Alyeska pipeline
SERVICE COMPANY

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2016

TRANS ALASKA PIPELINE SYSTEM | the **facts.**

A collection of facts compiled over the duration of the operation of the Trans Alaska Pipeline System, by Alyeska Pipeline Service Company.

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pipeline fast facts

Air Temperature Range Along Route: -80°F to 95°F.

Diameter of Pipe: 48 inches.

Elevations, Highest:

- Atigun Pass: 4,739 ft. (crest, pipeline MP 166.6).
- Isabel Pass: 3,420 ft.
- Thompson Pass: 2,812 ft.

Grade, Maximum: 145% (55°) at Thompson Pass.

Length of Line: 800 miles (1,288 kilometers); includes 407 ft. added in MP 200 reroute, April 22, 1985.

Linefill Volume: 9,059,057 bbl. This number differs with the "Linefill" (9,059,622 bbl).

Mountain Ranges Crossed, North to South (three): Brooks Range, Alaska Range, Chugach Range.

Number of Gallons in a Barrel: 42.

Right-of-Way Widths:

- Federal land: 54 ft. (buried pipe); 64 ft. (elevated pipe).
- State land: 100 ft.
- Private land: 54 ft. to 300 ft.

River and Stream Crossings: 34 major, nearly 500 others.

Valves: 178.

Vertical Support Members (VSMs): 78,000.

Workpad, Length: 790 miles.

Years Built: 1974 to 1977.

acronyms and abbreviations

ANP: Alaska Native Program

API: American Petroleum Institute

APSC: Alyeska Pipeline Service Company

ARCS: Alternate Route Communications System

BWT: Ballast Water Treatment

bbl: Barrel

CV: Check Valve

DRA: Drag Reducing Agent

DSMA: Digital Strong Motion Accelerograph

dwt: Deadweight Tons

E&A: Electification & Automation

EMS: Earthquake Monitoring System

ETT: Enhanced Tractor Tug

JPO: Joint Pipeline Office

kV: Kilovolts

MLU: Mainline Unit

MP: Milepost

MTU: Master Terminal Uni.

MW: Megawatts

OCC: Operations Control Center

PL: Pipeline

PRT: Prevention/Response Tug

PS: Pump Station

psi: Pounds Per Square Inch

PV: Power Vapor

RCAC: Regional Citizens Advisory Council

RGV: Remote Gate Valve

SIPPS: Safety Integrity Pressure Protection System

SERVS: Ship Escort/ Response Vessel System

TAPS: Trans Alaska Pipeline System

TG: Turbine Generator

VFD: Variable Frequency Drive

VSM: Vertical Support Member

VMT: Valdez Marine Terminal

UPS: Uninterruptible Power Supply

A

ABOVEGROUND PIPE: See PIPE, Aboveground.

ACCESS ROADS: 225, linking state roads with the pipeline, pump stations and airfields.
- Gravel base: 3 feet minimum.
- Length: 120 feet to 7.5 miles.
- Number of roads: 225.
  - Width: 28 feet.

AIRFIELDS, Operations: Two of the 14 airfields built during The Trans Alaska Pipeline System, or TAPS, construction are still in operation: Galbraith Lake (5,200 feet long) and Prospect (5,000 feet long). These two airfields are on federal land and are operated under state leases.

ALASKA, Facts:
Coastline: 33,900 miles.
Land area: 586,000 square miles.
Population: 737,625 (2015, Alaska Dept. of Labor).

ALASKA NATIVE PROGRAM: Alyeska created the Alaska Native Program in October 1995 to ensure TAPS owners fulfill their commitments to the United States as embodied in Section 29 of the Federal Agreement and Grant of Right-of-Way. Through the Alaska Native Program, Alyeska is committed to supporting recruitment, employment, job counseling, education and training opportunities for Alaska Native people. See SECTION 29.

ALYESKA, Corporate Name: Alyeska Pipeline Service Company. "Alyeska" is an Aleut word meaning "mainland."

ALYESKA, Date of Incorporation: August 14, 1970.

ALYESKA, Early History: TAPS was originally called the Trans Alaska Pipeline Project, and was a joint venture of Atlantic Pipe Line Company (now ConocoPhillips Transportation Alaska, Inc.), Humble Pipe Line Company (now ExxonMobil Pipeline Company) and BP Oil Corporation (now BP Pipelines (Alaska) Inc.), formed to develop a plan for construction of a pipeline for Prudhoe Bay oil.

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ALYESKA, Owners: The consortium of companies that owns TAPS. For a complete list, see www.alyeskapipeline.com.

ALYESKA, Personnel: Approximately 800 Alyeska employees and 1,000 or more contractors operate and maintain the Trans Alaska Pipeline System. On March 31, 2016, employee demographics were:

- 802 Alyeska employees
- Anchorage: 323
- Fairbanks: 220
- Valdez: 259
- Alaska residents: 94.5 percent, approximately.

ALYESKA, Responsibilities: Design, construct, operate and maintain the Trans Alaska Pipeline System.

ALYESKA TACTICAL OIL SPILL MODEL (ATOM): Software package specifically designed for oil spill trajectory modeling in Prince William Sound. ATOM is used to:

- Forecast path of oil, based on real weather input.
- Show wildlife impact potential and other sensitivities such as recreational sites, commercial fishing areas and shoreline types.
- Show locations of Prince William Sound communities and hatcheries.

ANIMAL CROSSINGS, Mainline: The purpose is to allow for free movement of big game animals (caribou, moose, etc.) across the pipeline right-of-way. Approximately 579 animal crossings are incorporated into TAPS, including:

- Elevated: 554 (minimum height 10 feet).
- Buried: 23.
- Buried, Refrigerated: 2 (MP 645 and MP 649).

ARCHAEOLOGICAL SURVEY, Preconstruction: The entire TAPS route was surveyed by the University of Alaska and Alaska Methodist University under contract to Alyeska. The survey, which cost approximately $2.2 million, resulted in the excavation of approximately 330 sites.

