the applicable chronic ammonia WQC (1.0 mg/L) and is 160 mg/L. This limitation for ammonia was developed to meet the "as small as practicable" requirement for mixing zones (18 AAC 70.240).

WQBELs for speeds of under 6 knots

The 95th percentile of ammonia and dissolved copper were used to establish the mixing zone size for speeds of under 6 knots, in order to meet WQC for ammonia and dissolved copper and to avoid overlapping other mixing zones. The 95th percentile of ammonia and dissolved copper effluent results were calculated for each ship and the maximum of these 95th percentile values were used to establish WQBELs that met all the mixing zone requirements in 18 AAC 70.240 are:

- Ammonia – 78 mg/L
- Dissolved Copper – 77 μg/L

Appendix D: Discharge Characterization Figures

Figure 6 through Figure 11 below illustrate trends in levels of BOD, TSS, TRC, fecal coliform, and the four pollutants of concerns in large cruise ship effluent from 2008-2012. Data used to generate the graphs are from the CPVEC wastewater sampling dataset.

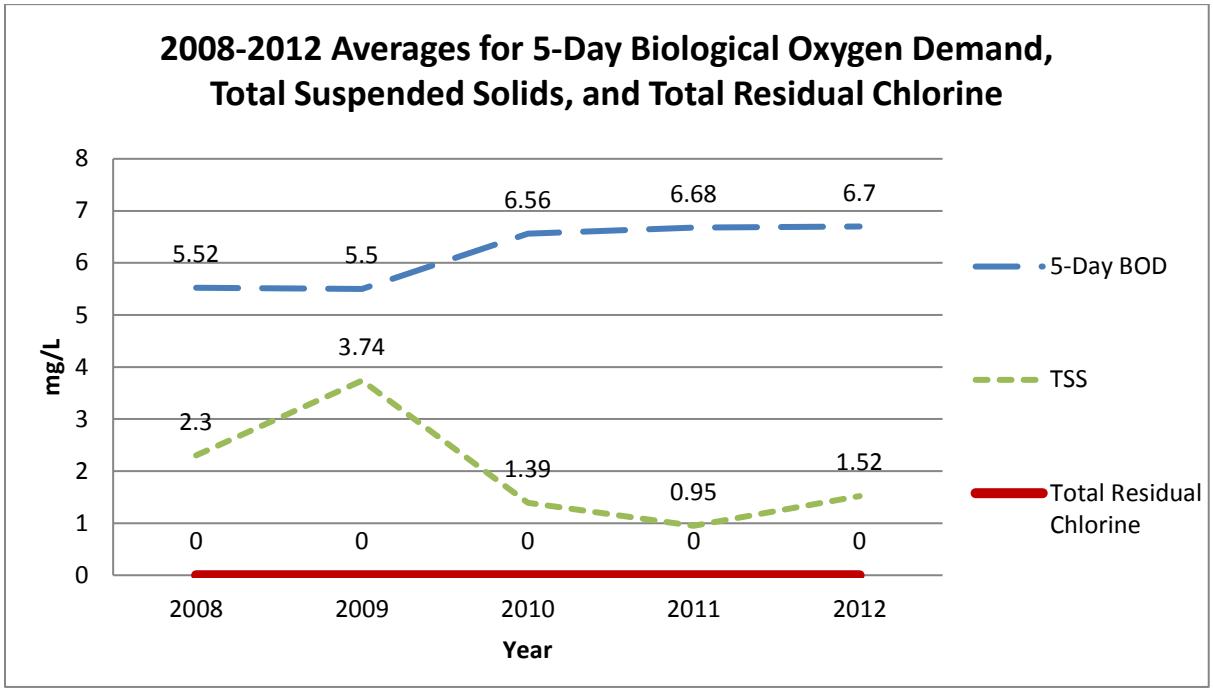


Figure 2: Large Cruise Ship Effluent Sample 5-day Biochemical Oxygen Demand (BOD), Total Suspended Solids (TSS), and Total Residual Chlorine (TRC) Averages from 2008 to 2012.

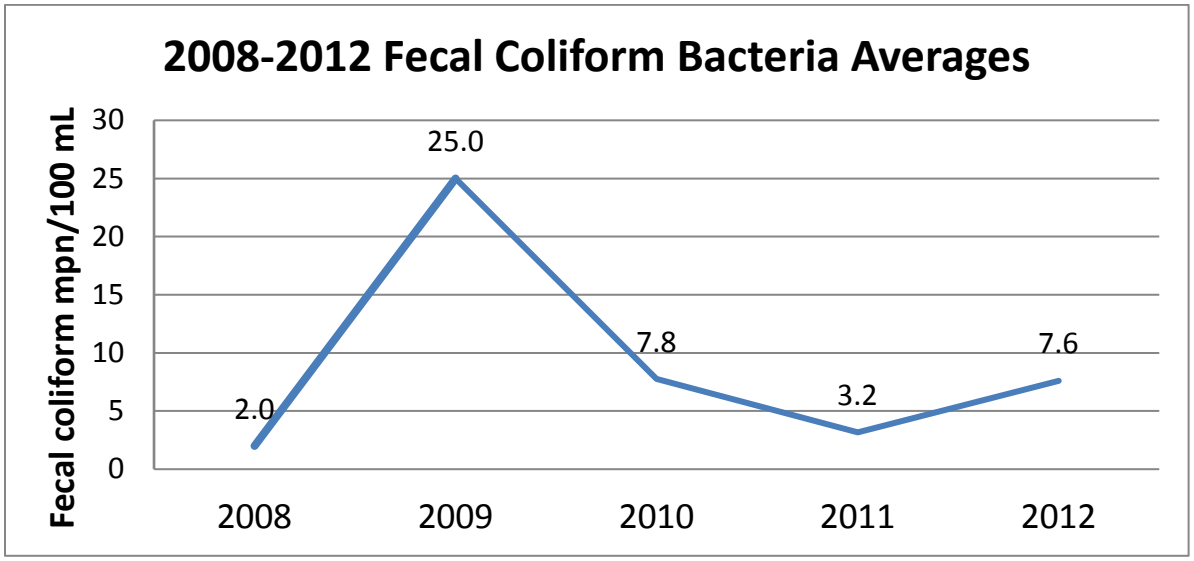


Figure 3: Large Cruise Ship Effluent Sample Fecal Coliform Averages from 2008 to 2012.

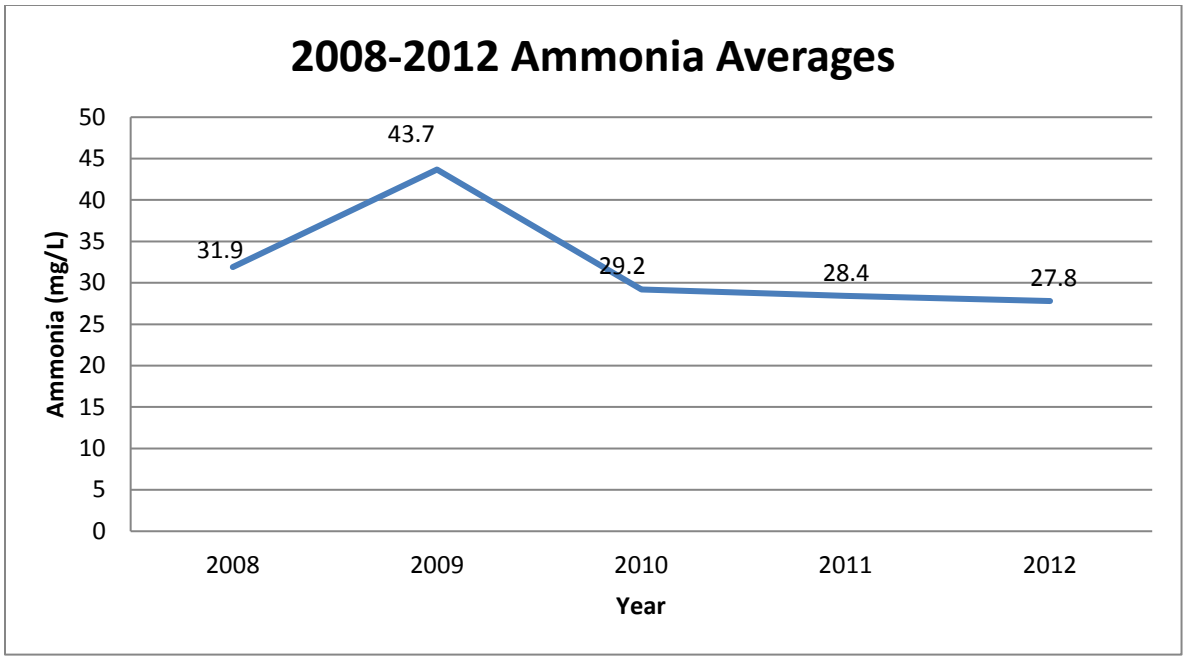


Figure 4: Large Cruise Ship Effluent Sample Ammonia Averages from 2008 to 2012.

