

**DEVELOPMENT OF THE CURRENT PRINCE WILLIAM SOUND ESCORT SYSTEM:
REGULATIONS, ANALYSIS, AND SYSTEM ENHANCEMENTS**

PREPARED FOR: PRINCE WILLIAM SOUND REGIONAL CITIZENS' ADVISORY COUNCIL
Contract # 8020.17.02

SUBMITTED BY: NUKA RESEARCH AND PLANNING GROUP, LLC

JUNE 8, 2017

*The opinions expressed in this PWSRCAC-commissioned report are not necessarily those of
PWSRCAC.*



ABSTRACT

Within two months of the *T/V Exxon Valdez* oil spill in Prince William Sound (PWS), the State of Alaska mandated that all tankers shipping crude oil through PWS be escorted. Today, Alyeska Pipeline Services Company operates the Ship Escort/Response Vessel System (SERVS), which is governed by both federal and state regulations. This report documents the process through which the current escort system evolved by summarizing relevant technical studies and other activities that lead to the current system. While escort system development was guided by a series of collaborative efforts by the shipping companies, SERVS, Prince William Sound Regional Citizens' Advisory Council (PWSRCAC), the U.S. Coast Guard (USCG), and the Alaska Department of Environmental Conservation (ADEC), the system that was ultimately established was compelled by ADEC's authority under the State of Alaska's statutes and regulations, and complemented by federal statute and regulations.

ABBREVIATIONS

ADEC	Alaska Department of Environmental Conservation
Alyeska	Alyeska Pipeline Service Company
BAT	Best available technology
COA	Condition of Approval (issued by ADEC in C-plan review process)
DWT	Deadweight ton
ERV	Emergency Response Vessel
ETT	Enhanced Tractor Tugs
HE	Hinchinbrook Entrance
OPA90	Oil Pollution Act of 1990
PRT	Prevention and Response Tug
PWS	Prince William Sound
PWSRCAC	Prince William Sound Regional Citizens' Advisory Council
RFP	Request for Proposal
RMROL	Realistic maximum response operating limitations
RPG	Response Planning Group (representing the PWS C-Plan holders)
SERVS	Alyeska Pipeline Service Company's Ship Escort/Response Vessel System
Tanker C-plan	Prince William Sound Crude Oil Tanker Oil Discharge Prevention and Contingency Plan
VERP	Vessel Escort and Response Plan
VSP	Voith Schneider Propulsion
USCG	U.S. Coast Guard

Timeline of Key Activities in Development of Current SERVS Escort System

	Regulatory Actions	Collaborative Analysis	System Changes
1989 - 1991	ADEC emergency order mandates that tankers be escorted in PWS. OPA90 enacted, including 2-escort requirement for PWS.		Escort system established using conventional tugs and converted offshore supply vessels called Emergency Response Vessels (ERV).
1992 - 1994	ADEC contingency plan regulations promulgated.	Workgroup commissions 1st Disabled Tanker Towing Study , including pushing and towing exercises, to address concerns regarding tug capabilities. Results in procedural changes & consideration of purpose-built tugs.	New procedures: - Tethered escort in Narrows & Arm established - Routine tethering/towing exercises started - Tanker speed limit in Narrows
1995	RPG submits Tanker C-plan for review. ADEC approves with Conditions of Approval (COA), including COA 2 : - address tankers of 190,000 DWT or greater in Narrows in winter conditions - propose a system that meets needs of each operating area and justify it as BAT (pending risk assessment results)	Atkinson report commissioned by ADEC concludes that ERV must be tethered prior to entering narrows & that there are superior tugs to those currently in system.	
1996		PWS risk assessment concludes that escort system is most important risk reduction measure in PWS.	
1997	ADEC issues new BAT regulations, including 8 criteria , with explicit requirement that escort system be examined. ADEC approves RPG's proposed tug criteria as being BAT prior to procurement of new tugs. (PWSRCAC also reviews RFP.)	RPG convenes Enhanced Escort System Task Force to identify, test, and develop tugs to meet ADEC's COA 2 requirements. RPG proposes enhanced system . Some immediate changes are made, and plans developed to conduct sea trials for Protector class tugs and to upgrade fleet overall. Sea trials conducted with Protector class tugs; determination made that they are suitable for smaller tankers only.	High-powered tug chartered at Hinchinbrook Entrance (HE) until purpose-built tugs can be developed and procured. Tug operating procedures revised.
1998		Discussions are ongoing regarding what is required for BAT specifically at HE. PWSRCAC convenes workshop on RPG's proposed tug for use there. RPG submits analysis to ADEC.	
1999	ADEC approves 1998 Tanker C-plan with COA, including COA 8 which requires simulations & sea trials to demonstrate that new, purpose-built tugs can save tanker at HE in worst-case conditions.	RPG conducts 2nd Disabled Tanker Towing Study to satisfy COA 8. ADEC requires additional analyses because simulation inputs were not vetted prior to first round. Simulations precede HE-focused sea trials. Worst-case tanker drift trajectory analysis conducted.	Two Enhanced Tractor Tugs (ETT) put into service in PWS.
2000		Towing exercise conducted using ETT and PRT to tow 261,000 DWT tanker. RPG, ADEC, PWSRCAC agree on simulation criteria for worst-case tanker trajectory analysis. Additional analyses conducted. Simulations conducted to evaluate ETT & PRT assisting a 211,000 DWT tanker at HE in closure conditions.	Three Prevention Response Tugs (PRT) put into service in PWS.
2001	ADEC finds that escort system is BAT based on amendments submitted.	ETT radio controlled model tests conducted.	

In 2004, based on requests from PWSRCAC and ADEC, a full-scale exercise was conducted near HE to demonstrate the ability of tugs to arrest a tanker in less-than-calm conditions. Together, an ETT and PRT arrested a > 90,000 DWT in 12-foot seas and 40-knot winds at the most extreme.

TABLE OF CONTENTS

1. Introduction	6
1.1 Scope.....	6
2. Background.....	7
2.1 Regulatory Context.....	7
2.1.1 Federal regulations	7
2.1.2 State regulations	8
2.2 Overview of Current System.....	9
3. Development of Current SERVS System.....	11
3.1 Origins of escort system (1989-1999)	11
3.2 Additional enhancements (1999-2004).....	16
3.3 Exercise in less-than-calm conditions (2004)	19
4. Summary of Requirements	19
5. Conclusion.....	20
6. References.....	22

1. Introduction

This report documents the development of the current Alyeska Pipeline Service Company's (Alyeska) Ship Escort/Response Vessel Systems' (SERVS) escort system. Nuka Research and Planning Group, LLC developed this report for Prince William Sound Regional Citizens' Advisory Council (PWSRCAC) as part of that organization's Marine Transition Project, ongoing in 2017. The Marine Transition Project focuses on the upcoming transition of vessels, equipment, and personnel managed under contract to SERVS from Crowley Marine Services to Edison Chouest Offshore.

1.1 SCOPE

In this report, the escort system is considered to include the tugs and their equipment, the roles and responsibilities defined for each tug, and the procedures developed to enable the tugs to achieve their intended roles throughout Prince William Sound (PWS).

While the ship escort system development was guided by a series of collaborative efforts by the Prince William Sound Tanker Oil Discharge Prevention and Contingency Plan holders (Tanker C-plan), SERVS, Prince William Sound Regional Citizens' Advisory Council (PWSRCAC), U.S. Coast Guard (USCG), and Alaska Department of Environmental Conservation (ADEC), the system that was ultimately established was compelled by ADEC's authority under the State of Alaska's regulations and statutes, complemented by federal statute and regulations. This report documents the process through which the current system evolved by summarizing relevant reports and correspondence, and other activities that lead to the current system.

The function of escort vessels is to be immediately available to warn of impending danger, to assist tank vessels in case of emergency and to assist in initial oil spill response. The tank vessel must be operated within the performance capabilities of the escort vessels, taking into account factors such as speed, sea and weather conditions, and navigational considerations.

PWS Tanker C-plan (2017)

Vessels that comprise the SERVS escort system are used for both accident or oil spill prevention and, if needed, oil spill response. This report focuses on the tugs and procedures in place to prevent a tanker from grounding in PWS should it suffer loss of power or steering.

2. Background

This section provides background information about the regulatory context and the current SERVS escort system.

2.1 REGULATORY CONTEXT

The ship escort system in PWS originated through a suite of legislative and regulatory changes enacted after the 1989 *T/V Exxon Valdez* oil spill. Soon after the oil spill, the federal government required two escorts for all laden tankers in PWS. Subsequent updates to the system were governed by Alaska's regulations. This section describes the relevant federal and state regulations.

2.1.1 Federal regulations

Federal regulations (33 CFR 168) fall under the Oil Pollution Act of 1990 (OPA90), which established the requirement that two escorts accompany all laden tankers in PWS out to Seal Rocks. This requirement applied only to the operation of single hull tankers and would have ended when the tanker fleet completed its federally-mandated transition to double hull tankers. However, in 2010, the law was updated to apply the dual-tug requirement to double hull tankers as well (P.L. 111-281).

Federal regulations specify the minimum performance capabilities that the escort tugs must be able to achieve either singly or operating together [33 CFR 168.50(b)],¹ and also require that a tanker in any area subject to the regulations² must operate with escorts that meet these standards [[33 CFR 168.50(a)]. These requirements were added to the federal regulations based on USCG consideration of tanker/tug maneuvering studies submitted with comments on the proposed regulations (59 FR 160, 1994). One of the escort tugs must be outfitted for oil spill response [33 CFR 155.1130(g)].