ARCS (Alternate Route Communications System): A private radio network used by TAPS technicians for voice communications in remote locations.

ATIGUN AWARDS: First awarded in 2014, these awards recognize employees, contractors and teams for excellent performance in five categories: Environment; Health and Safety; Innovation; Integrity; and Teamwork. Awards are also given to individuals for Professionalism and Lifetime Achievement on TAPS.

B

BALLAST WATER TREATMENT (BWT): The Valdez Marine Terminal treats tanker ballast water to remove oil.

- Average ballast water treated: 28,000 bbl/day.
- Capacity of system: 8,600 bbl/hour.
- Crude oil recovered from ballast: 150 bbl/day average.
- Purity standards: 0.73 parts per million aromatic hydrocarbons (Permitted Daily Maximum).

BALLAST WATER TREATMENT (BWT) FACILITY: Major components:

- Biological treatment tanks: One aboveground concrete tank with a capacity of 5.5 million gallons.
- Diffuser line at discharge into Port Valdez: The line discharges at a maximum depth of 300 feet at a distance of 700 to 1,050 feet offshore.
- Dissolved Air Flotation (DAF) Units: Two cells, each 144 feet long, 24 feet wide and 12 feet deep.
- Piping from berths to tanks: 42-inch diameter.
- Time required for treatment: 28 hours average.
- Settling tanks: Two tanks with capacity of 430,000 bbl each, 53 feet 6 inches high and 250 feet in diameter.
- BETX air strippers: Four with a capacity of 1100 gpm (gallons per minute) each.
- Regenerative thermal oxidizers: Two with a capacity of 11,000 cfm (cubic feet per minute) each.

BARREL, Crude Oil: The normal unit of measurement for

crude oil: 1 bbl = 42 gallons; 310.9 pounds per bbl.

BERTHS, Valdez Marine Terminal: Four berths were built at the terminal: Berth 1 (floating platform with 13 buoyancy chambers and weighing 6.5 million pounds) and Berths 3, 4 and 5 (fixed platform). Berth 1 and Berth 3 are now out of service. Berths 4 and 5 are equipped with vapor-recovery arms, and as such, are the only active berths on the Terminal. All the loading and vapor arms on Berth 4 were replaced in an overhaul in 2014. The loading and vapor arms on Berth 5 are planned for replacement in 2016.

BIRD SPECIES: More than 170 identified along the TAPS route.

BRIDGE, Yukon River: Located at MP 353.3.
- Construction dates: 1974-1975.
- Cost: $30 million (Owners' share approximately $10 million).
- Dimensions: 2,295 feet long; road deck 30 feet wide; grade 5.99°.
- Name: Bridge officially named E.L. Patton Yukon River Bridge by Alaska Legislature in 1982, after E.L. Patton, President of Alyeska during pipeline construction. A monument to E.L. Patton was dedicated in October 1982.
- Opening date: October 1979.
- River width: 1,900 feet, typical.

BRIDGES, Pipeline: 13 total along TAPS.

BRIDGES, Road: 21 north of Yukon; 23 south of Yukon.

CARIBOU: TAPS crosses the ranges of the Central Arctic Herd on the North Slope and the Nelchina Herd in the Copper River Basin.

C

COLUMBIA GLACIER: Tidewater glacier in the northeast corner of Prince William Sound, at the head of Columbia Bay.
- Impact on tankers: When the captain of the port determines hazardous ice conditions exist in Valdez Arm, the Valdez Narrows ice routing measures are placed into effect in accordance with the Prince William Sound Vessel Escort Response Plan.

COMMUNICATIONS SYSTEM: The primary communications system uses microwave, which is backed up by satellite.

COMMUNICATIONS SYSTEM, Central: Backbone communication system, remote gate valve (RGV), ARCS. Control systems are provided for supervisory control and telemetering, seismic monitoring, and monitoring and control of RGVs.

COMMUNICATIONS SYSTEM, Enterprise Data Services: Voice, data, video, cable TV enterprise data services are provided for business systems. The primary data system uses fiber optics, which is backed up by satellite.

CONCRETE WEIGHTS:
- Pipe coating: Used at river crossings; weight 75,000 pounds per 40-foot section.
- Saddles: Used in floodplains; weight 18,500 pounds each.

CONSTRUCTION, Airfields:
- Seven, 2,500 to 3,000 feet long.
- Seven, 5,000 feet long (Galbraith Lake and Prospect continue to be used by TAPS).

CONSTRUCTION, Camps:
- Largest camp: Valdez Marine Terminal, 3,480 beds.
- Largest pipeline camp: Isabel Pass, 1,652 beds.
- Number, 1974 to 1977: 29 total.
- Smallest pipeline camp: Sourdough, 112 beds.

CONSTRUCTION, Contractors and Subcontractors: 2,000, approximately.

CONSTRUCTION, Cost: Approximately $8 billion for entire system, including terminal and pump stations, at conclusion of initial construction period in 1977. Does not include interest on capital investment or capital construction after 1977.

CONSTRUCTION, Ditch: See DITCH, Buried Pipeline.

CONSTRUCTION, Hydrostatic Testing:
- Maximum: equivalent to 96 percent of specified minimum yield strength.
- Minimum: 125 percent of operating pressure or 750 psi, whichever was greater.

CONSTRUCTION, Materials:
- Gravel for entire project: 73 million cubic yards.
- Gravel for work pad: 32 million cubic yards.
- Largest piece shipped: Floating tanker berth (3,250 tons).
- Shipped to Alaska: 3 million tons, approximately.

CONSTRUCTION, Time: 3 years, 2 months (April 29, 1974 to June 20, 1977) to complete pipeline, pump stations, roads and terminal.

CONSTRUCTION, Time for Preconstruction Effort: 6 years, approximately.

CONSTRUCTION, Welding: See WELDS, Pipe.