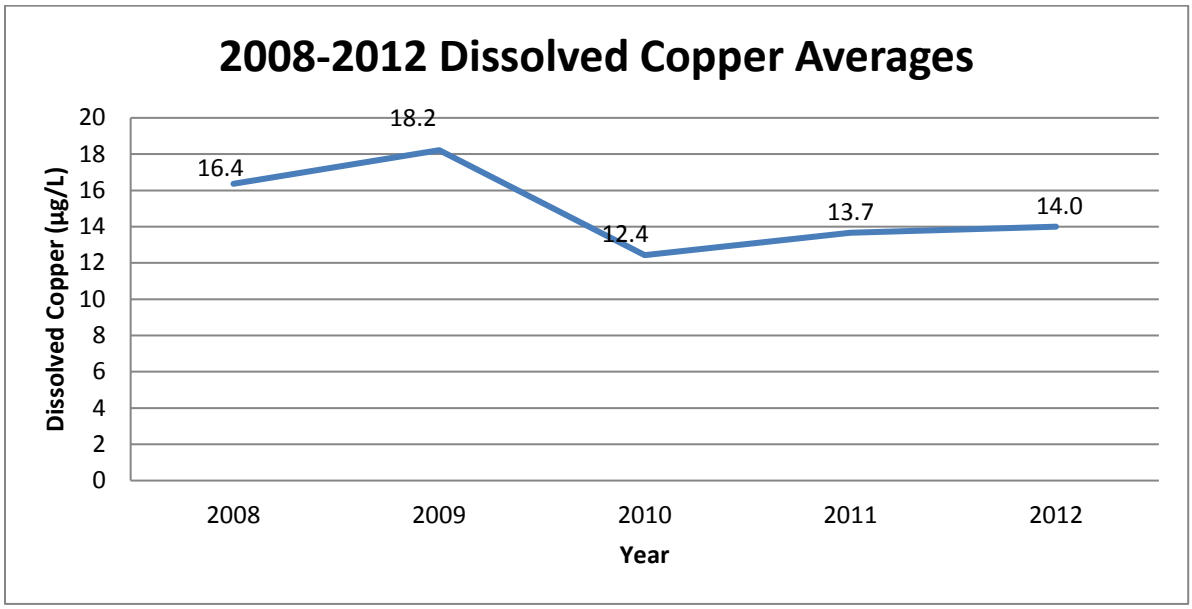


Figure 5: Large Cruise Ship Effluent Sample Dissolved Copper Averages from 2008 to 2012.

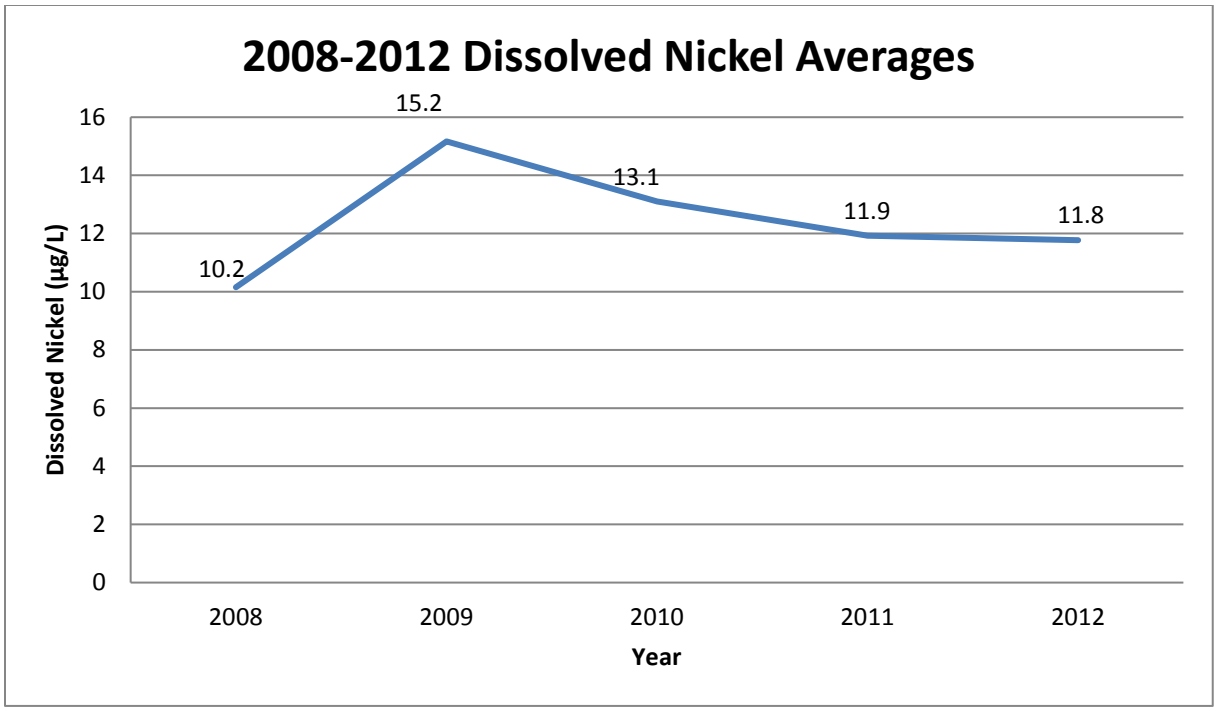


Figure 6: Large Cruise Ship Effluent Sample Dissolved Nickel Averages from 2008 to 2012.

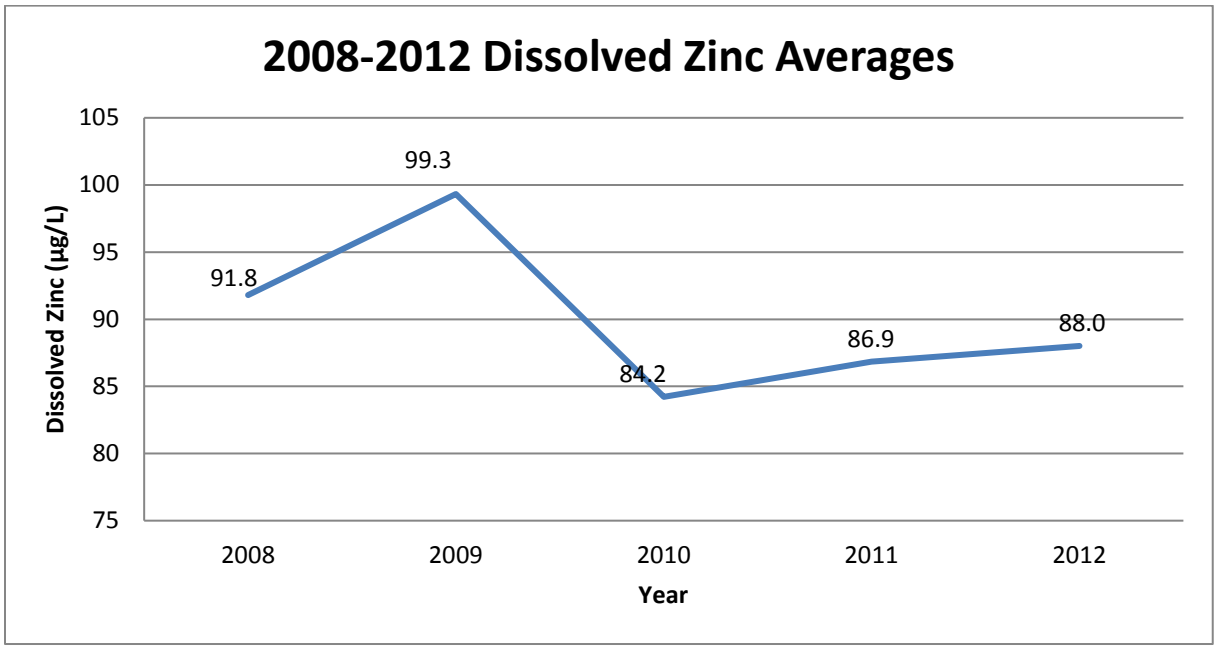


Figure 7: Large Cruise Ship Effluent Sample Dissolved Zinc Averages from 2008 to 2012.

Appendix E. Reasonable Potential Analysis

A reasonable potential analysis (RPA) calculates reasonable potential for a pollutant or parameter to cause or contribute to an exceedance of WQC. If RPA is found, WQBELs are then calculated. RPA is used to determine whether water quality-based effluent limitations (WQBELs) are required but can also be used to determine frequency of sampling for a particular parameter.

Determining Potential Pollutants of Concern from Exceedances of Applicable WQC at the Point of Discharge

Potential pollutants of concern were evaluated by comparing cruise ship effluent quality from AWTS discharges to the most restrictive, applicable WQC for State marine waters to determine if there was potential to exceed water quality criteria (WQC) before considering whether there was available dilution.

This potential was primarily evaluated by comparing the maximum values observed in the historical effluent dataset for ships with AWTS from 2008-2012 to the most restrictive, applicable WQC in Table 13. Available information was used to assess the extent to which waterbodies may be affected and to evaluate compliance with other criteria, particular narrative criteria. The monitoring data from 2013 was not used as permit development and modeling efforts were initiated prior to the end of the 2103 cruise ship season and prior to receipt of the all monitoring reports. Any pollutant that exceeds the applicable WQC from 18 AAC 70.020(b) at the point of discharge was a potential pollutant of concern. Note that ammonia criteria in marine waters are a function of pH, temperature, and salinity as described in the *Alaska Toxics Water Quality Criteria Manual* (DEC 2008), adopted by reference in 18 AAC 70.020(b). The basis for the pH, temperature, and salinity values are identified in the next section.