Shippers develop a Vessel Escort Response Plan (VERP) for submittal to the USCG. While initially reviewed and approved by the USCG, the VERP was later changed to being a proprietary document that the industry shares with USCG. (APSC-SERVS, 2013)

¹ These requirements are: (1) Towing the tanker at 4 knots in calm conditions, and holding it in steady position against a 45-knot headwind; (2) Holding the tanker on a steady course against a 35-degree locked rudder at a speed of 6 knots; and (3) Turning the tanker 90 degrees, assuming a free-swinging rudder and a speed of 6 knots, within the same distance (advance and transfer) that it could turn itself with a hard-over rudder.

² Prince William Sound is identified as one of the areas where escorts are required, at 33 CFR 168.40(a).

2.1.2 State regulations

ADEC reviews and – at their discretion – approves Oil Discharge Prevention and Contingency Plans according to evaluation criteria set out in state regulations under the statutory authority at AS 46.04.030. An ADEC-approved plan is required to operate a tanker in Alaska state waters [AS 46.04.030(e)]. State regulations establish requirements for plan contents and criteria for their approval. Those applicable to the prevention role of the SERVS escort system are described below.

Plans must include a **prevention plan** that identifies conditions that may increase risks, such as navigational hazards, and the measures taken to reduce the risk of a spill resulting from these hazards [18 AAC 75.425(e)(2)(D)].

Plans must also identify **realistic maximum response operating limitations (RMROL)** that may be encountered, and an analysis of how these limitations may be exceeded by weather, sea state, ice or debris, and darkness. This section also requires a description of prevention or response measures that will be used to mitigate risks associated with these conditions [18 AAC 75.425(e)(3)(D) and 18 AAC 75.445(f)]. While RMROL does not apply to the escort system directly, that system is identified as a prevention method in the Tanker C-plan.

Finally, plans must justify their equipment as **best available technology (BAT)** for all equipment that is not subject to another performance standard in the regulations [18 AAC 75.445(k)]. While the state already required BAT in statute at AS 46.04.030(e), BAT regulations were not promulgated until 1997.

BAT is defined according to eight criteria [18 AAC 75.445(k)(3)]. The escort vessels and towsheets must also be determined to be BAT [18 AAC 75.425(e)(4)(A)(iii)].

The PWS crude oil shipping companies have worked together in a Response Planning Group (RPG)³ to develop the Tanker C-plan, which includes the sections required by regulation, and a Technical Manual, which provides additional details on SERVS' vessels and equipment and how these resources would be used for a response to a tanker spill. The documents are submitted to ADEC and for public review on a five-year renewal cycle, or any time there is change warranting a plan amendment.

BAT Criteria

Equipment subject to ADEC's BAT requirements is assessed according to the following:

- 1) Best in use in similar situations
- 2) Transferrable for use by the operator
- 3) Reason to expect it will improve spill prevention/response
- 4) Cost
- 5) Age and condition of current equipment used
- 6) Compatibility with existing systems
- 7) Feasibility
- 8) Environmental impacts associated with its use do not offset anticipated environmental benefits

18 AAC 75.445(k)(3)(A-H)

³ This group was originally called the Prince William Sound Tanker Association and the Prince William Sound Shipping Companies but is called the RPG throughout this report for consistency.

2.2 OVERVIEW OF CURRENT SYSTEM

Alyeska formed SERVS to develop and implement an escort and spill response system for PWS.

Since the promulgation of the regulations described in Section 2.1, the escort system has evolved to establish operating procedures and vessel requirements particular to each of three operating areas defined in PWS (see Figure 1). The process by which this occurred is the focus of Section 3 of this report.

Figure 1 shows the three PWS operating areas and the escort configurations used for laden tankers in each.⁴ Two escorts are used throughout PWS. In each operating area, primary and secondary escorts work together. In the Valdez Narrows and Arm, the primary escort is tethered to the tanker, while in other areas the escorts may be within ¼ nautical mile of the tanker but are not tethered. As the tanker departs PWS through Hinchinbrook Entrance, one tug stays on station as a sentinel until the tanker is at least 17 miles into the Gulf of Alaska. The current fleet has five types of tugs that are equipped for the roles identified in Table 2.

Table 2. Escort vessel designations (based on 2017 Tanker C-plan, Table 2-3)

Escort Vessel	Designated Escort Role		
	Primary Escort	Secondary Escort	Hinchinbrook Sentinel
Enhanced Tractor Tug (ETT)	x	x	x
Prevention Response Tug (PRT)	x	x	x
Utility Vessel		x	
Conventional Escort*		x	Theriot Class
Protector Class**	x		

NOTES:

* Conventional escort includes Theriot, Invader, and Sea Swift classes.

** May be used in this role for tankers up to 90,000 deadweight ton (DWT). See discussion of how this determination was made in Section 3.2.

The tug specifications and procedures were developed primarily under the State of Alaska's BAT regulations and are documented accordingly in the Tanker C-plan and SERVS Technical Manual. While these are developed to comply with ADEC regulations, many details were resolved through a series of studies, simulations, and field trials framed with input from a series of collaborative efforts including ADEC, SERVS, RPG, USCG, and PWSRCAC. These processes are described in Section 3.

⁴ Different configurations are used for tankers in ballast.

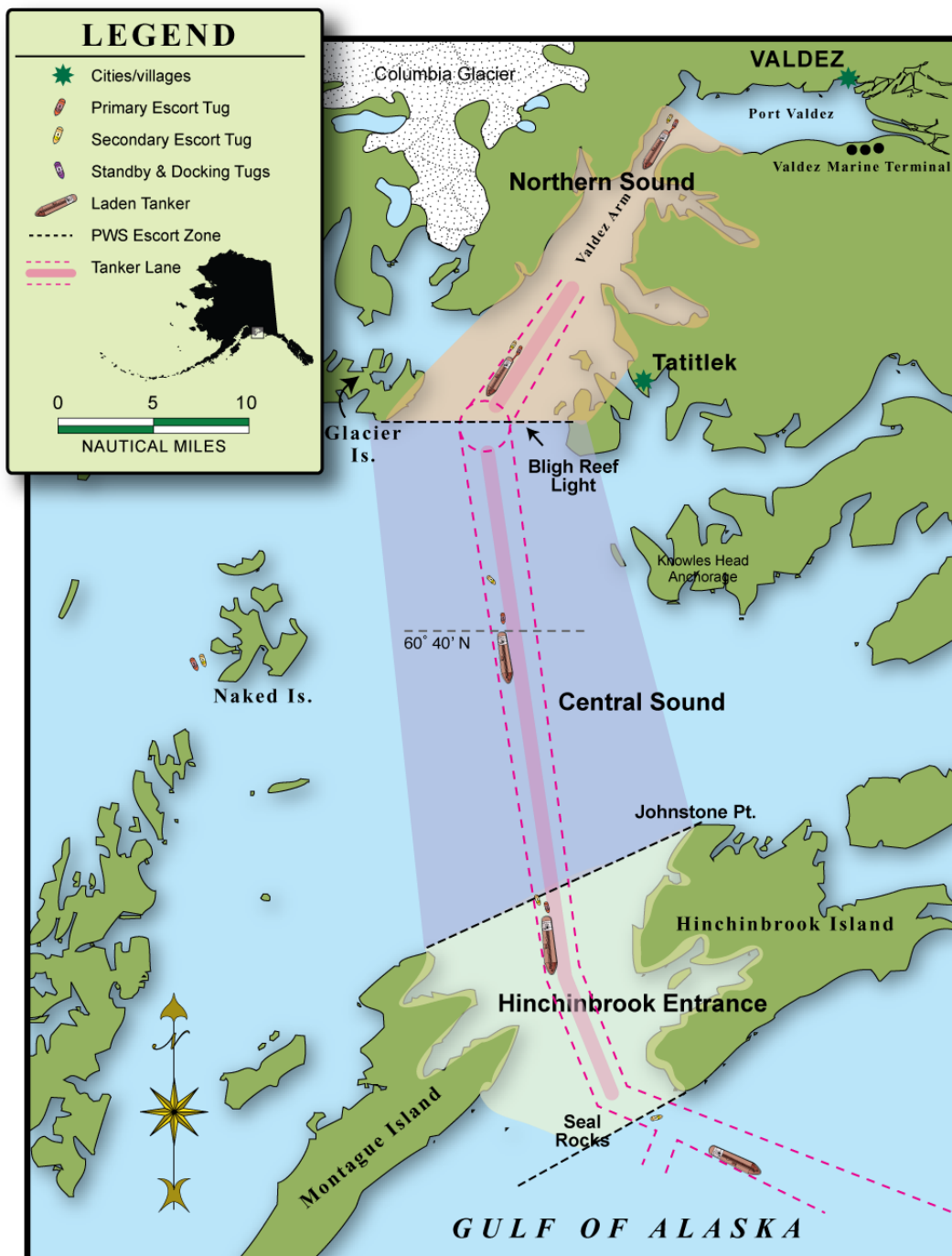


Figure 1. Prince William Sound operating areas and associated escort configuration

3. Development of Current SERVS System

In May 1989, ADEC established the first requirement for escorts of laden crude oil tankers in PWS by an Emergency Order issued under their statutory authority at AS 46.03.820 (ADEC, 1989). The system has evolved over time.