CONSTRUCTION, Workforce:
- Minority hire: Ranged from 14 percent to 19 percent.
- Peak, contractors only: 21,600.
- Peak, total: 28,072 in October 1975 (Alyeska employees and contractors).
- Total for project: 70,000 approximately (1969-1977).
- Women: Ranged from 5-10 percent.

CONTINGENCY PLANS: A Contingency Plan (C-Plan) is a regulatory document that outlines commitments to specific oil spill response and preparedness scenarios. It is approved by the Alaska Department of Environmental Conservation. The plan is renewed every 5 years, when it is updated by Alyeska and then subjected to a lengthy public review when interest groups and individuals submit comments. Alyeska prepares three separate C-Plans, one for the pipeline, one for the Valdez Marine Terminal, and one for Prince William Sound (also known as the Tanker C-Plan.) The oil shipping companies are responsible for the Tanker C-Plan, however Alyeska is considered the subject matter expert and co-authors the document.

CROSSINGS, Refrigerated, Road: The buried pipeline crossing of the Glenn Highway at Glennallen is refrigerated.

Atigun Construction Camp was one of 30 camps operating during pipeline construction. The buildings were removed and the site was revegetated in 1978.

CRUDE OIL: A fluid made up of various hydrocarbon components, natural gas liquids and fixed gases.

CRUDE OIL, API Gravity: 33.4° API at 60 F for North Slope crude oil.

CRUDE OIL, TAPS:

- Temperature in March 2016: 110 F at injection into pipeline at PS 1. Approximately 51 F at the Terminal.
- Throughput (March 2016): 544,445 bbl/day = 22,685 bbl/hour = 15,880 gallons/minute.
- Travel time in March 2016: 16.4 days from PS 1 to the TERMINAL .
- Velocity: 2 mph in pipeline.
- Weight: 301.8 pounds/bbl; 6.63 bbl/ton.

CULTURAL ATTRIBUTES, Alyeska: Alyeska Pipeline Service Company has defined five cultural attributes. These attributes are recognized and reinforced throughout the company as important in safe day-to-day operations and critical to future success. They are:

- Take a system view: Acting and making decisions while considering risk and/or impact on the success of the total system.
- Make sound decisions: Make timely decisions with the right people, right data, right processes, and the right focus.
- Learn, improve, innovate: Seek to learn from experiences, overcome challenges and enhance the way employees do business.

- Speak up, step up: Spot opportunities, share ideas and concerns, and take action on solutions.
- Act with discipline: Commit to high standards and consistency in work on TAPS.

D

DALTON HIGHWAY (Formerly North Slope Haul Road): James B. Dalton Highway is the name applied by the state in 1981 to 415 miles of roadway, including the North Slope Haul Road and the 57-mile road from the Yukon River to Livengood, constructed by Alyeska in the winter of 1969-70. This section of road was originally 56 miles, but one mile was added after realignment by the state at Livengood in 1981. James B. Dalton was a native-born Alaskan and graduate mining engineer who supervised construction of the Distant Early Warning (DEW) Line in Alaska. He was an expert in Arctic engineering and logistics and served as a consultant in early oil exploration in northern Alaska, pioneering winter trails for heavy equipment transport. The following information about the highway is current as of construction:

- Bridges, permanent: 20.
- Grade: 12 percent maximum.
- Gravel used: 32 million cubic yards.

DALTON HIGHWAY, Haul Road Portion: See HAUL ROAD.

DALTON HIGHWAY, Ownership: Originally Alyeska; control transferred to the state in October 1978.

DAMAGE PREVENTION PROGRAM: Alyeska Pipeline operators continually seek to reduce the risk of accidental releases through its public awareness and damage

prevention programs. Alyeska participates in the 811 "Call Before You Dig" program and regularly communicates with land owners, excavators and emergency responders who live and work within the pipeline corridor.

DEADWEIGHT TONS (dwt): A unit of measure for the weight of tanker cargo; dwt x 7 = number of barrels, approximately.

DESIGN MODES, Selection: Soil sampling and other means were used to determine soil types along the route. Where thaw-stable soils were found, the pipeline was buried in the conventional manner. In areas of thaw-unstable soils, and where heat from the pipeline might cause thawing and consequent loss of soil foundation stability, the pipeline was insulated and elevated aboveground by means of a unique support system (see VERTICAL SUPPORT MEMBERS). To allow animals to cross, 23 sections were buried line-wide, each about 200 feet long.

DESIGN MODES, Types:

- Aboveground: 420 miles (see VERTICAL SUPPORT MEMBERS). Where thaw-unstable permafrost was encountered, problems associated with melting permafrost were avoided by placing the pipeline aboveground on an elevated support system. VSMs (pilings) were designed to resist frost-jacking forces and support the line.
- Belowground (conventional): 376 miles. Where either unfrozen or thaw-stable permafrost was encountered, the pipeline was buried in the conventional manner with no special provisions for permafrost (see PIPE, Belowground (Conventional)).
- Belowground (special burial): About 4 miles (see PIPE, Special Burial). Where thaw-unstable permafrost was found, but where the pipeline had to be buried for highway, animal crossing, or avoidance of rockslides and avalanches, the permafrost was protected from the heat of the pipeline by insulation around the pipeline. Some special burials include ground refrigeration systems along with pipe insulations. Special burial locations:
  - Atigun Pass: Two sections (about 1 mile) were buried in insulated boxes to provide protection from rockslides and avalanches.
  - MP 645-649: Caribou crossing.
  - MP 653: Caribou crossing.
  - MP 681: Crossing of Glenn Highway.
  - 23 Animal Crossings (all animal crossings are special burial).

DIGITAL STRONG MOTION ACCELEROGRAPH (DSMA): Field instrument to evaluate pipeline motion caused by earthquakes (see EARTHQUAKE, DSMAs). Pipe is wrapped before being placed in the trench during construction.

DISCHARGE PRESSURE: Pressure of the oil leaving a pump station.