Table 3: Most Restrictive Applicable Marine Water Quality Criteria for Pollutants of Concern.

Parameter	Units[a]	WQC Limits		Reference
Fecal Coliform (FC) Bacteria	FC/100 mL	14[b]	40[c]	18 AAC 70.20(b)(14)
Dissolved Oxygen (DO)	mg/L	may not be less than 6 or greater than 17		18 AAC 70.20(b)(15)
pH	S.U.	may not be less than 6.5 or greater than 8.5, may not vary more than 0.2 outside of the naturally occurring range		18 AAC 70.20(b)(18)
Parameter	**Units[a]**	**Chronic WQC**	**Acute WQC**	**Reference**
Total Residual Chlorine (TRC)[d]	mg/L	0.0075	0.013	18 AAC 70.20(b)(23) [e]
Ammonia	mg/L	1.0	6.2	18 AAC 70.20(b)(23) [e, f]
Dissolved Copper	µg/L	3.1	4.8	18 AAC 70.20(b)(23) [e]
Dissolved Nickel	µg/L	8.2	74	18 AAC 70.20(b)(23) [e]
Dissolved Zinc	µg/L	81	90	18 AAC 70.20(b)(23) [e]

Notes:

a. L (liter), mg (milligram), mL (milliliter), S.U. (standard pH units)
b. Monthly Geometric Mean
c. In a 30-day period, not more than 10% of the samples may exceed 40 FC/100 mL
d. The TRC effluent limits are not quantifiable. DEC will use the minimum level (ML) of 0.01 mg/L as the compliance evaluation level for this parameter.

e. Which adopts by reference *Alaska Water Quality Criteria for Toxics and Other Deleterious Organic and Inorganic Substances*, dated December 12, 2008
f. Ammonia WQC are based on a pH of 8.2, a salinity of 20 g/kg, and a temperature of 10-15 °C

Without consideration of available dilution, there were three categories of potential pollutants of concern: conventional pollutants (fecal coliform, pH, BOD, and TSS), non-conventionals (ammonia and TRC) and priority pollutants (dissolved copper, dissolved nickel, and dissolved zinc).

Available dilution is generally not applicable, without further evaluation, for use with many conventional or non-toxic criteria when the pollutant can react in a detrimental manner after discharge (e.g., BOD loading effects on dissolved oxygen, radioactivity, etc.) or the pollutant directly affects the mixing characteristics of the discharge (e.g., temperature and dissolved solids). Thus, reasonable potential to exceed WQS is determined to exist for fecal coliform, .

Consideration of available dilution for the other potential pollutants of concern (ammonia, TRC, dissolved copper, dissolved nickel, and dissolved zinc) requires knowledge of ambient receiving water conditions, discharge characteristics, and application of the mixing zone requirements in 18 AAC 70.240.

Ambient Receiving Water Conditions

TRC indicates the residual presence of chorine and chlorine disinfection byproducts and is not present to any significant extent in ambient waters; thus the baseline is assumed to be zero. For establishing numeric baselines for ammonia and dissolved metals concentrations, the data available in Alaska marine waters is variable across all marine waters and can be limited in location and frequency of measurement. In cooperation with the United States Environmental Protection Agency (EPA), the DEC Alaska Monitoring and Assessment Program (AKMAP) has been working to characterize ambient conditions for Alaska's marine waters. To date, AKMAP has produced reports for the coastal regions of Southcentral Alaska, Aleutian Islands, and Southeast Alaska (DEC 2005; DEC 2011). These reports can be found at: http://dec.alaska.gov/water/wqsar/monitoring/AKMAP.htm.

AKMAP water column data includes pH, temperature, salinity, and total suspended solids. AKMAP does not provide water column data for ammonia or dissolved metals, but there are limited sources of information for these parameters of concern. Large cruise ships can transit any coastal waters in Alaska, but most cruises are in Southeast and Southcentral Alaska (Appendix B).

pH, temperature, and salinity for ammonia criteria

The median surface water pH from AKMAP data for Southcentral AK sampling locations was equal to 7.96 S.U. at an average temperature of 11.1°C and average salinity of 27.7 PSU (practical salinity unit). The median pH from AKMAP data for Southeast AK sampling locations was equal to 7.93 at an average temperature of 9.3 degrees C and average salinity of 28.4 practical salinity unit.

Ammonia

Ammonia was measured at nine locations within Gastineau Channel during 1989-1991 (Echo Bay Alaska, Inc., 1991). Samples were analyzed for ammonia as nitrogen (N). The average concentration of ammonia from that study was 0.021 mg/L ± 0.039 mg/L (n=91), which is well below the applicable chronic water criterion of 1.0 mg/L.

While AKMAP does not provide ammonia data, it does provide data for ammonium, the ionized form of ammonia, which is the more prevalent form at ambient pH. While unionized ammonia is the toxic form(at ambient pH and temperature) the ammonium concentration is greater than or equal to the unionized ammonia concentration, and the ammonium serves as a surrogate for ammonia The average surface water ammonium concentration from AKMAP data for Southcentral AK was equal to 0.01 mg/L, with a maximum value of 0.05 mg/L. The average ammonium concentration in samples taken from the sea bottom was equal to 0.02 mg/L, with a maximum value of 0.12 mg/L. The average ammonium concentration from AKMAP data for Southeast AK was equal to 0.01 mg/L.

Copper

There were 90 measurements of total recoverable copper obtained from nine locations in Gastineau Channel in 1989-1991 (Echo Bay Alaska, Inc., 1991). The average was 0.73 µg/L as total recoverable copper. The marine copper criteria uses a factor of 0.83 to convert total recoverable copper to dissolved copper. After applying that conversion factor to the Gastineau Channel average, an average concentration of 0.61 µg/L dissolved copper would result. Dissolved copper concentrations in Hawk Inlet and Chatham Strait were measured in 2006-2010 (Hecla Greens Creek Mining Company, 2011). The average of 60 samples was 0.41 µg/L dissolved copper. Based on these studies covering Hawk Inlet, Chatham Strait, and Gastineau Channel, it is reasonable to assign an approximate value of 0.5 µg/L dissolved copper as a background concentration for Southeast Alaska marine waters.

To meet the purpose of using stationary discharges in Juneau Harbor as a worst-case scenario for all Southeast Alaska ports, except Skagway, the department conservatively used the calculated dissolved copper value of 0.61 µg/L from Gastineau Channel as the ambient value for the RPA and the CORMIX modeling of discharges in Juneau Harbor. This value is below the applicable chronic water quality criterion of 3.1 µg/L (DEC 2008).

In a 2008 study of metals in Skagway Harbor, samples were collected from the surface (number of samples (n)=12), middle (n=12), and bottom (n=12) of the harbor and analyzed for dissolved copper (DEC and EPA Region 10, 2009). Dissolved nickel and dissolved zinc were not measured. Concentrations of dissolved copper were below the analytical detection limit of 2.6 µg/L for all samples with the exception of one of the reference sites, which had a dissolved copper concentration of 5.3 µg/L in the surface water sample.

Nickel

There were 86 measurements of total recoverable nickel obtained from nine locations in Gastineau Channel in 1989-1991 (Echo Bay Alaska, Inc., 1991). The average was 0.97 µg/L as total recoverable nickel. EPA's marine nickel criteria use a factor of 0.99 to convert total recoverable nickel to dissolved nickel, so it is reasonable to assume dissolved nickel is about the same as total recoverable nickel in this case. A background level of 0.97 µg/L for dissolved nickel in Alaska marine waters is below the applicable chronic water quality criterion of 8.2 µg/L.

Zinc

There were 90 measurements of total recoverable zinc obtained from nine locations in Gastineau Channel in 1989-1991 (Echo Bay Alaska, Inc., 1991). The average was 1.6 µg/L as total recoverable zinc. EPA's marine zinc criteria use a factor of 0.946 to convert total recoverable zinc to dissolved zinc. After applying that conversion, an average concentration of 1.5 µg/L dissolved zinc would result. Dissolved zinc concentrations in Hawk Inlet and Chatham Strait were measured in 2006-2010 (Hecla Greens Creek Mining Company 2011).

The average of 60 samples was 1.17 µg/L dissolved zinc. Based on these studies, it is be reasonable to assign an approximate value of 1.3 µg/L as a background dissolved zinc concentration in Alaska marine waters. This value is well below the applicable chronic water quality criterion of 81 µg/L.

To meet the purpose of using stationary discharges in Juneau Harbor as a worst-case scenario for all Southeast Alaska ports, except Skagway, the department conservatively used the calculated dissolved zinc value of 1.5 µg/L from Gastineau Channel as the ambient value for the RPA and the CORMIX modeling of discharges in Juneau Harbor. This value is well below the applicable chronic water quality criterion of 81 µg/L.