Two major improvements have taken place since the escort system was established: (1) the development of new operating procedures, including the tethered escort through Valdez Narrows and improved training practices (early 1990s), and (2) the addition of powerful, purpose-built tugs in 1999 and 2000 (the Prevention and Response Tugs, or PRT, and Enhanced Tractor Tugs, or ETT).

The purpose-built tugs serving in PWS today were first considered in 1995. Before ADEC approved their use in the system, SERVS, RPG, USCG, and PWSRCAC collaborated with ADEC to determine the analyses, simulations, and sea trials needed to demonstrate tug capability to control a drifting tanker in PWS. Particular attention was given to the Hinchinbrook Entrance operating area.

This section provides a detailed summary of the process that unfolded based on the letters, studies, and findings documents generated throughout the process.

3.1 ORIGINS OF ESCORT SYSTEM (1989-1999)

From 1989 - 1999, the SERVS escort system consisted of conventional tugs and offshore supply vessels that were converted to oil spill response vessels and called Emergency Response Vessels (ERV).

SERVS and the RPG asserted that the combination of vessels in the initial escort system was sufficient to stop and control a disabled crude oil tanker in PWS. PWSRCAC and ADEC were not sure that these vessels were adequate in all circumstances to successfully rescue a laden tanker prior to grounding.

In 1992, ADEC, SERVS, RPG, USCG, and PWSRCAC worked together to commission an analysis known as the *Disabled Tanker Towing Study*. The results of this study were presented in two parts. In Part 1, professional towing masters evaluated the existing capacity for emergency towing in PWS and examined alternatives that could enhance the escort and assist capabilities for disabled tankers (The Glosten Associates, Inc., 1993). Part 2 of the study evaluated the capability of existing escort vessels in PWS and also considered alternatives to enhance the system through computer simulations of worst-case failures (The Glosten Associates, Inc., 1994).

The *Disabled Tanker Towing Study* led to immediate changes in the escort system operating procedures, including:

- Tethering an escort tug to laden tankers during the transit through Valdez Narrows and Arm,
- Reducing the transit speed through Valdez Narrows to 5 knots,⁵ and
- A program of routine tethering and towing exercises.

The *Disabled Tanker Towing Study* also led to discussions regarding the construction of purpose-built escort tugs for PWS (Mitchell et. al., 2001).

In 1995, concerns about the effectiveness of the existing escort system resulted in the commissioning of a probabilistic risk assessment that was overseen by the RPG, PWSRCAC, ADEC, and USCG (Merrick et al., 2002). The risk assessment overlapped with the 1995 Tanker C-plan renewal and ADEC's issuance of COA 2a and 2b (the latter related directly to the forthcoming results of the risk assessment).

The PWS risk assessment was underway when the RPG submitted a revised version of the Tanker C-plan for review and approval by ADEC for the required 1995 plan renewal. In August 1995, ADEC issued its Findings and Response to Comments on the Tanker C-plan. ADEC found that there were "sufficient issues to preclude a finding that Best Available Technology is presently being utilized in the tanker escort system." ADEC concluded, "escort performance improvements are available, can be obtained and readily applied to assist very large crude carriers in Valdez Narrows." They cited their statutory authority at AS 46.04.030(e) that requires planholders to use BAT at the time their contingency plan is submitted or renewed. They also noted that State regulations at 18 AAC 75.990(5) define BAT as "equipment, supplies and other resources which, in the Department's judgment, meet or exceed the current level of demonstrated available technology," (ADEC, 1995a).

In their basis for decision, ADEC stated that caution must be exercised in applying the data from the *Disabled Tanker Towing Study* to the current escort system and cited a report commissioned by ADEC from an independent technical expert, Captain James Atkinson. The purpose of the report was to consider more realistic operational circumstances. The findings from the Atkinson (1995) report included:

- ERV must be tethered before entering the Narrows to be of any value, and
- Enhanced Voith Schneider Propulsion (VSP) tractor tugs are far superior to conventional escort tugs.⁶

⁵ Later increased to 6 knots based on the results of subsequent simulations and towing exercises.

⁶ VSP combines steering and propulsion in one unit for use in cases where precise maneuvering is needed.

Because of these issues, ADEC approved the plan with conditions of approval (COA). One of these, COA 2, required the plan holders to:

COA 2a. Submit a vessel escort improvement proposal for review and approval. At a minimum, the proposal was to achieve improvements in vessel escort performance for tankers above 190,000 DWT while transiting the Valdez Narrows during the winter season.

COA 2b. Following the completion of a risk assessment that also began in 1995 (see below), plan holders were required to develop a final vessel escort improvement proposal for ADEC's review. The proposal was to give consideration to vessel escort needs for specific areas: the Valdez Narrows and Arm, the open reaches of PWS, and Hinchinbrook Entrance, as well as the escort vessel needs taken as a whole for the entire PWS transit. The RPG was to provide a reasoned basis to assert that the proposed vessel escort system represented BAT (ADEC, 1995b).

In December 1996, the risk assessment concluded that the escort system was the single most effective risk reduction measure in PWS.

In early 1997, ADEC promulgated new regulations, adding the requirement for a BAT review for certain aspects of contingency plans, including the escort system⁷ (ADEC, 1997a). Prior to this, there had been a statutory requirement for BAT⁸ but no guidance in regulation as to how to implement the statute. The new regulations took effect as the RPG was working to address COA 2a and 2b.

Following completion of the risk assessment in 1997, the RPG convened an Enhanced Escort System Task Force to identify, test, and develop appropriate tug technology for the PWS escort system (Mitchell et. al., 2001) to meet the requirements of COA 2b of the 1995 C-plan approval.

In February 1997, the RPG reported to ADEC on their efforts to comply with COA 2b (BP Oil, 1997a). The RPG had formed sub-committees to implement the findings of the risk assessment and were committed to the following escort tug enhancements:

- Charter a high horse power tug for service at Hinchinbrook Entrance (the *Gulf Service*);
- Conduct sea trials of the Crowley Protector Class tugs (if they performed better than the existing escort tugs, arrangement would be made to replace the existing tugs with the Protector Class tugs);
- Develop a plan to upgrade the current tug fleet and implement the plan with at least two new tugs in service by the year 2000; and

⁷ 18 AAC 75.425(e)(4) and 18 ACC 75.445(k)(3)

⁸ AS 46.04.030(e)

- Revise tug operating procedures.

In March 1997, the RPG also reported to ADEC on the process they had used to determine the requirements for an escort tug to meet the State's newly-promulgated BAT regulations (BP Oil, 1997b). They stated that PWS stakeholders, including ADEC, were consulted or had participated in extensive studies, performance trials, and field trips to observe various tugs in operation. The RPG concluded that ETTs had the capabilities best suited to the needs of the escort duties in PWS. They developed request for proposal (RFP) criteria and specifications for tugs that included requiring VSP. Separate performance criteria were developed for Valdez Narrows, Valdez Arm, and PWS.

The RPG also reported on their program to further enhance the escort system. The first Protector Class tug had been brought into PWS in December 1996, as an interim measure, but simulations and performance trials (Jones, 1997) led them to conclude that the Protector Class *did not* improve the overall safety of the escort system. (Instead it was approved as an escort for smaller tankers only.) These trials *did* lead to the development of protocols for trials to evaluate the performance of tugs and maneuvers to assist tankers in distress.

The RPG requested that ADEC determine whether a tug meeting certain performance criteria (spelled out in the March 1997 letter) would meet the State's BAT requirement at 18 ACC 75.445(k)(3). Once that determination was received, the RPG indicated that they would begin a procurement process that would result in two new tugs being delivered no later than the end of 1999.

The RPG included the draft RFP and draft description of the proposed enhanced escort system with their March 1997 letter to ADEC and shared these with PWSRCAC as well.

On April 9, 1997, the ADEC replied to the RPG and approved performance criteria for the RFP as meeting the State's BAT requirement, with the reservation that if the chosen tug design did not have VSP, an additional approval would be necessary (ADEC, 1997b). ADEC also approved the description of the enhanced escort system. On May 2, 1997, ADEC issued a formal BAT decision for Condition 2a, indicating that the plans submitted by the RPG met the State's regulations at 18 AAC 75.425(e)(4) and 18 AAC 75.445(k)(1-2)(ADEC, 1997c). Finally, ADEC also approved the rescue tug *Gulf Service* as BAT for the escort at Hinchinbrook Entrance until the process in COA 2b was concluded.

The *Gulf Service* was placed into service as the Hinchinbrook escort in 1997 as an interim measure while COA 2b was being addressed.

On May 21, 1997, the USCG Commander of the 17th District sent a memorandum to the Commanding Officer of the Valdez Marine Safety Office stating that the federal

regulations (33 CFR 168) did not preclude a “sentinel” tug escort (USCG, 1997), so the sentinel escort proposed by the RPG was found to be in compliance with USCG regulations.

On October 5, 1998, ADEC concluded that COA 2a had been satisfied after reviewing the September 1 version of the VERP and a letter from RPG dated September 30, 1998 (ADEC, 1998a).

On October 28, 1998, SERVS wrote PWSRCAC asking for the Council’s support for the replacement of three ERVs with three PRTs and agreement that the PRTs should be considered BAT (SERVS, 1998). On October 30, PWSRCAC replied that they would support SERVS’ request with some conditions (PWSRCAC, 1998a).