DITCH, Buried Pipeline: 8 feet wide, 8 feet deep, approximately, but variable for overburden depth, which ranged from 3 to 35 feet.

DRAG REDUCING AGENT (DRA): A long-chain hydrocarbon polymer injected into the oil to reduce the friction due to turbulence in the oil. In today's operating climate, DRA is periodically used to facilitate ramping up to higher throughputs while running Inline Inspection Tools, and during other operational activities.

E

EARTHQUAKE, Denali Fault, November 3, 2002: The pipeline withstood a magnitude 7.9 Richter Scale earthquake that was centered along the Denali Fault in Interior Alaska, approximately 50 miles west of the pipeline. The ground along the fault moved an estimated 18 feet horizontally and nearly 2.5 feet vertically. The quake was the largest on the Denali Fault since at least 1912 and among the strongest earthquakes recorded in North America in the last 100 years.

EARTHQUAKE, Design Magnitude: The pipeline is designed to withstand a maximum 8.5 Richter Scale earthquake at the Denali Fault. The range is 5.5 to 8.5, depending on the area. The seismic design of TAPS includes two levels of earthquake hazards: the design contingency earthquakes (DCE) and the design operating earthquakes (DOE). The DCE corresponds to the design earthquake magnitude and may interrupt operations, but not compromise the pipe. The DOE is a lower-intensity earthquake that has ground motion amplitudes one-half those of a DCE. Operations should be able to continue following a DCE.

EARTHQUAKE, Design Movement: Maximum movement of pipe at pipeline crossing of major faults:
- Denali Fault: 20 feet lateral, 5 feet vertical.
- McGinnis Glacier Fault: 8 feet lateral, 6 feet vertical.
- Donnelly Dome Fault: 3 feet lateral, 10 feet vertical.
- Minor Potential Faults: 2 feet lateral, 2 feet vertical.

EARTHQUAKE, DSMAs: The instrumentation at field locations consists of accelerometers mounted on concrete pads which measure strong ground motions in three directions (tri-axial) and are connected to a digital strong motion accelerograph (DSMA). The DSMA, generally located in the pump station control room, processes the signals from the accelerometers in real time and reports alarms and selected data to the central processor at the Operations Control Center (OCC).

EARTHQUAKE, Faults Crossed by Pipeline: Denali, McGinnis Glacier and Donnelly Dome.

EARTHQUAKE, Monitoring System (EMS): Alyeska's EMS consists of sensing and processing instruments at PS 1, at all pump stations south of Atigun Pass and at the TERMINAL. A central processing unit at the OCC is linked to the pipeline and terminal operator consoles. The EMS is specifically designed to process strong ground motions, to interpolate or extrapolate estimates of earthquake accelerations between the sensing instruments, and to prepare a mile-by-mile report comparing the estimated accelerations along the pipeline with the pipeline seismic design criteria. Field instrumentation consists of DSMAs (see EARTHQUAKE, DSMA).

EARTHQUAKE, Lateral Movement for Aboveground Pipeline: 2 feet maximum (predicted).

ELECTRIFICATION AND AUTOMATION (E&A): Electrification and Automation (previously called "Strategic Reconfiguration" or "SR") refers to Alyeska's overall renewal of assets. Work began in 2001 and concentrated on reducing physical infrastructure and simplifying operations and maintenance. The project focuses on creating more efficient operations while maintaining or enhancing safety, operational integrity and environmental performance. The system is modular and scalable and with flexibility for future increases or decreases in throughput. As of March 2016, pump stations 1, 3, 4 and 9 were operating on new pumps, with some final work at PS 1 continuing.

EMERGENCY RESPONSE: TAPS personnel train year-round to respond to emergencies, including oil spills. Requirements for response capabilities are outlined in three oil spill contingency plans (see CONTINGENCY PLAN). As part of Alyeska's response strategy, employees are trained to fulfill roles in both the Incident Management Team (IMT) and the Crisis Management Team (IMT).

- CMT: The CMT's objective is to prevent an internal or external event from creating a crisis situation. The team is focused on business continuity, while providing other assistance so the IMT can focus on managing the incident.
- IMT: The IMT is a universal organization with common terminology, structure and roles that forms to manage an incident. The IMT often includes representatives from many different agencies.

ENHANCED TRACTOR TUGS (ETT): *Nanuq and Tan'erliq* (Alaska Native words for "polar bear" and "black bear"). Designed for tethered tanker escort and oil spill response operations. The 153-foot vessels enhance SERVS' ability to assist a disabled tanker. The state-of-the-art vessels have exceptional maneuverability and were deployed in 1999.

- Crew: Seven trained response personnel.
- Firefighting: ABS Class 1 firefighting rating that includes pumps, monitors, foam and vessel spray system.
- Propulsion: Voith Schneider system; 10,192 hp.
- Spill response equipment:
  - 3,300 feet of oil containment boom.
  - DESMI skimmers.
  - 70,000 gallons of recovered oil storage capacity.
  - Dispersant spray arm systems.

The *Tan'erliq* (far right), one of two enhanced tractor tugs at the Valdez Marine Terminal.

F

FATALITIES, Construction: 32 incidents directly related to construction (includes employees of Alyeska, contractors and subcontractors; excludes common carriers).

FATALITIES, Operations: Nine operations-related incidents (includes employees of Alyeska, contractors and subcontractors):

- July 1977: PS 8 explosion.
- September 1977: Chandalar Camp heavy equipment accident.
- November 1978: PS 8 snow-clearing accident.
- December 1984: Valdez Marine Terminal heavy equipment accident.
- August 1985: Charter aircraft accident, Glennallen.
- 1987: Security helicopter accident, Keystone Canyon.
- March 1997: Vehicle accident, Haul Road.
- August 2000: Vehicle accident, Valdez Marine Terminal.
- April 2006: Tug operations accident, SERVS.

FISH, Species: 34 identified in waters crossed by the pipeline.

FUEL GAS LINE: Carries natural gas from North Slope fields to fuel pump stations north of the Brooks Range. Generally parallels mainline crude oil pipeline, from Prudhoe Bay to PS 4.