Available Dilution and Mixing Zone Modeling

Mixing zones

Through the evaluation of the factors in 18 AAC 70.240, the Department determines whether and how much of the available dilution will be considered in the reasonable potential analysis, in determining the authorized mixing zone, and in determining WQBELs. These evaluation factors include the treatment technology, existing uses of the water body, human consumption, spawning areas, human health, aquatic life, endangered species, and size of the mixing zone. All factors must be met in order to authorize a mixing zone. For further information see Appendix G: Mixing Zone Analysis Checklist.

Modeling

Since there is a marked difference in the mixing and available dilution for a cruise ship that is underway versus docked, the mixing zone analysis considered two different modeling scenarios for large cruise ships: 1) speeds of 6 knots or greater and 2) speeds of under 6 knots. Cornell Mixing Zone Expert System models near-field plumes as they come into contact with marine receiving waters. A detailed explanation is included in Appendix F: Available Dilution and Mixing Zone Modeling

Determining Reasonable Potential to Exceed WQS at the Boundaries of the Mixing Zone

Historical effluent monitoring results from 2008 through 2012 were used in the RPA. In the 2010 General Permit, sample data was grouped for each treatment system. This method was not used for the Permit because all ships with AWTS are now defined as a class as per statutory changes.

Speeds of 6 knots or greater

The available dilution for the RPA while at speeds of 6 knots or greater was 700:1. Ships with AWTS are a class per statute, but AWTS were designed to treat only conventional parameters. There is substantial variability in effluent concentrations of ammonia, TRC, dissolved copper, dissolved nickel, and dissolved zinc from ships with AWTS. However, given the large available dilution of 700:1 that occurs within a minute after discharge at the stern in the wake of the ship, the variability in effluent concentrations is small relative to the available dilution and the performance for all ships can be judged by using the maximum observed concentrations.

Speeds of under 6 knots

Because of the much smaller available dilution when docked or at speeds of under 6 knots, both the vessel-specific discharge characteristics and effluent characteristics become important. CORMIX modeling conducted by the Department indicated that the available dilution factors in Juneau Harbor with the low flow ambient tidal velocity of 0.06 meters/second range from 8:1 to 150:1 at 100 meters from the discharge port.

These ship-specific dilution factors were used for the RPA at speeds of less than 6 knots. Reasonable potential to exceed WQS was determined on a ship-by-ship basis using the maximum effluent concentrations for that ship. As this is a general permit, if any ship showed reasonable potential for a pollutant, then the Department considers that reasonable potential exists for that pollutant for all ships.

Summary of Results

As stated earlier, available dilution is generally not applicable for use with conventional or non-toxic criteria for dissolved oxygen, pH, radioactivity, residues, sediment, temperature, and marine water dissolved solids. Thus, reasonable potential to exceed WQS is determined to exist for fecal coliform, BOD, and TSS from the class of ships with AWTS.

No mixing zone authorized

Since permittees that seek authorization to discharge will likely seek a mixing zone authorization in their NOI for ammonia, dissolved copper, dissolved nickel, and/or dissolved zinc, reasonable potential and the need for effluent limits will be assessed for ships requesting to discharge without a mixing zone on a ship-specific basis. When reasonable potential to exceed WQS is determined then effluent limits will be required in the authorization and no mixing zone will be granted without request and further analysis.

Speeds of 6 knots or greater

No reasonable potential to exceed WQS for any pollutants other than fecal coliform, pH, BOD, and TSS was found for cruise ships that historically have discharged in Alaska marine waters while moving at speeds of 6 knots or greater. This is due to the large available dilution when moving at speed (700:1). However, since ammonia is the driving parameter in determining the 6 knots or greater mixing zone size, there is reasonable potential to exceed ammonia at the boundaries of the mixing zone. Note that all other pollutants were evaluated to verify they would meet water quality standards at the boundary of the 6 knots or greater mixing zone.

Speeds of under 6 knots

Using the minimum available dilution (8:1) across all ships and the maximum observed effluent concentrations, reasonable potential to exceed WQS exists for ammonia and dissolved copper and nickel (in addition to fecal coliform, BOD, and TSS) when cruise ships discharge wastewater while moving at speeds under 6 knots. There is no reasonable potential to exceed WQS for zinc with an under 6 knots mixing zone. Note that all other pollutants were evaluated to verify they would meet water quality standards at the boundary of the 6 knots or greater mixing zone.

Because of the ship-specific differences in available dilution when moving at speeds under 6 knots, an additional reasonable potential analysis was done for each ship. For a small number of ships, there is reasonable potential to exceed the acute ammonia criterion outside the smaller initial mixing zone, which would be a violation of 18 AAC 70.240(d)(8). For these ships, an under 6 knots mixing zone cannot be authorized without additional information demonstrating compliance per the Implementation Guidance available here http://dec.alaska.gov/water/wqsar/wqs/pdfs/MixingZoneGuidance2-3-09.pdf.

Results of the ship-specific RPA for discharges while moving at under 6 knots are presented below. These values are based upon the results of the mixing zone modeling described in Appendix F: Available Dilution and Mixing Zone Modeling. Chronic water quality criteria were used and combined with each ship's

Mixing Zone Information

CORMIX dilution to determine reasonable potential to exceed WQS at the boundaries of a hypothetical 100 meter mixing zone in Juneau Harbor. While the low flow ambient tidal velocity for Skagway Harbor is lower at 0.05 meters/second, density stratification for the discharge plume is also less. Thus, if ships exhibit reasonable potential to exceed WQS in Juneau Harbor they are expected to exhibit reasonable potential in Skagway Harbor. A "Yes" in Table 14 below represents a reasonable potential to exceed WQS for speeds under 6 knots including stationary discharges.

Table 4: Ship-specific RPA Results for Juneau at 0.06 Ambient Tidal Velocity and a Default 100 Meters

Vessel	Ammonia	Copper	Nickel	Zinc
Coral Princess	NO	NO	NO	NO
Diamond Princess	YES	NO	NO	NO
Disney Wonder	YES	NO	NO	NO
Golden mixed wastewater	YES	NO	NO	NO
Golden graywater only	NO	NO	NO	NO
Island Princess	YES	NO	NO	NO
Norwegian Jewel	NO	NO	NO	NO
Norwegian Pearl	NO	NO	NO	NO
Norwegian Sun	YES	NO	NO	NO
Ocean Regatta	YES	NO	NO	NO
Sapphire mixed wastewater	YES	YES	YES	NO
Sapphire graywater only	NO	YES	NO	NO
Seven Seas Navigator	YES	YES	NO	NO
Silver Shadow	NO	NO	NO	NO
Star Princess	YES	YES	YES	NO
Statendam	YES	NO	NO	NO
Volendam	NO	NO	NO	NO
Zaandam	NO	NO	NO	NO

Limitations of the RPAs

- Total daily load data could not be included in the analyses. DEC has maximum flow rates and daily volumes but not totals for in-port discharges. This is not significant since there is not a localized concern for loading of pollutants or bioaccumulation.
- Sample data on some ships is limited and can be highly variable compared with combined sample data from multiple ships. All ships had at least 10 sample results.

Appendix F: Available Dilution and Mixing Zone Modeling

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F.1. Overview of CORMIX Modeling

Cornell Mixing Zone Expert System (CORMIX) version 8.0 was used to analyze and predict the behavior of cruise ship wastewater discharge plumes as they come into contact with marine receiving waters. CORMIX determines equilibrium conditions in the near field when the available dilution is primary determined by the discharge characteristics. CORMIX is a mixing zone model and decision support system for environmental impact assessment of regulatory mixing zones. This program is used by the EPA, the State of Alaska, and other states as a tool to simulate mixing behavior of wastewater discharges into receiving waters. The results of the mixing zone modeling conducted by the Department on cruise ships serves as the basis for determining authorized mixing zone sizes and effluent limits for ammonia, and dissolved copper, nickel, and zinc in the Permit. More information on the CORMIX modeling system can be found at: http://www.cormix.info/.

F.2. Available Dilution While Moving at 6 Knots or Greater

A 2001 Science Advisory Panel and DEC report concluded that for a typical large cruise ship moving at a minimum speed of 6 knots and discharging wastewater at 200 meters^3/hour the dilution factor for wastewater effluent ranges from 700:1 just at the stern of the ship to 50,000:1 within 15 minutes of discharge and including turbulent mixing in the wake behind the ship. The 700:1 dilution is a conservative estimation for near-field mixing, but does not consider vigorous mixing in the boundary layer, at the stern of a cruise ship moving at 6 knots ("Cruise Ship Wastewater Discharge into Alaskan Coastal Waters. Technical Report 2000-01" and the "March 8, 2001 Addendum" prepared for the Alaska SeaLife Center). The 2001 Science Advisory Panel's assessment of the Alaska SeaLife Center's Technical Report 2000-01 and why it may underestimate available dilution is included in its "Near-Field Dispersion of Wastewater Behind a Moving Large Cruise Ship," June 26, 2001 and available at: http://dec.alaska.gov/water/cruise_ships/pdfs/dispersion_of_ww_report.pdf. The 50,000:1 dilution is based on "The Impact of Cruise Ship Wastewater Discharge on Alaska Waters," November 2002, available at: http://www.dec.state.ak.us/water/cruise_ships/pdfs/impactofcruiseship.pdf).

The dilution factor of 700:1 was used to conservatively assess reasonable potential to exceed WQS as this dilution is achieved in less than a minute and could be authorized in a mixing zone.