On November 3, 1998, ADEC wrote SERVS answering a verbal request as to how long the ETTs and PRTs would be considered BAT (ADEC, 1998b). ADEC stated,

Because the state regulation requires the use of a ‘proven’ technology, it appears evident that it will be many years, perhaps a decade or more, before another alternative tanker assistance technology becomes proven to either compete with or potentially supersede the capabilities of the proposed tugs to achieve their mission as Best Availability (sic) Technology for Prince William Sound tanker operations.

On October 27, the RPG wrote ADEC to express concerns regarding ADEC’s implementation of BAT regulations, specifically that the BAT regulations were being used to force adoption of new and unproven technology that did not result in greater environmental protection than the vessels already in use (RPG, 1998a). On November 16, PWSRCAC wrote the RPG to object to statements in this letter (PWSRCAC, 1998b).

On November 25, 1998, PWSRCAC wrote letters to ADEC, the RPG, and the USCG to invite them to a three-day technical workshop to review the Hinchinbrook Tug BAT Analysis that was scheduled to be submitted by the RPG on November 30 (PWSRCAC, 1998c). On December 15, the RPG submitted the analysis to ADEC (RPG, 1998b).

**Two ETTs with VSP
were placed into
service as escort tugs
in 1999.**

In January 1999, PWSRCAC submitted comments and requests for additional information to ADEC on the Hinchinbrook BAT Analysis (PWS RCAC, 1999). Among other things, PWSRCAC requested:

- Case histories of saves in similar conditions,
- Simulations of tanker trajectories during worst case steering and power failures in Hinchinbrook Entrance,

- Field trials with the Gulf Service and ETTs,
- Simulations to study save capabilities of escort vessels in Hinchinbrook Entrance.

On January 27, 1999, ADEC responded to the RPG that they had reviewed the RPG's December submittal regarding BAT for the Hinchinbrook tug. ADEC stated that while the information submitted to date supported the conclusion that the *Gulf Service* was suited to rescue towing, more information was needed to fully define the mission of the Hinchinbrook tug in order to determine whether the *Gulf Service* was BAT. This would require modeling as well as sea trials would be needed (ADEC, 1999a).

In March 1999, the RPG wrote to the ADEC Commissioner objecting to ADEC's January 27, 1999 requests for additional information on the Hinchinbrook Tug (RPG, 1999a). The RPG wanted a finding that the *Gulf Service* met BAT regulations as a final determination. On April 29, ADEC replied that they interpreted the BAT regulations to require the assessment of new technologies, if appropriate, at the time of plan renewal. They requested that the RPG work with ADEC and other stakeholders to gather information and data that could be utilized to make a BAT assessment for escort at Hinchinbrook Entrance during the next plan renewal period (ADEC, 1999b).

On May 6, 1999, the RPG wrote to ADEC requesting a determination that PRTs would be considered BAT when used to replace the existing ERV (RPG, 1999b). ADEC responded on May 12, with a finding that the PRTs are BAT and therefore meet the requirements of 18 AAC 75.445(k)(1 and 3) (ADEC, 1999c). However, on May 21, ADEC stated that the May 12 letter was not a formal decision by the department and thus not subject to appeal (ADEC, 1999d).

3.2 ADDITIONAL ENHANCEMENTS (1999-2004)

In late 1998, the RPG submitted a revised Tanker C-plan for renewal. ADEC approved the plan with conditions in November 1999 (ADEC, 1999e). These included COA 8, which focused on the escort system. COA 8 required that the RPG conduct simulations and sea trials to demonstrate that PRTs and ETTs could save a tanker in Hinchinbrook Entrance closure conditions with worst-case wave period, wind direction, and current speed and direction. ADEC issued this requirement under their statutory authority at AS 46.04.030(e) and regulations at 18 AAC 75.027(e), 18 AAC 75.425(e)(2)(D), 18 AAC 75.425(e)(4)(A)(iii), 18 AAC 75.425(e)(3)(D), and 18 AAC 75.445(f).

In December 1999, the State of Alaska, BP Exploration Alaska, and ARCO Alaska entered into a Charter for Development of the Alaskan North Slope in order for the State of Alaska to approve the sale of ARCO Alaska to BP (State of Alaska, et. al., 1999). In Section B of the Charter, Marine Environmental Commitments, BP and ARCO agreed to continue to support a ship escort response vessel system for PWS at

current or better levels of effectiveness. On December 10, BP Oil Shipping wrote the ADEC Commissioner confirming support for the escort system in PWS and pledging to ensure that it remained world class. BP Oil Shipping noted that before newly built tugs could be integrated into the escort system, tests and sea trials needed to be completed. The letter also stated that in addition to training, the sea trials would be used to collect data to use to model a tanker arrest in closure conditions in Hinchinbrook Entrance (BP, 1999).

On December 30, 1999, the RPG submitted a study conducted by The Glosten Associates, Inc. that calculated worst-case drift trajectories for tankers in PWS as part of COA 8 (RPG, 1999c). On January 14, 2000, PWSRCAC wrote a letter to ADEC stating that they did not feel that the study submitted by the RPG represented the worst-case drift trajectories (PWSRCAC, 2000a). ADEC replied to the RPG by noting that they had not met the requirement of COA 8 to submit input parameters to ADEC for review before running the simulations (ADEC, 2000a). ADEC requested a meeting of all stakeholders (including PWSRCAC) to review and approve input parameters to expedite compliance with COA 8. The meeting was held on February 22. On February 28, the RPG sent ADEC a letter documenting the input parameters discussed at the meeting and asserting that the submittal of December 30, 1999, met the requirements of COA 8 (RPG, 2000a). Nuka Research did not identify a record of ADEC responding to this letter, but the outcome was that the RPG performed additional drift trajectory simulations with results submitted in April and June that year (The Glosten Associates, Inc., 2000a; The Glosten Associates, Inc. 2000b).

On February 25, 2000, Alyeska asked for PWSRCAC's support to release the *Gulf Service* from Hinchinbrook escort duties to be replaced with a PRT (APSC, 2000). On March 17, PWSRCAC replied to Alyeska stating that they felt the release of the *Gulf Service* at that time was contrary to the process required by COA 8 (PWSRCAC, 2000b). PWSRCAC urged Alyeska and the RPG to follow the process described in COA 8, which would eventually lead to the release for the *Gulf Service* once simulations and sea trials were completed, but not before.

Three PRTs were placed into escort service in the spring and summer of 2000, even as the COA 8 process continued to unfold.

On March 14, 2000, a towing exercise was conducted in PWS using an ETT and PRT to tow a 261,000 DWT crude oil tanker (Jones, 2000; USCG 2000). The purpose of the exercise was to practice and improve techniques for the rescue of a disabled tanker. The Glosten Associates, Inc. evaluated test data from the exercise and found that the ETT exceeded performance requirements of the 1997 RFP (The Glosten Associates, Inc., 2000c).

On March 22, 2000, the RPG sent a letter to ADEC recommending criteria for additional worst-case trajectory simulations (RPG, 2000b). On March 31, ADEC affirmed the simulation criteria and requested that the RPG meet with ADEC and PWSRCAC to review the results and see if additional simulations were warranted

(ADEC, 2000b). Once the simulations were complete, tug maneuvers would be identified and tested through sea trials. Once proven, the tug maneuvers would be incorporated into the simulations.

Also on March 22, 2000, the RPG submitted an amendment to the Tanker C-plan to request a determination that the PRT *Alert* was equivalent to the *Gulf Service* and therefore the PRT could be substituted as the Hinchinbrook escort (RPG, 2000c). On April 14, 2000, ADEC determined the proposed amendment sufficient for public review (ADEC, 2000c). On August 4, ADEC issued a proposed consistency determination and draft approval for the amendment (ADEC, 2000d).

On June 28, 2000, ADEC wrote a letter to the RPG indicating that they had reviewed the trajectory simulations submitted on December 30, 1999; April 7, 2000; June 13, 2000; and June 27, 2000, which considered input from ADEC and PWSRCAC (ADEC, 2000e). ADEC indicated readiness to bring the trajectory simulations to a close and begin considering tug maneuvers for tanker arrest and sea trials. On July 13, the RPG submitted the final worst-case trajectory simulations and tug maneuvers in a letter to ADEC (RPG, 2000d). On August 2, PWSRCAC sent ADEC a letter stating that they did not feel that the July 13 submittal contained enough detail to meet the requirements of COA 8 (PWSRCAC, 2000c).

On August 14, 2000, The Glosten Associates, Inc. issued a report on drift simulations in Hinchinbrook Entrance (The Glosten Associates, Inc., 2000d). The report contained a series of simulations of different scenarios of ETT and PRT assisting a 211,000 DWT tanker in Hinchinbrook Entrance at closure conditions.

On September 1, 2000, the RPG submitted a letter and package of information that they believed demonstrated that all requirements of COA 8 had been met (RPG, 2000e). On September 11, PWSRCAC's project team met with ADEC and USCG to discuss their concerns with the RPG's submittal (PWSRCAC, 2000d). On October 4, the RPG submitted another Tanker C-plan amendment that included the information submitted on September 1, and language for a revised BAT section in the plan (RPG, 2000f). On November 17, ADEC notified the RPG that the proposed amendment submitted on October 4 was not sufficient for review because the amendment did not reflect the then-current escort fleet (ADEC, 2000f). On December 8, the RPG submitted a revised text for the proposed plan amendment (RPG, 2000g). On December 21, ADEC indicated that additional information was needed before the plan could be submitted for public review (ADEC, 2000g). In this letter, ADEC also informed the RPG that they would require a sea trial in less-than-calm conditions to verify the simulations.⁹ On January 10, 2001,¹⁰ the Tanker C-plan holders provided a letter to ADEC with answers to the questions ADEC had raised in their letter of December 21 (RPG, 2000h).