- Compressors: Two 1,200-hp gas turbine compressors at PS 1 boost gas pressure from approximately 600 psi to 1,100 psi.
- Diameter: 10 inches from PS 1 to MP 34 (34 miles); 8 inches from MP 34 to PS 4 (115 miles).
- Gas temperature: 30 F, maximum (leaving PS 1).
- Length: 149 miles.
- Pressure Design: 1,335 psi. Operating: 1,090 psi, maximum currently.

G

GABIONS AND CONCRETE MATS: Used in Atigun Floodplain Pipe Replacement Project as cover on pipe in shallow burial area for protection from natural erosion and scouring. A gabion is a metal cage filled with rock; Gabions are used to stabilize banks.
- Gabions: 31,750 feet.
- Concrete mats: 9,525 feet.

GRADE, Maximum on TAPS Route: 145 percent (55°) at Thompson Pass.

H

HAUL ROAD: Portion of Dalton Highway from the Yukon River to Prudhoe Bay. Built by Alyeska.
- Cost: $125 million, approximately.
- Dates: Started April 29, 1974; completed and dedicated September 29, 1974.
- Labor: 3 million hours.
- Time: 154 days.
- Length: 358 miles (Yukon River to Prudhoe Bay).

HEAT PIPES: These self-contained passive refrigeration devices contain anhydrous ammonia or carbon dioxide gas under pressure which vaporize at temperatures just below freezing, rise and condense at radiators aboveground when the air temperature is well below freezing. This process transfers ground heat into the air during cold periods, thereby lowering the ground temperature to ensure thaw unstable soils remain frozen throughout the summer to steadily support the pipeline. There are 124,300 individual heat pipes along the pipeline (see VERTICAL SUPPORT MEMBERS).

I

INSULATION, Thickness:

- Elevated pipeline: 3.75 inches thick.
- Refrigerated belowground pipeline: 3.2 inches thick.
- Under gravel workpad or road: 2 to 4 inches.

INTEGRITY MANAGEMENT PLAN (IMP): Integrity management comprises all activities that monitor and maintain the integrity of all hydrocarbon handling facilities on TAPS. The purpose of IMP is to protect the environment by preventing oil spills, comply with all laws and regulations, maintain facilities within industry standards, and monitor and mitigate integrity risks.

J

JOINT PIPELINE OFFICE (JPO): The JPO is a consortium of federal and state agencies. The agencies include the State of Alaska Departments of Natural Resources, Environmental Conservation, Fish and Game, Labor and Workplace Development, Transportation Public Facilities, and Public Safety, Division of Fire Prevention; and, on the federal side, The Bureau of Land Management, the U.S. Department of Transportation/Office of Pipeline Safety, Environmental Protection Agency, U.S. Army Corps of Engineers, U.S. Coast Guard, and Minerals Management Service. The JPO has employees with offices in Anchorage, Fairbanks and Valdez. See REGULATORY AGENCIES.

L

LAND, Municipal Jurisdiction: Approximate pipeline length in each jurisdiction, north to south:
- North Slope Borough: 179.2 miles.
- Fairbanks North Slope Borough: 89.1 miles.
- City of Delta Junction: 5.5 miles.
- City of Valdez: 20.8 miles.

LAND OWNERSHIP, Area: Approximate area for all of TAPS (18.4 square miles total):
- State government: 7.79 square miles.
- Federal government: 6.27 square miles.
- Owner companies: 2.9 square miles.
- Private: 1.41 square miles.

LAND OWNERSHIP, Owner: Approximate pipeline length for each ownership category (800 miles total):
- Federal government: 376 miles.
- State government: 344 miles.
- Private: 80 miles (including 51 miles on Alaska Native corporation land).

LEAK DETECTION SYSTEM: Provides detection and location of oil spills. TAPS has three independent systems:
- Line Volume Balance (LVB), which compares the volume of oil entering the line with the volume leaving it.

- Transient Volume Balance (TVB), which compares reported flow with calculated flow and can identify the probable location of a leak by pipeline section.
- Alarms which signal deviations in pressure, flow or flow rate balance.

LINEFILL: The oil necessary to fill the pipeline to start the pumps in a mechanically sound manner. At a throughput of 0.935 million bbl per day, the linefill volume is 9,059,622 bbl.

M

MAXIMUM ALLOWABLE OPERATING PRESSURE: A rating indicating the maximum pressure at which a pipeline or segment of a pipeline may be operated under U.S. Department of Transportation regulations in normal conditions. Also called "pressure rating."

MOUNTAIN RANGES, Crossed by Pipeline: Brooks Range, Alaska Range and Chugach Range.

MUTUAL AID AGREEMENTS: See OIL SPILL RESPONSE, Mutual Aid Agreements.

N

NORTH SLOPE, Environment: A nearly flat, treeless plain, covering about 88,000 square miles extending from the foothills of the Brooks Mountain Range to the Arctic Ocean. For 56 days in winter, the sun never rises. Winter twilight provides sufficient light for driving without headlights during the day. Winter temperatures drop to minus 60 F. Wind chill factor may fall as low as minus 135 F. From mid-April to mid-August, there is daylight 24 hours a day. Summer temperatures climb to 70 F and higher.

NORTH SLOPE, Oil Discovery: Exploratory drilling on the North Slope continued for more than 20 years. Many unsuccessful exploratory wells were drilled and many companies gave up the search before the Prudhoe Bay Discovery Well was drilled by Atlantic Richfield Company and Humble Oil and Refining Company in 1967. A confirmation well the following year proved the discovery of the large oil and gas reservoir.

NOTICES TO PROCEED, Construction: 465 federal and 403 state notices to proceed were required from the Federal Alaska Pipeline Office and the State Pipeline Coordinator's Office.