To determine the authorized mixing zone size for discharges from cruise ships moving at 6 knots or greater, CORMIX was used to model the mixing that occurs after and before the plume reaches the stern of the ship. Rather than modeling the ship as moving and the receiving water as stationary, the ship was modeled as stationary with the receiving water moving at 6 knots. This approach preserves the relative difference in velocities of 6 knots.

F.3. Inputs for Mixing Zone When Moving at 6 Knots or Greater

F.3.1 Default Values Used in the CORMIX Program

CORMIX allows wind speed to be used in prediction calculations. The default value used by CORMIX is 2 m/s (a breeze). The range of wind speeds used in the CORMIX program is from 0 m/s (no breeze) to 15 m/s (strong wind). DEC used a wind speed of 2 m/s in the interest of modeling a worst case scenario when there is minimal wind-driven surface mixing of the water.

Another default parameter used in the CORMIX modeling is a Manning's n coefficient, which specifies any bottom friction. Because none of the plumes evaluated made contact with the bottom, a low Manning's n of 0.01 was used.

F.3.2 Ambient Conditions

The ambient temperature, salinity, and density profiles, as well as ambient concentrations, for Juneau harbor were used as surrogates for all marine waters (see description in the "Inputs" section below under "Inputs for Mixing Zone While Moving at Under 6 Knots").

F.3.3 Vessel Characteristics

Ship specific information was obtained from documents submitted by permittees (e.g., 2013 VSSPs, 2010-2013 NOIs) as well as from Ocean Ranger observations during the 2013 cruise season for the vessels identified in Table 15. Information included maximum estimated effluent discharge rate and discharge port diameter, orientation (angle) to waterline, and depth below waterline. Ranges for reported vessel characteristics are presented in Table 16 below. Discharge port characteristics (diameter, shape, angle, and depth) were verified by Ocean Rangers onboard the ships during the 2013 cruise season.

Discharge rates and port diameters were used by modelers to calculate a discharge exit velocity for each ship. The variations in individual ship characteristics resulted in a unique available dilution factor for each ship under each evaluated scenario. However, the predicted dilution available for each pollutant of concern for each ship remained the same because each ship's characteristics remained constant.

Table 5: Vessels Evaluated

Coral Princess Diamond Princess Disney Wonder Golden Princess – Mixed sewage and graywater Golden Princess – Graywater only Island Princess	Norwegian Jewel Norwegian Pearl Norwegian Sun Oceania Regatta Sapphire Princess – Mixed sewage and graywater Sapphire Princess – Graywater only	Seven Seas Navigator Silver Shadow Star Princess Statendam Volendam Zaandam

Table 6: Vessel Discharge Characteristics

Vessel Discharge Characteristic	Range of Values
Discharge rate (maximum for each ship estimated)	0.0022 – 0.0139 cubic meters per second (m^3/s)
Discharge port diameter (internal)	0.06 – 0.2 meters
Discharge exit velocity	0.22 – 2.936 meters per second (m/s)
Discharge port depth below waterline	0.4 – 6.3 meters

F.3.4 Discharge Scenarios Considered

Modeling of cruise ship wastewater discharges was conducted on effluent discharges for the 16 ships that were permitted to discharge in Alaskan waters in 2013 and had effluent sampling data during the time period of 2008–2012. For two of the ships both mixed (sewage and graywater) discharges and graywater only

discharges were modeled since those two ships had a split system in which they were able to discharge different types of effluent at different times. As a result, a total of 18 ship scenarios were modeled.

F.3.5 Pollutants of Concern and Effluent Data

The potential pollutants of concerns evaluated for the available dilution were: TRC, ammonia, dissolved copper, dissolved nickel, and dissolved zinc. The dataset used for CORMIX modeling consisted of effluent sampling data submitted by permittees on Discharge Monitoring Reports (DMRs) within the 5 year timeframe of 2008-2012. Data from 2010 that was rejected due to QA/QC issues were not included in the dataset.

F.4. Inputs for Mixing Zone While Moving at Under 6 Knots

The default values for CORMIX, vessel characteristics, and pollutants of concern from the 6 knots or greater mixing zone size analysis were used for the under 6 knots mixing zone.

F.4.1 Discharge Scenarios Considered

For each ship scenario, the two pollutants of concerns that were most likely to dictate mixing zone size, ammonia and dissolved copper, were modeled for the worst case under 6 knots scenario of discharging when docked (i.e., speed of zero knots). All 18 ship scenarios were modeled for discharges at two harbors under unbounded conditions (i.e., discharges away from shore and at two ambient velocities. The two harbor (Juneau and Skagway) were deemed to be representative of the range of discharge scenarios for ships moving at speeds under 6 knots. All ships were also modeled for discharges at a speed of 6 knots.

F.4.2 Harbors Evaluated

Juneau and Skagway harbors were the focus of this project's CORMIX modeling. Juneau and Skagway are two of the top three cruise ship ports in Alaska and have been identified by the Department as having the potential for limited mixing; therefore, they can be considered worst case scenarios for in port discharges. In addition, these two ports have multiple docks that are close together. Ketchikan harbor, the second most visited port, has multiple docks located close together as well, but is open-ended and has higher current velocities.

Ambient data for the harbors are from a variety of sources. Temperature and salinity data for determining density were collected by DEC staff, tidal data were obtained from National Oceanic and Atmospheric Administration (NOAA) web sites, and ambient concentrations of pollutants of concerns were based on data compiled by CPVEC staff (DEC 2012, Ambient Dissolved Metals and Ammonia Data for Alaska Marine Waters).

F.4.3 Ambient Temperature, Salinity, and Density Profiles

Available temperature and conductivity data for the receiving waters in the Juneau and Skagway harbors were used to determine density. Temperature and conductivity readings were taken in Juneau in July 2013 at low tide and high tide and at two locations close to where cruise ships dock. Values typically vary because moving water is dynamic and eddies and currents not obvious from surface observation exist. To determine a density profile for the Juneau harbor, the four sets of readings were graphed and best professional judgment was used to choose one profile. It was determined that a linear density stratification where the water becomes denser with depth could be used to represent Juneau harbor (CORMIX Profile type A). Surface density was the same

for all ships and bottom densities for each ship were actual data that corresponded with each schematized bottom.

For Skagway, temperature and salinity readings were used from the DEC and EPA study of cruise ship discharges in July 2008. The calculated densities were graphed and best professional judgment was used to choose a profile to represent the Skagway harbor. The data showed that the Skagway harbor receiving water had a uniform density down to at least 6.5 meters in depth. Of the ships evaluated in this project, the maximum depth of a ship's discharge pipe was 6.3 meters from the surface; therefore, a uniform density was chosen as the CORMIX Profile. An average of the calculated densities from the surface to 6.5 meters was used for all ships.

F.4.4 Ambient Water Depths

Water depths at high tide were estimated using tidal information and reported low tide depths. Data characterizing the temperature and salinity in each harbor was only available to a depth of 10 meters except at one dock during low tide when data only goes to 8 meters because that was the measured depth at low tide. Preliminary modeling indicated that there was no difference between results obtained for low and high tide conditions because the effluent discharges occur near the surface and the plumes do not come in contact with either the true bottom or the schematized bottom. A depth change based on low or high tide conditions would not be a factor. The depth of water used for dilution would always be the top 4 –8 meters depending on the depth of the discharge pipe. Low tide conditions were used in all modeling runs.

In order to run the CORMIX model the discharge port must be located within the top (slightly submerged discharge) or bottom (deeply submerged discharge) 1/3 of the water column. The model does not allow it to be located within the middle 1/3 of the water column. About half of the ship scenarios modeled had discharge ports located in the middle 1/3 of the water column. To account for this, an artificial "bottom" depth was entered for the model runs for those ships. This did not affect the output from the model because the "schematized" bottom depth was always below the discharge port depth, and since the plume was buoyant it always rose within the water column. The modeled plumes stayed above the depth of the discharge port and did not interact with the bottom.

F.4.5 Ambient Tidal Currents

EPA has a Technical Support Document (TSD) in which there is a recommendation for the tidal current to be used to model discharges to tidally influenced waters. At Section 4.4.2 Critical Design periods for Waterbodies, 4) Oceans, it states: The 10th percentile value from the cumulative frequency of each parameter should be used to define the period of minimal dilution. For the purposes of modeling DEC uses the upper and lower 10th percentiles for the current based upon the cumulative velocities in a tidal cycle.

For the CORMIX modeling runs using Juneau harbor as the receiving water, predicted daily maximum currents at a depth of 3.99 meters (13.1 feet) for the months of May through September of 2013 from NOAA were used. As a result of tidal harmonics, the following results are also obtained using May through September data in 2014, 2012, 2011, and 2010. Data was available for two locations in Gastineau Channel. Only data from one location was used because the second location was located at a point where the channel narrowed and the current velocities were higher than what would be expected in the harbor. Due to the sinusoidal nature of tidal currents, the current velocity is close to the maximum velocity the majority of the time. Since the cumulative frequency distribution was not available for tidal current, the 90th percentile and 10th percentile of the maximum tidal current was used. The maximum predicted tidal current velocity was

determined to be 0.566 meter per second (m/s), the 90th percentile was determined to be 0.50 m/s, and the 10th percentile was 0.06 m/s.