⁹ The sea trial was eventually conducted in 2004.

¹⁰ This letter is mistakenly dated January 10, 2000.

On November 14, 2000, PWSRCAC asked the RPG to conduct a drift stop exercise to validate the simulations done for worst-case trajectories (PWSRCAC, 2000e). On January 9, 2001, the RPG declined to conduct the exercise on the basis it would be a disruption and distraction, and would elevate risk of an incident (RPG, 2001a).

In March 2001, The Glosten Associates, Inc. produced a final report on ETT Radio Controlled Model Tests (The Glosten Associates, Inc., 2001a). This report contains the results of model tests to study the behaviors of the ETT in escort situations. These tests inform the development of rescue maneuvers. In July, The Glosten Associates, Inc. produced a final report on their SHIPMAN maneuvering simulations of tanker escort tugs including ETT, PRT, and Protector (The Glosten Associates, Inc., 2001b). This report included computer simulations of escort tug interventions in disabled tanker scenarios to aid in determining the appropriate substitution of escort tugs in Valdez Narrows and Valdez Arm.

On April 6, 2001, ADEC issued the RPG a notice to publish a Tanker C-plan amendment for public review (ADEC, 2001a), which was then published on April 16 (RPG, 2001b). On August 2, ADEC issued a proposed consistency determination and draft approval of the C-plan amendment (ADEC, 2001b). On August 15, ADEC notified the RPG that the amendment was approved, confirming that the escort system met the State's BAT requirements (ADEC, 2001c).

3.3 EXERCISE IN LESS-THAN-CALM CONDITIONS (2004)

On February 6, 2004, after requests by PWSRCAC and ADEC to conduct drift stop exercises in higher winds and sea states, a full-scale exercise was conducted near Hinchinbrook Entrance in "less than calm" conditions to demonstrate the ability of escort tugs to arrest a disabled tanker in higher winds and rougher sea states. Conditions during the exercise varied but at the extremes were estimated to be 12-foot seas and 40 knots of wind. Together, an ETT and PRT were able to successfully arrest a 91,967 DWT crude oil tanker (Jones, 2004).

4. Summary of Requirements

Prior to the introduction of new, purpose-built tugs to the PWS escort system in 1999 and 2000, a series of simulations, analyses, and sea trials were conducted to provide the best possible assurance that the new tugs would be capable of filling their roles in PWS and, in particular, controlling a tanker at or near Hinchinbrook Entrance.

These measures were implemented in response to Conditions of Approval issued by the ADEC in its review of the state-required contingency plan for oil tankers operating in PWS.

Studies

- PWS metocean conditions
- Comparison of tug capabilities
- Functional requirements for an escort towing tug in PWS
- Definitions of tug maneuvers

Simulations

- Worst-case tanker trajectories studying how disabled tankers might behave without intervention
- Predicted tanker trajectories for various scenarios where tug interventions occur in PWS and Hinchinbrook Entrance
- Scale model tests to study tug behavior in emergency towing maneuvers

Sea trials

- Full-scale sea trials of Protector Class tugs
- Full-scale tanker towing exercises in near-calm conditions
- Full-scale tanker towing exercise in less-than-calm conditions

5. Conclusion

The process of developing the PWS tanker escort system, while arduous and contentious at times, led to development of what has been recognized by many experts as one of the best tanker oil spill prevention systems in the world. The stakeholders in the process had competing interests, but collaborated to develop the world-class system in place today. Ultimately, ADEC's statutory authority to require that the Tanker C-plan demonstrate that the escort system is the best available technology under state regulations drove the overall effort that resulted in the system as it is today.

Figure 2 depicts the timeline associated with the development of the escort system.

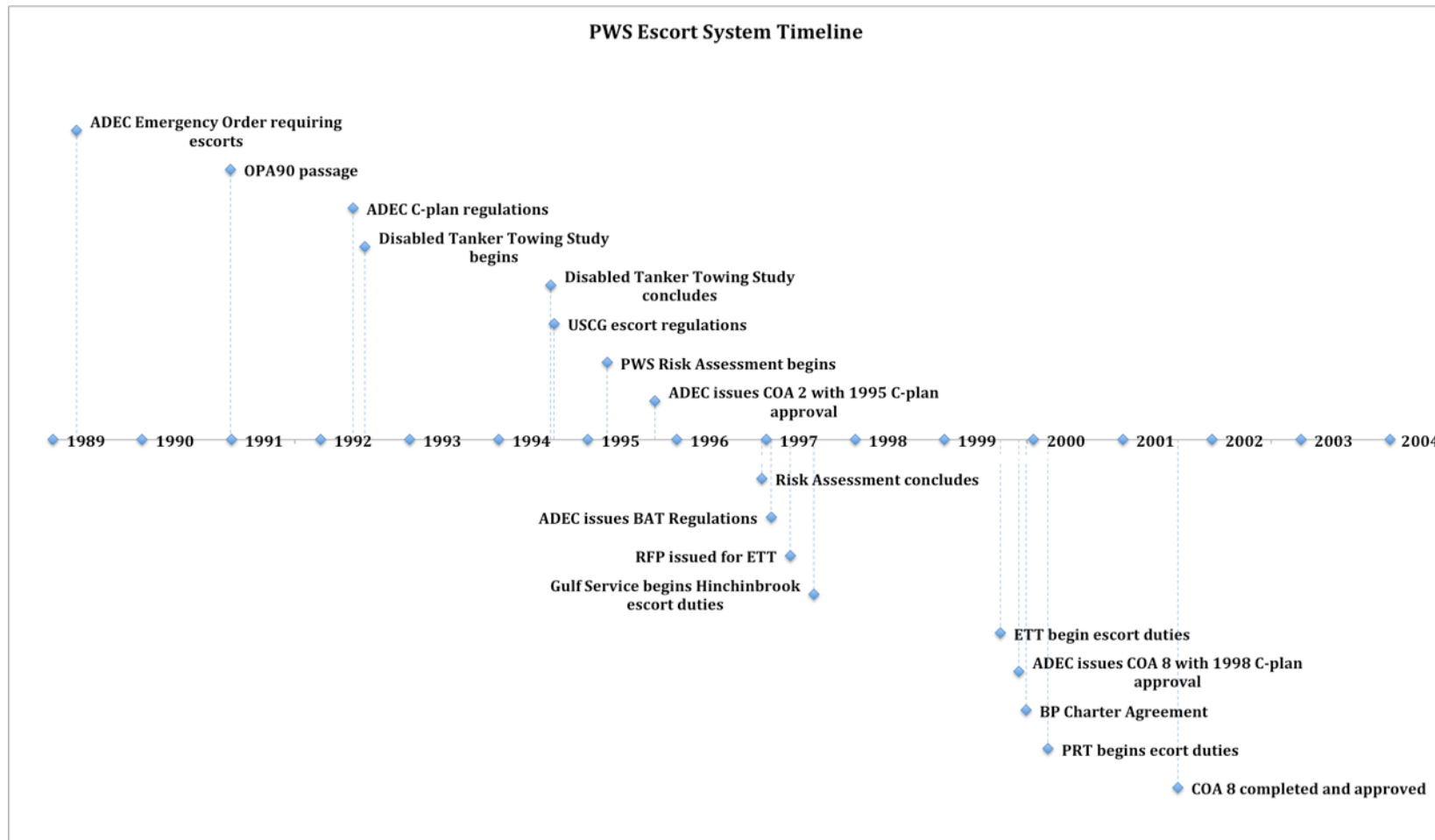


Figure 2. Summary timeline for PWS escort system development

6. References

Alaska Department of Environmental Conservation (ADEC). (1989). <i>Alyeska Pipeline Service Company Oil Spill Contingency Plan: Emergency Order</i> . Juneau, AK, April. https://www.dropbox.com/s/pzva2l688cd029p/ 890407 ADEC Emergency Order.pdf?dl=0
Alaska Department of Environmental Conservation (ADEC). (1995a). <i>Prince William Sound Oil Tanker Contingency Plan Review, Findings Document and Response to Comments</i> . August. https://www.dropbox.com/s/ul04ny8l8pq7u7i/%20950800%20ADEC%20Cplan%20Findings.pdf?dl=0
Alaska Department of Environmental Conservation (ADEC). (1995b). <i>Oil Tanker Contingency Plan Approval</i> . ADEC Division of Spill Prevention and Response. Anchorage, AK. October. https://www.dropbox.com/s/b7ozo1woc2v9vz3/%20951003%20ADEC%20ltr%20RPG%20cplan%20approval.pdf?dl=0
Alaska Department of Environmental Conservation (ADEC). (1997a). Letter to Contingency Plan Holders and Interested Parties. <i>Adoption of Regulations for Best Available Technology</i> . Anchorage, AK. January 21. https://www.dropbox.com/s/8rld7xwv4lub013/%20970121%20ADEC%20ltr%20new%20BAT%20Regs.pdf?dl=0
Alaska Department of Environmental Conservation (ADEC). (1997b). Letter to Simon Lisiecki, Prince William Sound Tanker Plan Holders. <i>Application of Best Available Technology Requirements for Escort Vessels: Condition 2b of October 2, 1995 Prince William Sound Tanker Contingency Plan Approval</i> . Anchorage, AK. April 9. https://www.dropbox.com/s/ek1uor7y74lp8js/%20970409%20ADEC%20ltr%20RPG%20BAT%20cplan%20Con2.pdf?dl=0
Alaska Department of Environmental Conservation (ADEC). (1997c). <i>Best Available Technology Decision for Condition 2b PWS Tanker Contingency Plan Approvals: Technical Support Document</i> . Anchorage, AK. May 2. https://www.dropbox.com/s/m11pgd1c0181vqm/%20970502%20ADEC%20BAT%20decision%20doc.pdf?dl=0
Alaska Department of Environmental Conservation (ADEC). (1998a). Letter to PWS Plan Holders c/o Patrick Carney, Marine Affairs Advisor. <i>Prince William Sound Tanker Oil Discharge Prevention and Contingence Plans, October 2, 1995 Condition of Approval 2a</i> . Valdez, AK. October 5. https://www.dropbox.com/s/dv4zdx72au5ceaz/%20981005%20ADEC%20RPG%20approval%20of%20COA2a.pdf?dl=0
Alaska Department of Environmental Conservation (ADEC). (1998b). Letter to Gregory T. Jones, Asset Manager, SERVS. <i>BAT Requirements for Replacement PRTs in Prince William Sound</i> . Anchorage, AK. November 3.