O

OIL SPILL CONTINGENCY PLAN, Pipeline: TAPS Pipeline Oil Discharge Prevention and Contingency Plan:

- Containment Sites: 223 designated sites on or near drainages along TAPS. Criteria for selection: accessibility, river velocity, river channel configuration, environmental sensitivity. Equipment stored at containment sites varies per site and includes oil spill equipment, concrete anchors, and/or dam kits.
- Equipment: Varies by response facility. Total inventory available includes the following:
  - Vessels (jet boats, airboats, rafts, landing craft): 35.
  - Boom, containment: 48,500 feet.
  - Boom, fire: 2,150 feet.
  - Vacuum trucks: 11.
- Leak Detection: Four systems (see LEAK DETECTION SYSTEMS).
- Personnel:
  - Pipeline personnel trained in oil spill response. Each response facility has 24-hour oil spill response capabilities.
  - Drills: Field drills are conducted to evaluate preparedness to react to an oil spill. The drills permit evaluation of the training program, particularly oil spill skills such as reconnaissance, assessment and response.

– Training: Consists of a five-day academy for new employees and a two-day refresher for existing employees.

OIL SPILL CONTINGENCY PLAN, Tankers: Tankers transiting Prince William Sound are required by the state to have oil spill contingency plans. The Prince William Sound Tanker Oil Discharge Prevention and Contingency Plan is a required part of each tanker's individual contingency plan. Alyeska Pipeline/SERVS is the primary response action contractor responsible for the implementation aspects of the tanker plan. The prevention portion of this plan requires that each laden tanker transiting Prince William Sound must be escorted by two vessels, one of which must be a specially equipped prevention and response vessel or tug. Laden tankers are tethered to escort tugs from the TERMINAL through the Valdez Narrows and Valdez Arm. Also included in the plan are speed limits for tankers and weather restrictions. The response portion of the plan includes plans for open-water and nearshore shoreline response and support operations.

OIL SPILL CONTINGENCY PLAN, Terminal: The Valdez Marine Terminal Oil Discharge Prevention and Contingency Plan includes a comprehensive prevention plan outlining spill prevention measures taken at the terminal, as well as a response section describing land and water response for spills originating from terminal facilities. A spill from a tanker at berth or transiting Port Valdez is covered under the Prince William Sound Tanker Oil Discharge Prevention and Response Plan. Although a spill from a tanker is the responsibility of the tanker owner, Alyeska provides initial spill response.

- Personnel: Oil spill response crews trained to conduct land and water response operations are available 24 hours a day.
- Equipment: The following equipment is stored in Prince William Sound:
  - Barges: Seven barges (700,000 bbl, approximately, for recovered oil); 1 flat-deck barge with sensitive-area protection boom (serves as on-water staging location).
  - Boom: 50 miles of various types of containment and recovery boom.
  - More than 50 major skimming systems and more than 50 smaller skimming systems with recovery capability of 300,000 barrels of oil within 72 hours.
  - Skimmers, self-propelled: Four total: JBF 6001 *(Valdez Star)* with recovery rate of 2,000 bbl/ hour and storage of 1,310 bbl; JBF 3003 (two units) with recovery rate of 571 bbl/hour; and MARCO Class VII with recovery rate of 1,281 bbl/hour.
  - Tugs: 10.
  - Vacuum trucks: Three.
  - Work boats: Six.
- Prevention programs:
  - Corrosion control programs.
  - Inspection and records.
  - Medical monitoring.
  - Preventive maintenance.
  - Security.
  - Substance abuse programs.
  - Tank leak protection.
  - Training programs.
  - Transfer procedures.
  - Escort System.

OIL SPILL RESPONSE, Mutual Aid Agreements: An official agreement to provide equipment and resources for oil spill response to entities outside of Alyeska such as the United States Coast Guard.

OPERATIONAL INTEGRITY: An Alyeska program designed to assure the integrity of the pipeline system is maintained while attaining the highest standards of safety and environmental protection.

OPERATIONS CONTROL CENTER (OCC): The OCC in Anchorage continually monitors the status of all pump stations and valves using supervisory control and data acquisition (SCADA) systems with remote sensors. Data such as pressures, flow rates, temperatures, tank levels and valve positions are recorded and analyzed for abnormal operations or any indication of a pipeline leak. The pipeline controller at the OCC can rectify any abnormal operation by changing settings for pump speed or relief valves, or by issuing idle or stop commands to the mainline pumps. The OCC controller can also activate remote control valves. The monitoring and analysis systems include backup communications equipment and computers.

P

PACKLINE: Oil flow that completely fills a pipeline.

PERMAFROST: Any rock or soil material that has remained below 32 F continuously for two or more years. The two-year minimum stipulation is meant to exclude from the definition the overlying ground surface layer which freezes every winter and thaws every summer (called the "active layer" or "seasonal frost").

PERMAFROST, Affected Areas on TAPS: Approximately 75 percent of the line passes through permafrost terrain. The line traverses the continuous zone on the North Slope and through the Brooks Range. It then encounters the discontinuous and sporadic zones and passes through areas of no permafrost in the immediate vicinity of Valdez.

PERMAFROST, Depth Along Pipeline Route: A few inches to 2,230 feet, approximately.

PERMAFROST, Design Solutions: The pipeline design is based primarily on the soil conditions encountered along the right-of-way. There are three principle design modes: aboveground, conventional burial and special burial (see DESIGN MODES).

PERMAFROST, Problems:

- Frost-heaving: When the active layer freezes, ice forms and pushes the ground surface upward.

- Frost-jacking: When heaving occurs, if a structure embedded in the ground is not properly anchored to resist such movement, the structure will be forced upward along with the ground surface. In most cases, the structure does not return to its original position when the active layer thaws during the following summer. The net upward movement is called "jacking." This phenomenon can occur whenever there is seasonal freezing and thawing of the active layer and is not limited to permafrost areas.
- Thaw settlement: Structures founded on "thaw-unstable" permafrost may settle if large amounts of ice in the permafrost melt. Melting is typically caused by heat from the structure or changes to the natural thermal conditions.