For Skagway harbor CORMIX modeling runs, predicted daily maximum currents for the months of May through September in 2013 from the NOAA were used. Data from the location closest to the cruise ship dock was used (Taiya Inlet). The maximum predicted tidal current velocity was determined to be 0.154 m/s and the 90th percentile was determined to be 0.15 m/s and the 10th percentile was 0.05 m/s.

F.4.6 Ambient Concentrations of the Pollutants of Concern

The following background ambient concentrations in Table 17 were used in CORMIX modeling:

Table 7: Ambient Concentrations for Pollutants of Concern

Location	Ammonia (mg/L)	Dissolved Copper (µg/L)	Dissolved Nickel (µg/L)	Dissolved Zinc (µg/L)
Juneau Harbor	0.021	0.61	0.97	1.6
Skagway Harbor	0.021	2.6	1.14	37

Site specific data were not available for ammonia for Skagway Harbor. Therefore, the ammonia value obtained for Juneau Harbor was used for Skagway. This value was based on data collected in Gastineau Channel from 1989-1991 (Echo Bay Alaska, Inc., 1991).

Total recoverable data for copper, nickel and zinc from data collected in 1989-1991 were used in modeling. (Echo Bay Alaska, Inc., 1991) Dissolved sample data for the metals that are parameters of concern were not available for Gastineau Channel. The total recoverable metals data was converted using the values of 0.83 for copper, 0.99 for nickel, and 0.946 for zinc. The conversion factors were obtained from the Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances which is adopted by reference in 18 AAC 70.020(b). An average was obtained based on each dataset. (See Appendix E. Reasonable Potential Analysis).

An exact value for dissolved copper was not available for Skagway Harbor. Samples analyzed in 2008 were below the detection limit of 2.6 µg/L, with the exception of a reference site sample which was below a detection limit of 5.3 µg/L (DEC and EPA Region 10, 2009). A value of 2.6 µg/L was used in CORMIX modeling. It should be noted that this was a very conservative use of the available data for ambient dissolved copper.

While using a copper value of 2.6 µg/L for Skagway Harbor may appear excessively conservative as compared to the value of 0.61 µg/L for Juneau Harbor, this did not result in unreasonable findings. In 12 of the 18 Skagway modeling scenarios, ammonia was the parameter that needed the largest dilution to meet water quality criteria. In three scenarios, copper needed more dilution than ammonia to meet water quality criteria, but the dilution was achievable in less than 10 meters which is a smaller distance than that required for ammonia in the first 12 scenarios. In the final three scenarios, both ammonia and copper needed even more dilution that would equate to a chronic mixing zone size of hundreds of meters; however, exceedance of acute WQC requirements prohibits mixing zones of that size for the conditions in Skagway.

A dissolved zinc value of 37 µg/L was used in CORMIX modeling for Skagway Harbor. This value was based on 2007 sampling (DEC and EPA Region 10, 2008). It should be noted that samples collected in 2007 were

not filtered in the field. Therefore, the value may represent total recoverable zinc rather than dissolved. Dissolved nickel samples collected in Skagway in 2007 were not filtered in the field, and were rejected by project researchers due to levels higher than total recoverable levels (DEC and EPA Region 10, 2008). The total recoverable nickel value from the study was used because it was the only data available.

F.4.7 Vessel Characteristics and Effluent Characteristics

Vessel characteristics are as described above in Section F.3.3

F.5. CORMIX Results

F.5.1 Dilution Required to Meet Water Quality Criteria

The amount of dilution required to meet WQC depends not only on the effluent concentration and the applicable WQC, but also on the amount of that parameter that naturally exists in the receiving water. If ambient levels are high, the dilution needed to meet WQC is higher than if there were no pollutant present in the receiving water.

Although the dilution required depends on the effluent concentration, the WQC for the pollutant, and the concentration of the parameter in the receiving water, these factors do not influence the way a discharge plume physically interacts with the receiving water. Once it has been determined that a ship can obtain a dilution at a particular distance from the point of discharge this holds true no matter the pollutant reviewed.

DEC determined that dissolved nickel and dissolved zinc did not need to be modeled. For each ship, the dilution required to meet chronic WQC for dissolved nickel was compared with the dilution available at different distances from the point of discharge to determine whether that pollutant would drive the mixing zone size. In all scenarios it was determined that dissolved nickel and dissolved zinc would reach chronic WQC within a 10 meter mixing zone.

F.6. Compliance with Acute Aquatic Life Criteria

As per 18 AAC 70.240(d)(8), the size of the zone in which acute aquatic life criteria are exceeded (smaller initial mixing zone) was evaluated for all 18 scenarios for the 16 ships modeled. The Department's *Implementation Guidance: 2006 Mixing Zone Regulation Revisions* (DEC 2009), available at http://dec.alaska.gov/water/wqsar/wqs/mixingzones.html, was used to select a method for determining whether the requirement was being. Method 3 (a drifting organism reaches the acute mixing zone boundary in 15 minutes or less) was chosen. CORMIX was used to determine which ships would required longer than 15 minutes to reach the acute aquatic life WQC and what length of time is required to meet acute aquatic life. Most ships meet the acute aquatic life within 15 minutes. Mixing zones will not be authorized for ships that cannot meet the acute aquatic life criteria.

F.7. Analysis and Findings for 6 Knots of Greater Mixing Zone

F.7.1 Driving Parameter

An analysis of available dilution was performed for all ships when discharging at knots or greater. The analysis determined that ammonia required the most dilution to meet chronic WQC in the receiving water, and therefore ammonia was the driving parameter that determined the mixing zone size in all cases. The maximum observed effluent ammonia value was used along with the minimum available dilution across all

ships to determine the mixing zone size. This approach was sufficient to set a mixing zone size in the Permit for the class of ships with AWTS.

F.7.2 Findings

The most restrictive WQC (ammonia chronic criterion) will be met in less than 21 seconds or 63 meters aft (to the rear of the ship) of the discharge port. As the discharge port of a large cruise ship is typically 100 meters from the stern (midship to a typical large cruise ship), this means the chronic WQC for ammonia will be met before the discharge reaches the stern. The width of the discharge plume will be 5 meters or less, and the depth extends from the surface to 1 meter below the discharge port. Modeling indicated that a rectangular mixing zone shape appropriately characterizes discharges at these speeds, with one end of the rectangle located at the discharge port and the rectangle extending along the side of the ship towards the stern. This rectangular mixing zone moves with the ship and represent the maximum size (63 meters long, 5 meters wide, and depth of the discharge port plus 1 meter) and time (21 seconds) that the waterbody that could exceed WQC due to any one cruise ship discharge at one time. Overlap of mixing zones for ships discharging at speed of 6 knots or greater are considered by the Department as not reasonably likely, to impossible, to occur as ships are never in this close proximity to each other while moving at 6 knots or greater. Therefore a greater than 6 knots mixing zone size of 63 meters by 5 meters is authorized. Additionally, once a discharged pollutant reaches the stern of the ship, the turbulent wake results in an additional 700:1 dilution factor.

F.8. Analysis and Findings for Under 6 Knots Mixing Zone

F.8.1 Driving Parameter

Because of the much smaller available dilution when docked, both the vessel-specific discharge characteristics and effluent characteristics become important. Ammonia and occasionally copper were the driving parameters in determining the mixing zone size for a particular ship. Initially the maximum effluent concentrations for each ship were used to determine the available dilution and the mixing zone size. However, the mixing zone sizes required to meet chronic WQC with maximum effluent concentrations could not be authorized because they were so large that several ships 1) could overlap with other mixing zones and potentially cause or contribute to an exceedance of WQC and 2) there was the potential for direct effects on aquatic life within the mixing zone.

The 95th percentile of ammonia and dissolved copper were used to establish the mixing zone size for speeds of under 6 knots, in order to meet WQC for ammonia and dissolved copper and to avoid overlapping other mixing zones. No outliers were identified. The ranges of the ships' 95th percentiles are identified in Table 18.

Table 8: 95th percentiles for Pollutants of Concern in Cruise Ships Effluent

Pollutant	Range of Values	WQC (chronic/acute)
Ammonia [a]	1.42 mg/L – 126.5 mg/L[b]	1 mg/L / 6.2 mg/L
Dissolved Copper	3.22 µg/L – 143.5 µg/L [c]	3.1 µg/L / 4.8 µg/L
Dissolved Nickel	8.70 µg/L – 72.8 µg/L	8.2 µg/L / 74 µg/L
Dissolved Zinc	42 µg/L –321 µg/L	81 µg/L / 90 µg/L

Notes:
a. Ammonia standard was based on a pH of 8.2, a salinity of 20 g/kg, and a temperature of 10-15 °C.
b. mg/L = milligram per liter
c. µg/L = microgram per liter

F.8.2 Mixing Zone Size

The 95th percentile of ammonia and dissolved copper were used to establish the mixing zone size for speeds of under 6 knots, in order to meet WQC for ammonia and dissolved copper and to avoid overlapping other mixing zones. CORMIX modeling results showed all ships that could meet applicable WQC within 100 meters could also meet applicable WQC at or within 83 meters. Therefore, mixing zone for most ships discharging at speeds under 6 knots was set at an 83 meter radius (relative to the discharge port) to account for the changing direction of tidal currents and depth extending from the surface to 1 meter below the discharge port in the Permit. The tidal current will change direction as it moves from a flood to an ebb tide and vice versa. The mixing zone size needs to be a radius of 83 meters to accommodate the shift in discharge plume to either side of the discharge port fore, aft, or any angle in between.