https://www.dropbox.com/s/porzwnsj9wjf8jr/%20981103%20ADEC%20ltr%20SERVS%20PRT%20BAT%20how%20long.pdf?dl=0
Alaska Department of Environmental Conservation (ADEC). (1999a). Letter to Patrick Carney, RPG. Valdez, AK. January 27. https://www.dropbox.com/s/uriqtjm2yxutkcr/990127_ADEC_ltr_RPG_Hinchinbrook_tug_BAT.pdf?dl=0
Alaska Department of Environmental Conservation (ADEC). (1999b). Letter to Roger Gale, Vice President, BP. <i>BP Oil Shipping Letters of October 27, 1998 and March 8, 1999 Concerning Hinchinbrook Tug BAT Assessment</i> . Anchorage, AK. April 29. https://www.dropbox.com/home/PWSRCAC_Marine_Services_Transition_Project/nuka_drafts_%26_deliverables/1989_to_2001_escort_system_develoment/References?preview=+990429+ADEC+ltr+RPG+BAT+ruleing.pdf
Alaska Department of Environmental Conservation (ADEC). (1999c). Letter to Patrick Carney, RPG. <i>BAT Determination for Prevention Response Tugs</i> . Valdez, AK. May 12. https://www.dropbox.com/s/7ft9ne8q0o8p1yv/%20990512%20ADEC%20ltr%20RPG%20BAT%20ruleing.pdf?dl=0
Alaska Department of Environmental Conservation (ADEC). (1999d). Letter to Patrick Carney, RPG. <i>May 12, 1999 Letter Concerning BAT Determination for Prevention Response Tugs</i> . Valdez, AK. May 21. https://www.dropbox.com/s/o4bnjuvu2a27cys/%20990521%20ADEC%20ltr%20RPG%20990512%20ltr%20not%20a%20decision.pdf?dl=0
Alaska Department of Environmental Conservation (ADEC). (1999e). Letter to Stephen L. Ricks, Tesoro Alaska Petroleum. <i>Oil Discharge Prevention and Contingency Plan Approval: ADEC Plan #981-CP-2222</i> . Anchorage, AK. November 2. https://www.dropbox.com/s/7v424vmo42gnz4j/%20991102%20ADEC%20ltr%20RPG%20Cplan%20Approval%20with%20conditions.pdf?dl=0
Alaska Department of Environmental Conservation (ADEC). (2000a). Letter to Patrick J. Carney, BP Oil Shipping Company, USA. <i>Condition No. 8</i> . Anchorage, AK. February 7. https://www.dropbox.com/s/oaa3v784kz5wwuy/000207%20ADEC%20ltr%20RPG%20Sims%20COA8.pdf?dl=0
Alaska Department of Conservation (ADEC). (2000b). Letter to Patrick J. Carney, BP Oil Shipping Company, USA. <i>PWS Tanker Oil Discharge Prevention and Contingency Plan, November 2, 1999 Approval Letter, Condition No. 8(1)(2)(3)</i> . Anchorage, AK. March 31. https://www.dropbox.com/s/og9ft9zae5lq8l7/000331%20ADEC%20ltr%20RPG%20Cplan%20Adm%20Vessel%20Equivalency.pdf?dl=0
Alaska Department of Conservation (ADEC). (2000c). Letter to Patrick J. Carney, BP Oil Shipping Company, USA. <i>Amendment to the ADEC Approval of the Prince William Sound Tanker Oil Discharge Prevention and Contingency Plans: Notice to Publish</i> . Anchorage, AK. April 14.

https://www.dropbox.com/s/anzvyqpuwofnymb/000414%20ADEC%20ltr%20RPG%20Cplan%20Adm%20sufficient%20for%20review.pdf?dl=0
Alaska Department of Conservation (ADEC). (2000d). Letter to William C. Rogers, Chevron Shipping Company, LLC. <i>Proposed Consistency Determination for Amendment of the ADEC November 2, 1999 Approval of the Chevron Shipping Company, LLC, Oil Discharge Prevention and Contingency Plan date July 6, 1998 as Amended</i> . ADEC No. 981-CP-4044. Anchorage, AK. August 4. https://www.dropbox.com/s/x53crhminn8yciy/000804%20ADEC%20ltr%20RPG%20CZ%20consistency%20and%20draft%20approval%20PRT%20for%20Gulf%20Serivce.pdf?dl=0
Alaska Department of Conservation (ADEC). (2000e). Letter to Patrick J. Carney, BP Oil Shipping Company, USA. <i>Worst Case Tanker Trajectories</i> . Anchorage, AK. June 28. https://www.dropbox.com/s/7zv7oi30yzak0iq/000628%20ADEC%20ltr%20RPG%20Worse%20Case%20Tanker%20Trajectories.pdf?dl=0
Alaska Department of Conservation (ADEC). (2000f). Letter to Thomas T. Colby, Prince William Sound Contingency Plan Holders. <i>Condition of Approval No. 8 Final Report and Amendment to Prince William Sound Tanker Oil Discharge Prevention and Contingency Plans Approved November 2, 1999</i> . Anchorage, AK. November 17. https://www.dropbox.com/s/uwqy67v72l1mknP/001117%20ADEC%20ltr%20ADEC%20Cplan%20admend%20Not%20Sufficient%20to%20Review.pdf?dl=0
Alaska Department of Conservation (ADEC). (2000g). Letter to Thomas T. Colby, Prince William Sound Contingency Plan Holders. <i>Condition of Approval No. 8 to Prince William Sound Tanker Oil Discharge Prevention and Contingency Plans Approved November 2, 1999</i> . Anchorage, AK. December 21. https://www.dropbox.com/s/d31dakumy3q8cq9/001221%20ADEC%20ltr%20RPG%20Cplan%20admend%20Not%20Sufficient%20to%20Review.pdf?dl=0
Alaska Department of Conservation (ADEC). (2001a). Letter to Thomas T. Colby, Prince William Sound Contingency Plan Holders. <i>Consideration of the Prince William Sound Escort System Best Available Technology (BAT) Assessment: Notice To Publish</i> . Anchorage, AK. April 6. https://www.dropbox.com/s/ofpfyfbt9jz0kg5/010406%20ADEC%20ltr%20RPG%20Public%20Notice%20of%20Plan%20Admend%20review.pdf?dl=0
Alaska Department of Conservation (ADEC). (2001b). Letter to Thomas T. Colby, PWS Response Planning Group. <i>Proposed Consistency Determination for Amendment of ADEC's November 2, 1999 Approval of five Prince William Sound Tanker Oil Discharge Prevention and Contingency Plans</i> . Anchorage, AK. August 2. https://www.dropbox.com/s/ishs2t888fea0ww/010802%20ADEC%20ltr%20RPG%20CZ%20consistency%20and%20draft%20approval%20PRT%20for%20fulfillment%20of%20COA8.pdf?dl=0
Alaska Department of Environmental Conservation (ADEC). (2001c). Letter to Thomas T. Colby, PWS Response Planning Group. <i>Conclusive Consistency Determination for Amendment of ADEC's November 2, 1999 Approval of five Prince William Sound Tanker Oil Discharge Prevention and Contingency Plans</i> . Anchorage, AK. August 15.