PERMAFROST, Types:

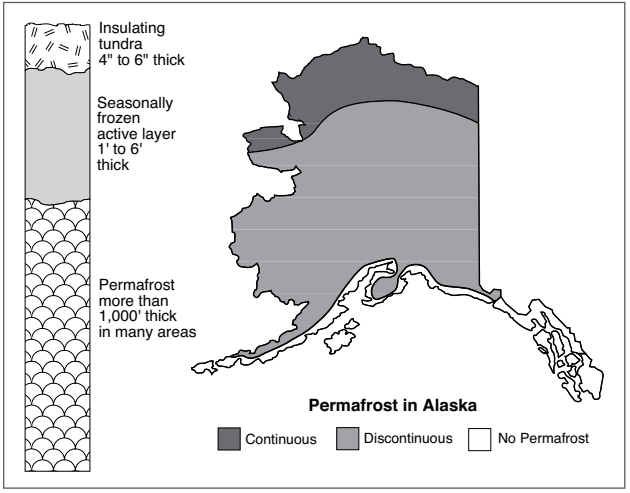
- Cold permafrost: Remains below 30 F (may be as low as 10 F on the North Slope); tolerates introduction of considerable heat without thawing.
- Ice-rich: 20 percent to 50 percent visible ice.
- Thaw-stable: Permafrost in bedrock, in well-drained, coarse-grained sediments such as glacial outwash gravel and in many sand and gravel mixtures. Subsidence or settlement when thawed is minor, foundation remains essentially sound.
- Thaw-unstable: Poorly drained, fine-grained soils, especially silts and clays. Such soils generally contain large amounts of ice. The result of thawing can be loss of strength, excessive settlement and so much moisture in the soil that it flows.
- Warm permafrost: Remains just below 32 F. The addition of very little heat may induce thawing.

PERMAFROST, Zones:

- Continuous zone: Permafrost is found almost everywhere in the zone, as the name implies; includes all of the North Slope.
- Discontinuous zone: Permafrost is found intermittently; includes much of the interior of the state.
- Sporadic zone: Permafrost is found in isolated small masses of permanently frozen ground.

PERMANENT LIVING QUARTERS: See PUMP STATIONS, Living Quarters.

PERMITS, Construction: 515 federal and 832 state permits were required to build TAPS.



PHILANTHROPY: Philanthropy is vital to Alyeska's mission and company culture. Alyeska supports Alaska-based nonprofit associations that are focused on areas such as health and social services, underserved populations, and culture. The company annually stages an active United Way campaign, with nearly 40 percent of employees donating to United Way in 2015. Alyeska also supports non-profits through its matching gift and volunteer match programs.

PIG: A pig is a mechanical device that is pushed through the pipeline by the oil to perform various operations on the pipeline without stopping the flow of oil. This process is referred to as "pigging." Alyeska runs two basic types or classes of pigs: cleaning and instrumented or "smart." These devices help Alyeska clean and inspect the pipeline to prevent and detect problems. The three basic types of smart pigs are ultrasonic transducer (UT), magnetic flux leakage (MFL) and curvature. These pigs are used to periodically inspect for pipeline corrosion and deformation using nondestructive sensor technologies including ultrasound and magnetic sensors. As they evaluate the data, engineers look for suspect areas and compile a list of specific locations to determine and prioritize integrity investigations through a "corrosion dig," a physical examination of the pipeline. Depending on what the dig reveals, the corrective action might be the addition of a sleeve or a new, higher-quality coating developed since the pipeline was originally constructed.

- **CLEANING PIG:** Also known as scraper pigs, these pigs sweep the pipe of built-up wax, water or other solids that precipitate out of the oil stream. They prevent the buildup of a corrosive environment. Their use also makes the oil easier to pump.
- **INSTRUMENTED (SMART) PIG:** Instrumented pigs are in-line-inspection (ILI) tools called "smart pigs." The data they gather allows engineers to recommend intervention before wall loss anomalies become a problem. Alyeska has been an industry leader in the use of ILI tools, also doing so before it was mandated by regulations. The UT and MFL pigs are used to detect and measure corrosion and metal loss internally and externally on the pipe wall. These two smart pigs complement each other — UT is a better measurement tool and MFL a better detection tool.
  - Ultrasonic Transducer (UT) pig: This pig uses sound waves to measure the thickness of the steel pipe wall. The pig knows the speed of sound in steel and therefore is able to calculate the thickness. The UT pig has 512 transducers, each taking 625 readings per second.
  - Magnetic Flux Leakage (MFL) pig: This type of corrosion tool uses powerful magnets to saturate the pipe wall with magnetism. Sensors between the poles of the magnets detect disturbances caused by metal loss due to corrosion or other mechanical damage. The MFL tool has 1,120 sensors to characterize the shape of the disturbance in the magnetic field.
  - Curvature pig: This tool uses inertial navigation technology to measure the position and shape of the pipe. This device tells the recorder where the pig is in three-dimensional space every 2 inches. This tool also has 64 radius measuring "fingers" arrayed around the pig body to measure the shape of the pipe. This data allows the engineers to monitor dents, ovalities and wrinkles in the pipe. Engineers also determine where

the pipe is moving due to settlement or upheaval. This tool is also called a deformation pig, or a caliper pig.

- **CRAWLER PIG:** This tool, a "Remotely Operated Diagnostic Inspection System" (RODIS), was originally developed for the nuclear industry and more recently has been used for natural gas pipelines. Alyeska has modified and tested the tool for inspecting varying pipe diameters and configurations. The tool is self-propelled (or "crawls") by remote operation, rather than being pushed by fluid or operated by hand. Alyeska has tested the unit in pump station piping. In 2016, the plan called for continued testing at pump stations.

PIG, Launching/Receiving Facilities: PS 1 (launch only), PS 4 (launch and receive), PS 8 (contingency launch only for smart pigs), PS 9 (launcher and receiver) and the Valdez Marine Terminal (receive only).