The under 6 knots mixing zone boundaries, which are based upon a docked ship discharging during the 10th percentile tidal current, were used to conservatively assess whether all existing and designated uses would be met for all wastewater discharges while moving at any speed under 6 knots. The actual mixing characteristics of discharge that occurs while moving at under 6 knots but not stationary will be intermediate between the moving mixing zone for 6 knots or greater and the stationary mixing zone for under 6 knots. The Department found that all existing marine water body uses will be maintained and protected. For example, the Douglas Island Pink and Chum fish hatchery net pens near the Thane-Sheep Creek estuary are outside the mixing zone boundaries for cruise ship discharges, even if a cruise ship was essentially stationary in the shipping channel. Cruise ship wastewater discharges would not expose the net pens to concentrations exceeding aquatic life criteria.

After considering possible docking configurations between cruise ships, including stern to stern and side to side, the Department determined that mixing zones no larger than 100 meters would prevent overlap of mixing zones in all ports except Skagway. For Skagway, there was significant potential for overlap if discharges were simultaneous permitted at Broadway Dock and Ore Dock. Thus, the Permit restricts the mixing zone size further to a 15 meter radius when discharging at either Broadway Dock or Ore Dock. Dissolved nickel chronic and acute WQC were met for all ships within a 10 meters. This was true even at the conservative ambient concentrations used to determine dilution requirements. These sizes were determined to be as small as practicable for the ships modeled that would also not result in overlapping mixing zones for multiple docked ships.

For modeling purposes, the aerial shape of the chronic mixing zone while a ship is moored is considered to be a semicircle centered on the discharge port. However, the actual aerial shape seen depends on the ambient current velocity and direction. Unless a discharge occurs during a slack tide, the mixing zone will actually resemble a cone with the narrow end at the discharge port and a plume that widens and flattens out as it moves away from the discharge port. Therefore, the chronic mixing zone will almost never fill the semicircle around the discharge port, but will constitute only a cone-shaped slice of the semicircle.

F.8.3 Effect of Discharge Exit Velocity

Discharge velocity greatly affects the interaction of the discharge plume with the receiving water. While the hydrodynamic mixing process between the discharge plume and the receiving water occurs within the near-field and far field, the near-field is the region of receiving water where the initial characteristics of the momentum flux, buoyancy flux, and outfall geometry influence the jet trajectory and mixing of an effluent

discharge. In the near-field region the outfall conditions are most likely to have an effect on plume's behavior. As the plume travels further away from the source, the source characteristics become less important and conditions existing in the ambient environment will control the trajectory and dilution of the plume through buoyant spreading motions and passive diffusion due to ambient turbulence. This region is referred to as the far-field.

As shown in Figure 12, the range of source characteristics (see Table 16) result in significant differences in available dilution, for discharges while stationary, among large cruise ships (i.e., the spread between the different lines) within the first ten meters or the smaller initial mixing zone. As the distance from the discharge port increases, the differences between the cruise ships remains fairly constant showing the greater influence of the ambient environment as the discharge moves from the near-field to the far-field.

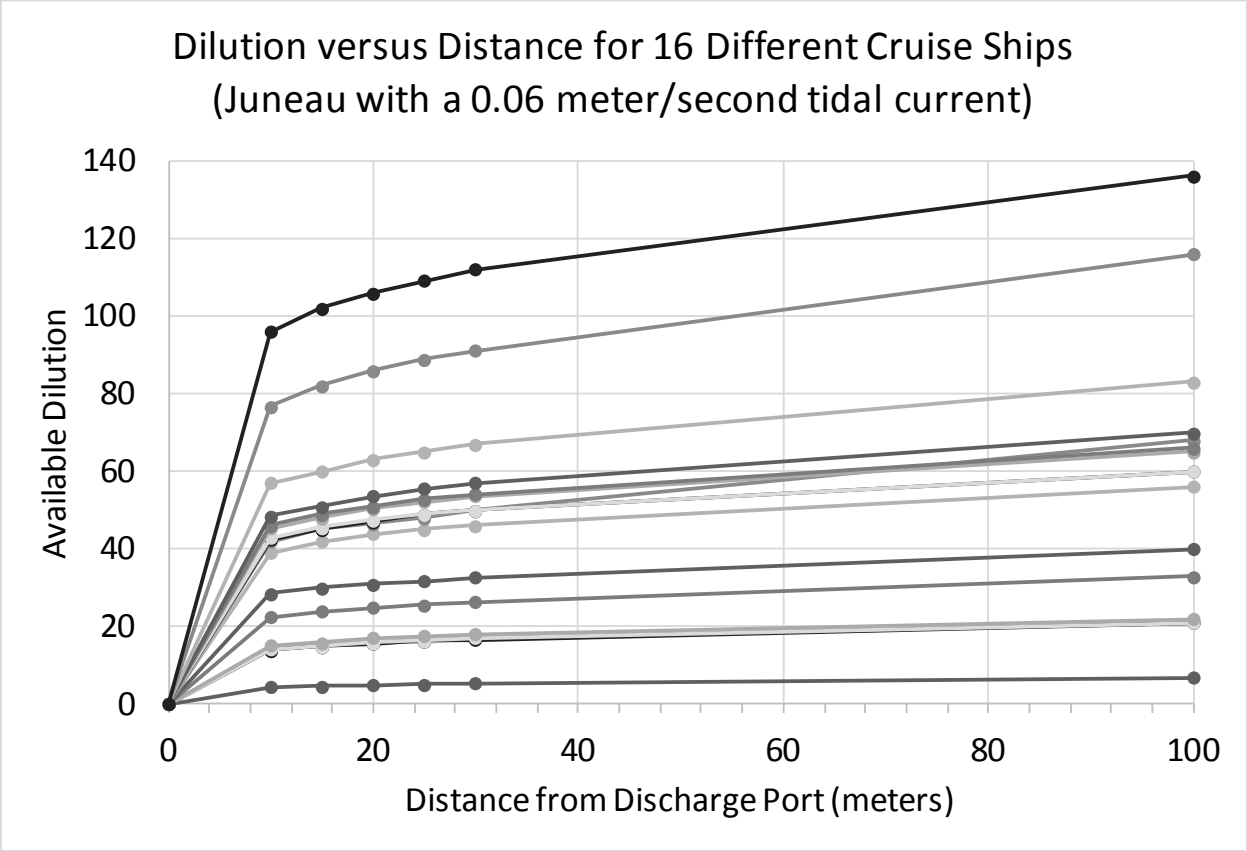

Figure 8: Available Dilution as a Function of Large Cruise Ship Characteristics and Distance from Discharge Port When Stationary

Due to varying discharge characteristics, the ship that has the highest dilution requirement may not be the one that requires the largest mixing zone. If the discharge has a high initial discharge velocity it is able to entrain water by jet turbulence, whereas a vessel with a low exit velocity may still have a relatively high concentration of pollutants at the termination of jet turbulence when it entrains ambient water by diffusion and ambient eddies, which occurs far more slowly than the jet turbulence entrainment.

Due to the effluent's density and temperature, the discharges from all ships reviewed in this project were positively buoyant with respect to the ambient seawater. The plume possesses initial momentum by virtue its

discharge velocity. This combination of properties creates a buoyant jet, instead of either a "pure" jet (no buoyancy) or a "pure" plume (no initial momentum). As the buoyant jet rises, its momentum is dissipated in turbulence and its density increases, as it mixes with the surrounding water.

Ships with a higher discharge velocity have a plume that is initially carried out and away from the side of the ship and water is entrained by jet turbulence from both sides of the plume, resulting in a mixing zone size less than that which occurs with a slow exit velocity. With low exit velocities the plume hugs the side of the ship, there is minimal jet turbulence entrainment, and the plume can only entrain ambient water from one side of the plume. This occurs at a slow rate in the "far field" from diffusion and ambient water eddies.

F.9. Discharges towards Shore

While a cruise ship is docked, wastewater discharges towards shore are intermittently constrained by both the ship and the shoreline rather than only by the ship. As a result of this additional boundary, the rate of mixing can be restricted for certain discharges. In CORMIX, a bounded channel is defined as "an ambient environment in which the plume is likely to interact with both lateral banks within the region of interest." This scenario is often referred to as a bounded discharge when the receiving waterbody is constrained to the point that the discharge plume has the potential to completely traverse across the waterbody.

However, this scenario does not apply to cruise ship discharges when docked and discharging towards shore since the volume of water between the ship and shore represent only a portion of the waterbody. The constrained volume between the ship and shore is still capable of mixing at either end of the ship. In order to avoid potential overlap of discharge plumes from ships docked and simultaneously discharging towards shore, the maximum authorized mixing zone size is less than 100 meters and was determined to be 83 meters in practice.