https://www.dropbox.com/s/e6q07825sh63729/010815%20ADEC%20ltr%20RPG%20Cplan%20admend%20approval.PDF?dl=0
Alyeska Pipeline Service Company Ship Escort/Response Vessel System (SERVS). (1998). Letter to Stan Stephens, President PWSRCAC. <i>Requesting Support for RFT Replacement</i> . Valdez, AK. October 28. https://www.dropbox.com/s/565izp523ftjsw/%20981028%20APSC%20ltr%20ORCAC%20support%20for%20PRTs.pdf?dl=0
Alyeska Pipeline Service Company (APSC). (2000). Letter to John Devens, Prince William Sound RCAC. <i>PRT Replacement of the Gulf Service</i> . Valdez, AK. February 25. https://www.dropbox.com/s/fvvees88zxrl6e6/000225%20APSC%20ltr%20RCA C%20Gulf%20Service%20Release.pdf?dl=0
Alyeska Pipeline Service Company (APSC)- SERVS. (2013). <i>Vessel Escort & Response Plan (VERP)</i> . April. https://www.dropbox.com/s/io5ya64vunovqcy/130401%20APSC%20VERP.pdf?dl=0
Atkinson, J. (1995). <i>Report of Investigation into Alternatives Available by the Winter of 1995-96 That Could Enhance the Ability to Save Disabled Tankers of Over 190,000 DWT in Valdez Narrows</i> . Marine Consultant, Charlottesville, VA. June 15. https://www.dropbox.com/s/1m70wn5lx5taedo/%20950615%20Atkinson%20Escort%20Alternatives.pdf?dl=0
British Petroleum Oil Shipping Company (BP). (1997a). Letter to Tom Chapple, ADEC. <i>State of Alaska Approval for Oil Discharge Prevention and Contingency Plan, Terms and Conditions - 2b</i> . Cleveland, Ohio. February 5. https://www.dropbox.com/s/vxr6d9rn24od1gh/%20970205%20RPG%20ltr%20ADEC%20COA2b.pdf?dl=0
British Petroleum Oil Shipping Company (BP). (1997b). Letter to Tom Chapple, ADEC. <i>State of Alaska Approval for Oil Discharge Prevention and Contingency Plan, Terms and Conditions 2 (b)</i> . Cleveland, Ohio. March 31. https://www.dropbox.com/s/clbng2ys4usrku/%20970331%20RPG%20ltr%20ADEC%20COA2b.pdf?dl=0
British Petroleum Oil Shipping Company (BP). (1999). Letter to Commissioner Michelle Brown, ADEC. <i>Confirming Support of Ship Escort and Response System</i> . Anchorage, AK. December 10. https://www.dropbox.com/s/0vvnpq92f3giuxk/%20991210%20BP%20ltr%20ADEC%20escort%20system.pdf?dl=0
Federal Register. (1994). <i>Escort Vessels for Certain Tankers: Final Rule. Volume 59, No. 160</i> . Department of Transportation. August 9. https://www.dropbox.com/home/PWSRCAC Marine Services Transition Project/nuka drafts %26 deliverables/1989 to 2001 escort system develoment/References?preview=Federal+Register,+Volume+59+Issue+160+(Fri day,+August+19,+1
Jones, T. (1997). <i>Protector Class Tug Trials: January/February 1997 Preliminary Report</i> . Prepared for PWSRCAC Oil Spill Prevention and Response Committee; Port Operations and Vessel Traffic Committee. April 7.

https://www.dropbox.com/s/5i353ddw7iuu56k/%20970407%20Jones%20rpt%20Protector%20Sea%20Trials.pdf?dl=0
Jones, T. (2000). <i>Alert/Nanuq Towing Exercise Preliminary Report</i> . Prepared for PWSRCAC Oil Spill Prevention and Response Committee. March 15. https://www.dropbox.com/s/fge3x0fjuwh6usc/000315%20Jones%20Alert%20Tow%20Ex%20Rpt.pdf?dl=0
Jones, T. (2004). <i>Overseas Washington/Aware/Nanuq Heavy Weather Tow Exercise Report</i> . Prepared for PWSRCAC Oil Spill Prevention and Response Committee. February 7. https://www.dropbox.com/s/oqnw80krfbh7wty/040301%20Jones%20ppt%20Heavy%20Weather%20Towing%20Exercise.pdf?dl=0
Merrick, J, René van Dorp, J., Mazzuchi, T., Harrauld, J., Spahn, J., and Grabowski, M. (2002). <i>The Prince William Sound Risk Assessment</i> . October. https://www.dropbox.com/s/8gwchuafo5u2thl/021100%20Merick%20jrnl%20artical%20PWS%20Risk%20Assessment.pdf?dl=0
Mitchell, V., Carney, P., Randall, G., Jones, T., and Hyce, L. (2001). <i>Escort Tug Analysis for Oil Tankships in Prince William Sound and the Gulf of Alaska</i> . Hampton Roads Section of The Society of Naval Architects and Marine Engineers (SNAME). Hampton, VI. June 1. https://www.dropbox.com/s/d1un1l1kebjpci6/010000%20Mitchell%20escort_tug_analys.pdf?dl=0 http://www.sname.org/hamptonroadssection/ourlibrary/viewdocument?DocumentKey=d21755c8-5fda-4252-9f03-5e8d73eb4b45&tab=librarydocuments&CommunityKey=00000000-0000-0000-0000-000000000000
Prince William Sound Regional Citizen's Advisory Council (PWSRCAC). (1998a). Letter to Greg Jones, Asset Manager, SERVS. <i>New Prevention and Response Tugs in Prince William Sound</i> . Anchorage, AK. October 30. https://www.dropbox.com/s/e9if5qjail0tam5/%20981030%20RCAC%20ltr%20SERVS%20escort%20improvements.pdf?dl=0
Prince William Sound Regional Citizen's Advisory Council (PWSRCAC). (1998b). Letter to Pat Carney, PWS Plan Administrator. <i>1998 PWS Tanker Plan Review 10/27/98 letter to ADEC on BAT Regulations</i> . Anchorage, AK. November 16. https://www.dropbox.com/s/gh26vove4ahe8f0/%20981116%20RCAC%20ltr%20RPG%20%20escorts%20as%20BAT.pdf?dl=0
Prince William Sound Regional Citizen's Advisory Council (PWSRCAC). (1998c). Letter to Steve Provant, ADEC. <i>November 30 Submittal of Hinchinbrook Tug Best Available Technology (BAT) Analysis</i> . Anchorage, AK. November 25. https://www.dropbox.com/s/zpf874ch9sdm8aq/%20981125%20RCAC%20ltr%20ADEC%20RPG%20USCG%20BAT%20analysis.pdf?dl=0
Prince William Sound Regional Citizen's Advisory Council (PWSRCAC). (1999). Letter to Tom Chapple, Program Manager ADEC. <i>RCAC Request for Additional Information and Comments on the PWS Tanker Discharge Prevention and Contingency Plan, Best Available Technology (BAT) Analysis for the Hinchinbrook</i>

<p><i>Entrance Tug</i>. Anchorage, AK. January 8. https://www.dropbox.com/s/35wa8bd1kkju57t/%20990108%20RCAC%20ltr%20ADEC%20Hinchinbrook%20tug%20BAT%20analysis.pdf?dl=0</p>
<p>Prince William Sound Regional Citizen's Advisory Council (PWSRCAC). (2000a). Letter to Steve Provant, ADEC. <i>PWS Tanker C-Plan, Condition of Approval No. 8, Hinchinbrook Escort BAT</i>. Valdez, AK. January 14. https://www.dropbox.com/s/s6zefq8dl565wvp/000114%20RCAC%20ltr%20ADEC%20Sims%20COA8.pdf?dl=0</p>
<p>Prince William Sound Regional Citizen's Advisory Council (PWSRCAC). (2000b). Letter to Dan Hisey, Alyeska Pipeline Service Company. <i>PWS Tanker C-Plan, Condition of Approval No. 8, Gulf Service Release</i>. Valdez, AK. March 17. https://www.dropbox.com/s/2u093tuvd4xicu8/000317%20RCAC%20ltr%20APSC%20Gulf%20Service%20Release.pdf?dl=0</p>
<p>Prince William Sound Regional Citizen's Advisory Council (PWSRCAC). (2000c). Letter to Steve Provant, ADEC. <i>July 13, 2000 Planholder Letter regarding Condition of Approval No. 8, 1. (COA 8,1.): Analysis of Trajectories</i>. Valdez, AK. August 2. https://www.dropbox.com/s/arq53zw0zpbjm47/000802%20RCAC%20ltr%20ADEC%20Worse%20Case%20Tanker%20Trajectories.pdf?dl=0</p>
<p>Prince William Sound Regional Citizen's Advisory Council (PWSRCAC). (2000d). <i>C-Plan Project Team Meeting with ADEC re: Shippers COA 8 submittal</i>. September. https://www.dropbox.com/s/iuwlft7mz4zeqtk/000911%20RCAC%20Proj%20Team%20Mtg%20Notes.pdf?dl=0</p>
<p>Prince William Sound Regional Citizen's Advisory Council (PWSRCAC). (2000e). Letter to Tom Colby, Response Plan Group Coordinator. <i>Drift Stop Tanker Exercise</i>. Valdez, AK. November 14. https://www.dropbox.com/s/gstm7ook7po9oln/001114%20RCAC%20ltr%20RPG%20Drift%20Stop%20Tanker%20Exercise.pdf?dl=0</p>
<p>Response Plan Group (RPG). (1998a). Letter to Michele Brown, Commissioner, ADEC. <i>First 90-day Extension of 1995 PWS Tanker Plans</i>. Valdez, AK. https://www.dropbox.com/s/4nb16imqrbjzg01/981027 RPG ltr ADEC COA2.pdf?dl=0</p>
<p>Response Plan Group (RPG). (1998b). Letter to Tom Chapple, Program Manager ADEC. <i>First 1995 PWS Tanker Plan Extension Condition No. 2</i>. Anchorage, AK. December 15. https://www.dropbox.com/s/tc2jbqkrme7k17q/%20981215%20RPG%20ltr%20ADEC%20Gulf%20Service%20is%20BAT%20Coa2.pdf?dl=0</p>
<p>Response Plan Group (RPG). (1999a). Letter to Commissioner Michelle Brown, ADEC. <i>ADEC Letter January 27, 1999 Request for Additional Assessment, Hinchinbrook Tug</i>. Cleveland, OH. March 8. https://www.dropbox.com/s/ov7oxdoklyv4eit/%20990308%20RPG%20ltr%20ADEC%20objecting%20to%20BAT%20rueling.pdf?dl=0</p>
<p>Response Plan Group (RPG). (1999b). Letter to Steve Provant, ADEC. <i>Best Available Technology Analysis Prevention and Response Tugs for Prince William Sound Service</i>.</p>