F.9.1 Unsteady State Modeling

Unsteady state flows are those which occur during a tidal reversal, when the plume reverses upon itself. In order to model this, current velocities at the time of the desired analysis are needed (e.g. 30 minutes after slack tide). The modeler did not have this data for either Juneau or Skagway. It should be noted that whenever the time to reach WQS during a low ambient velocity scenario is greater than approximately 60 minutes the modeling results are not accurate because the amount of time spent at one velocity is not generally that long.

To represent a low ambient velocity, the 10^{th} percentile value from the cumulative frequency curve was used; 0.06 m/s was used in Juneau models and 0.05 m/s was used in Skagway models. However, the tidal velocity would not remain at this low velocity for longer than about 60 minutes. That would include a time period prior to a slack tide, slack tide, and time period after slack tide. As the tidal current increases, mixing also increases and the time to meet WQS would decrease.

DEC did not have the data needed to modify CORMIX to run as an unsteady state model. However, worst case modeling results indicated that discharges that did not reach WQS within 60 minutes were already larger than 83 meters at 30 minute; thus such discharges would not be authorized even if tidal velocity, and mixing, increases rapidly after 60 minutes.

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Appendix G: Mixing Zone Analysis Checklist

The table below outlines those items in State of Alaska regulations (18 AAC 70.240) that must be considered in order for the Department to authorize mixing zones for cruise ship wastewater discharges. The majority of the items are considered on a large scale, for the mixing zones described in the Permit. However, whether the acute WQC are met within the smaller initial mixing zone and whether chronic mixing zone size restrictions are met is specific to individual applicants and will be considered once NOIs (applications) are received by the Department.

18 AAC 70.240. Mixing Zones (only sections that apply to marine waters and require analysis are included here).

(b) In determining whether to authorize a mixing zone under this section, the Department will **consider**:

Criterion	Considered?	Resources used to consider
Characteristics of the receiving water	Yes	Ambient data collected directly for Juneau and Skagway harbors and past studies conducted in AK marine waters (e.g., Skagway, Gastineau Channel, Hawk Inlet).
Characteristics of the effluent	Yes	Sampling results, VSSPs, NOIs, CORMIX modeling
Cumulative effects of multiple discharges	Yes	Regulate behavior (e.g., WQC are met at boundaries of mixing zones(MZs)) to avoid cumulative effects. Overlapping mixing zones prohibited when under 6 knots and will not occur in any meaningful way when moving at 6 knots or greater (i.e., don't overlap in time). Later criteria address bioaccumulation, etc.
Additional measures that would mitigate potential adverse effects to the aquatic resources present	Yes	Whole effluent toxicity testing and receiving water monitoring required for discharges to approved mixing zones will at speeds under 6 knots.
Any other factors the Department finds must be considered to determine whether a mixing zone will comply with this section	Yes	No other factors required.

(c) The Department will approve a mixing zone, as proposed or with conditions, **only if** the Department finds that available evidence reasonably demonstrates that:

Criterion	Sub criterion	Available Evidence Demonstrates?	Evidence
Treatment methods are the most effective, technologically and economically feasible.	---	Yes	Science Advisory Panel, HB80
Treatment methods are at a minimum consistent with statutory and regulatory treatment requirements including:	(A) any federal technology-based effluent limitation	Yes	40 CFR 133.102 33 CFR Part 159 Subpart E (Title XIV—Certain Alaskan Cruise Ship Operations" contained in section 1(a)(4) of Pub. L. 106-554) 2013 EPA Vessel General Permit Coast Guard certifies. If approved by federal agency, consider this requirement met.
	(B) minimum treatment standards in 18 AAC 72.050	N/A	18 AAC 72.050 does not apply to the Permit.
	(C) any other more stringent state statute or regulatory treatment requirements	Yes	More stringent state treatment requirements for commercial passenger vessels do not exist.
Designated and existing uses of the waterbody as a whole will be maintained and protected	---	Yes	Achieved through size and location of approved MZ plus the requirement that acute WQC are met at boundaries of smaller initial MZ and chronic WQC are met at boundaries of the larger, chronic MZ. Antidegradation analysis
The overall biological integrity of the waterbody will not be impaired	---	Yes	Achieved through size and location of approved MZ plus the requirement that acute WQC are met at boundaries of smaller initial MZ and chronic WQC are met at boundaries of the larger, chronic MZ.
The mixing zone will **not:**	(A) result in an acute or chronic toxic effect in the water column, sediments, or biota outside the boundaries of the mixing zone	Yes	The established mixing zone size is expected to adequately protect the integrity of the water column, sediments, and biota outside the mixing zone boundaries.

Criterion	Sub criterion	Available Evidence Demonstrates?	Evidence
	(B) create a public health hazard	Yes	The mixing zone will not occur in water supply or contact recreation areas. The most restrictive ammonia and dissolved metal WQC that require a MZ are aquatic life based. Bacteria and total suspended solids requirements are human health related and met at end of pipe.
	(C) preclude or limit established processing activities or established fish and shellfish harvesting	Yes	The established mixing zone size is expected to adequately prevent effects on established processing activities or established fish and shellfish harvesting in the area.
	(D) result in a reduction in fish or shellfish population levels	Yes	Due to the transient nature of vessel discharges, population level effects are not expected.
	(E) result in permanent or irreparable displacement of indigenous organisms	Yes	Due to the transient nature of vessel discharges, permanent or irreparable displacement of indigenous organisms is not expected. Discharge plumes are buoyant, rise to surface, and are not expected to affect benthic organisms.
	(F) adversely affect threatened or endangered species	Yes	Threatened or endangered species are not expected to be adversely affected. MZ size and location ensures no toxicity to these species. http://www.fws.gov/alaska/fisheries/endangered/listing.htm http://www.adfg.alaska.gov/index.cfm?adfg=specialstatus.akendangered
	(G) form a barrier to migratory species or fish passage	Yes	Overlapping mixing zones prohibited; areas can be avoided by fish and migratory species, if necessary.

(d) The Department will approve a mixing zone, as proposed or with conditions, **only if** the Department finds that available evidence reasonably demonstrates that within the mixing zone the pollutants discharged **will not**:

Criterion	Available Evidence Demonstrates?	Evidence
Bioaccumulate, bioconcentrate, or persist above natural levels in sediments, water, or biota to significantly adverse levels, based on consideration of bioaccumulation and bioconcentration factors, toxicity, and exposure	Yes	While metals bioaccumulate, the discharges contain low level of metals that are not expected to bioaccumulate to adverse levels. Data from other discharge has not demonstrated evident that metals are bioaccumulating.
Present an unacceptable risk to human health from carcinogenic, mutagenic, teratogenic, or other effects as determined using risk assessment methods approved by the Department and consistent with 18 AAC 70.025	Yes	Past effluent sampling results (arsenic, mercury, chromium, benzene, thallium, vinyl chlorine, etc). Cancer threshold for chronic human health WQC has been developed to make sure it is protective.
Settle to form objectionable deposits, except as authorized under 18 AAC 70.210	Yes	Past effluent sampling results (settleable solids) indicate objectionable deposits will not form under current limits.
Produce floating debris, oil, scum, and other material in concentrations that form nuisances	Yes	Past effluent sampling results (TSS, SS, oil and grease) indicate objectionable deposits will not form under current limits. No past visual reports recorded.
Result in undesirable or nuisance aquatic life	Yes	No complaints recorded.
Produce objectionable color, taste, or odor in aquatic resources harvested from the area for human consumption	Yes	No complaints recorded.
Cause lethality to passing organisms	Yes	Based on the analysis and the modeling effort to determine whether the MZ is appropriate per the factors in implementation guide for 2006 MZ regs. WET testing results can be used to monitor and check expectations.
Exceed acute aquatic life criteria at and beyond the boundaries of a smaller initial mixing zone surrounding the outfall, the size of which shall be determined using methods approved by the Department	Yes	To be determined for each ship using Method 3 on page 9 of DEC's Implementation Guidance: 2006 Mixing Zone Regulation Revisions (2009).

(k) The Department will approve a mixing zone, as proposed or with conditions, **only if** it finds the mixing zone is as small as practicable and will comply with the following size restrictions, unless the Department finds that evidence is sufficient to reasonably demonstrate that these size restrictions can be safely increased:

Criterion	Sub criterion	Criterion Met?	Resources
Mixing zone is as small as practicable.	---	Yes	The MZ sizes in the Permit meet the "as small as practicable" requirement in 18 AAC 70.240 by limiting the MZ sizes to be no larger than necessary to concurrently meet WQC and all other mixing zone requirements at the boundaries of the MZs.
For estuarine and marine waters, measured at mean lower low water: These requirements could trigger a limitation on the number of ships allowed to discharge simultaneously in port, based on the size of their mixing zones. Limitations would be port specific. "unless the department finds that evidence is sufficient to reasonably demonstrate that these size restrictions can be safely increased"	(A) the cumulative linear length of all mixing zones intersected on any given cross section of an estuary, inlet, cove, channel, or other marine water may not exceed 10 percent of the total length of that cross section	Yes	Discharges constitute a small portion of each harbor where discharges routinely occur. The limitation on size to prevent overlapping discharges prevents these criteria from being exceeded.
	(B) the total horizontal area allocated to all mixing zones at any depth may not exceed 10 percent for the surface area		