https://www.dropbox.com/s/5g9gqfw32ti3cuv/990506 APSC ltr ADEC PRT BAT determination.pdf?dl=0
Response Plan Group (RPG). (1999c). Letter to Steve Provant, ADEC. <i>PWS Tanker Discharge Prevention and Contingency Plan: November 2, 1999 Approval Letter, Condition 8 Hinchinbrook Escort BAT Assessment</i> . Anchorage, AK. December 30. https://www.dropbox.com/s/d7owl15jtti72qh/%20991230%20RPG%20ltr%20ADEC%20COA8%20BAT.pdf?dl=0
Response Plan Group (RPG). (2000a). Letter to Steve Provant, ADEC. <i>PWS Tanker Discharge Prevention and Contingency Plan: November 2, 1999 Approval Letter, Condition 8 (1)(a)</i> . Anchorage, AK. February 28. https://www.dropbox.com/s/d8nwb1f5zs7aa1s/000228%20RPG%20ltr%20ADEC%20Sims%20COA8.pdf?dl=0
Response Plan Group (RPG). (2000b). Letter to Steve Provant, ADEC. <i>PWS Tanker Discharge Prevention and Contingency Plan: November 2, 1999 Approval Letter, Condition 8, February 7, 2000 and March 20, 2000</i> . Anchorage, AK. March 22. https://www.dropbox.com/s/64klv189fl8ogm0/000322%20RPG%20ltr%20ADEC%20COA8.pdf?dl=0
Response Plan Group (RPG). (2000c). <i>C-Plan Vessel Equivalency Report</i> . March. https://www.dropbox.com/s/gesb2ci215zp3kl/000322%20RPG%20Cplan%20Adm%20Vessel%20Equivalency.pdf?dl=0
Response Plan Group (RPG). (2000d). Letter to Steve Provant, ADEC. <i>PWS Tanker Discharge Prevention and Contingency Plan: November 2, 1999 Approval Letter and June 28, 2000 Letter regarding Condition 8 (1) Hinchinbrook Escort BAT Assessment</i> . Anchorage, AK. July 13. https://www.dropbox.com/s/0vuw4py9g36mg5e/000713%20RPG%20ltr%20ADEC%20%20Worse%20Case%20Tanker%20Trajectories.pdf?dl=0
Response Plan Group (RPG). (2000e). Letter to Steve Provant, ADEC. <i>PWS Tanker Discharge Prevention and Contingency Plan: November 2, 1999 Approval Letter, Condition 8 (1) Hinchinbrook Escort BAT Assessment</i> . Anchorage, AK. September 1. https://www.dropbox.com/s/7yiw01c3mvrdsrh/000901%20RPG%20ltr%20ADEC%20COA8%20analysis%20and%20cplan%20admend.pdf?dl=0
Response Plan Group (RPG). (2000f). Letter to Steve Provant, ADEC. <i>PWS Tanker Discharge Prevention and Contingency Plan: November 2, 1999 Approval Letter and September 25, 2000 Letter regarding Condition 8 (1) Hinchinbrook Escort BAT Assessment</i> . Valdez, AK. October 4. https://www.dropbox.com/s/5ksss2lode39toi/001004%20RPG%20ltr%20ADEC%20Cplan%20admend%20BAT%20.PDF?dl=0
Response Plan Group (RPG). (2000g). Letter to Steve Provant, ADEC. <i>PWS Tanker Discharge Prevention and Contingency Plan: November 2, 1999 Approval Letter, Condition 8, BAT and November 17, 2000 ADEC Letter</i> . Valdez, AK. December 8. https://www.dropbox.com/s/a22y5djs3ima1dz/001208%20RPG%20ltr%20ADEC%20Cplan%20admend%20Not%20Sufficient%20to%20Review.pdf?dl=0
Response Plan Group (RPG). (2000h). Letter to Steve Provant, ADEC. <i>PWS Tanker Discharge Prevention and Contingency Plan: November 2, 1999 Approval Letter, Condition 8, BAT and December 21, 2000 ADEC Letter</i> . Valdez, AK. January 10.

https://www.dropbox.com/s/l0490jq0h6k6u56/010110%20RPG%20ltr%20AD-EC%20Sims%20COA8.pdf?dl=0
Response Plan Group (RPG). (2001a). Letter to John Devens, Prince William Sound RCAC. <i>Drift Stop Tanker Exercise</i> . Valdez, AK. January 9. https://www.dropbox.com/s/c5nvvudoioro2pf/010109%20RPG%20ltr%20RCA-C%20Drift%20Stop%20Tanker%20Exercise.pdf?dl=0
Response Plan Group (RPG). (2001b). Public Notice Letter to Plan Reviewers and Interested Parties. <i>PWS Tanker Discharge Prevention and Contingency Plan: Proposed Plan Amendment</i> . Valdez, AK. April 16. https://www.dropbox.com/s/g10u0f5qozpn5n5/010416%20RPG%20Public%20Notice%20of%20Plan%20Admend%20review.pdf?dl=0
State of Alaska, BP, and ARCO. (1999). <i>Charter Agreement for Development of the Alaskan North Slope</i> . December 2. https://www.dropbox.com/s/7bj3ujsa86gv3v7/%20991202%20BP%20Charter%20Agreement.pdf?dl=0
The Glosten Associates, Inc. (1993). <i>Prince William Sound Disabled Tanker Towing Study Part 1: Evaluation of Existing Equipment, Personnel and Procedures</i> . Prepared for the Disabled Tanker Towing Study Group. Anchorage, AK. August. https://www.dropbox.com/s/3zyj5d4nptx4rzk/%20930801%20Glosten%20Disabled%20Tanker%20Towing%20P1.pdf?dl=0
The Glosten Associates, Inc. (1994). <i>Prince William Sound Disabled Tanker Towing Study Part 2: Computer Simulations of Escort and Rescue Towing Scenarios</i> . Prepared for the Disabled Tanker Towing Study Group. Anchorage, AK. August. https://www.dropbox.com/s/474ogicktdcowrd/%20940801%20Glosten%20Disabled%20Tanker%20Towing%20P2.pdf?dl=0
The Glosten Associates, Inc. (2000a). <i>Simulations Hinchinbrook Entrance</i> . Prepared for the Disabled Tanker Towing Study Group. Anchorage, AK. May. https://www.dropbox.com/s/mpf45s7ronxzk8l/000505%20RPG%20ADEC%20Hinchinbrook%20Simulation%20Results.pdf?dl=0
The Glosten Associates, Inc. (2000b). <i>Hinchinbrook Simulation Results</i> . Prepared for the Disabled Tanker Towing Study Group. Anchorage, AK. June. https://www.dropbox.com/s/ygtro4ibqq3qeeg/000626%20Glosten%20%20fax%20RPG%20Hinchinbrook%20Simulation%20Results.pdf?dl=0
The Glosten Associates, Inc. (2000c). Verification of VSP tugs <i>Nanuq</i> and <i>Tan'erliq</i> performance with respect to PWS RFP. April 4. https://www.dropbox.com/s/2xqn1vtp2x0k7aq/000404%20Glosten%20ltr%20Crowley%20Towing%20Ex%20Evaluation.doc?dl=0
The Glosten Associates, Inc. (2000d). Shipman Drifting Simulations Cape Hinchinbrook Entrance. August 14.
The Glosten Associates, Inc. (2001a). <i>Report of Results from Crowley Alaska ETT Nanuq/ Tan'erliq Radio Controlled Model Tests</i> . Prepared for Crowley Marine Services, Inc. Seattle, WA. March. https://www.dropbox.com/s/8nolaihow487ofp/010300%20Glosten%20rpt%20ETT%20tank%20tests.pdf?dl=0

<p>The Glosten Associates, Inc. (2001b). <i>Report of Results from Crowley Alaska ETT Nanuq/ Tan'erliq Radio Controlled Model Tests</i>. Prepared for Crowley Marine Services, Inc. Seattle, WA. July.</p> <p>https://www.dropbox.com/s/srrt8r3eqrpp3g9/010700%20Glosten%20rpt%20Manuvering%20Simulations.pdf?dl=0</p>
<p>United States Coast Guard (USCG). (1997). Letter to USCG Commanding Officer Marine Safety Office, Valdez, AK. <i>Change to Tanker Escort Regulations for Prince William Sound</i>. Juneau, AK. May 21.</p> <p>https://www.dropbox.com/s/tp3bxtfj01dg5cb/%20970521%20USCG%20memo%20Sentinal%20Tugs%20and%20CFRs.pdf?dl=0</p>
<p>United States Coast Guard (USCG). (2000). <i>Alert/Nanuq Towing Exercise Summary</i>. Valdez, AK. March 14.</p> <p>https://www.dropbox.com/s/lt51fh82rzhy0j2/000314%20USCG%20Alert%20Tow%20Ex%20Rpt.pdf?dl=0</p>