A TAPS employee cleans a scraper pig at the Valdez Marine Terminal. Scraper pigs, which clean the pipeline and enhance oil flow, are pushed by the oil.

PIG, Frequency: Smart pigs are run every three years. Scraper pigs are run every 6 days (as of early 2016). Changes to this schedule are made based on operational needs.

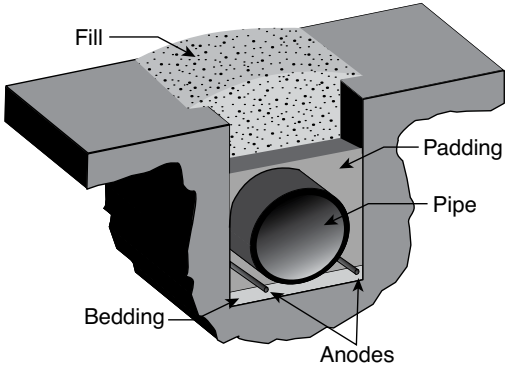
PIPE: The pipe for TAPS was manufactured in Japan (Italy for Atigun floodplain pipe replacement project).

- Diameter, outside: 48 inches (122 cm).
- Lengths, standard: 40 feet and 60 feet.
- Pieces required for pipeline: More than 100,000.
- Tested to: Maximum axial force of 2.52 million pounds and lateral deflection force of 459,000 pounds before wrinkling (typical test sample: 31 feet 5 inches).
- Thickness, wall: 0.462 inches (466 miles) and 0.562 inches (334 miles).
- Total shipped: 550,000 tons, approximately; 120 shiploads for original construction; 6 for Atigun Floodplain Pipe Replacement Project.
- Volumetric displacement: 11,366 bbl/mile (0.462-inch thickness); 11,270 bbl/mile (0.562-inch thickness).
- Weight: 235 pounds/linear foot (0.462-inch thickness); 285 pounds/linear foot (0.562-inch thickness).

PIPE, Aboveground: Specially designed vertical supports were placed in drilled holes or driven into the ground. In warm permafrost (see PERMAFROST) and other areas where heat might cause undesirable thawing, the supports contain two, 2-inch diameter pipes called "heat pipes," containing anhydrous ammonia, which vaporizes belowground, and rises and condenses aboveground, removing ground heat whenever the air temperature is 5 to 10 F cooler than the ground temperature at the base of the heat pipe. Heat is transferred through the walls of the heat

pipes to aluminum radiators atop the pipes (see VERTICAL SUPPORT MEMBERS).

PIPE, Belowground (Conventional): The pipe is underlain with a layer of fine bedding material and covered with prepared gravel padding and soil fill material, in a ditch from 8 to 16 feet deep in most locations, but up to 49 feet deep at one location. Zinc ribbons, which serve as sacrificial anodes to inhibit corrosion of the pipe, are buried alongside the pipeline. (The Atigun pipe replacement section, 8.5 miles in length, has four magnesium ribbon sacrificial anodes installed). Electrical currents in the earth's surface, called "telluric currents" and caused by the same phenomenon that generates the Northern Lights, can be picked up by the pipeline and zinc/magnesium anodes. The anodes act like grounding rods to safely return these currents to the earth, reducing the risk of damage to the pipeline.



the **facts**.

PIPE, Special Burial, Non-Refrigerated: In areas of thaw-unstable soils calling for elevated pipeline construction, but where the pipeline had to be buried for highway crossings, animal crossings, or avoidance of rockslides and avalanches, the line was insulated to protect the permafrost from the heat of the pipeline and buried.

PIPE, Special Burial, Refrigerated: In some areas the line was insulated and buried in a refrigerated ditch. Refrigeration plants at each of these points circulate chilled brine through loops of 6-inch diameter pipe to maintain the soil in a stable frozen condition.

PIPE SHOES: 39,000, approximately.

PORT OF VALDEZ: A natural fjord 12 miles long, 2.5 miles wide and up to 800 feet deep, with a tidal range of 12 to 14 feet.

POWER VAPOR FACILITY: The power generation facility at the Valdez Marine Terminal.

- Primary plant facilities:
  - Three steam boilers each with an output of 175,000 pounds/hour at 600 psi at 750 F.
  - Three condensing steam turbine generators each with a capacity of 12.5 MW at 13.8 kV.
- Standby systems:
  - Two 12-cylinder diesel generators: capacity 6.0 MW total.
  - Four uninterruptable power supply systems supplied by 125-volt battery bank for essential control equipment.

PRESSURE, Maximum Operating: 1,180 psi.

PRESSURE RELIEF STATION: PS 5 re-injects oil drained

down for pressure relief, but does not have mainline pumps and does not boost total stream.

PRESSURE RELIEF VALVE: A valve designed to open automatically to relieve pressure and keep it below a designated level.

PRESSURE SPIKE: A sudden, brief rise in pressure.

PRESSURE SURGE: A pressure spike/excursion moving through the pipeline at sonic velocity. Produced by a sudden change in velocity of the moving stream that results from shutting down a pump station or pumping unit, closure of a valve or any other blockage of the moving stream.

PREVENTION/RESPONSE TUGS (PRTs): *Alert, Attentive* and *Aware*. Specifically designed for escorting and response service in Prince William Sound. Technology for prevention and response missions by powerful ocean-class tugs. Deployed in 2000.

- Size: Approximately 140 feet long.
- Crew: 7 trained response personnel.
- Propulsion: Z drives; 10,200 horsepower.
- Firefighting: ABS Class 1 firefighting rating that includes pumps, monitors, foam and vessel spray systems.
- Spill Response Equipment:
  - 2,000 feet Kepner Sea Curtain oil containment boom.
  - 2 DESMI skimmers.
  - 2 20-foot Kvichak workboats.

PRINCE WILLIAM SOUND REGIONAL CITIZENS ADVISORY COUNCIL (PWSRCAC): Independent citizens' council empowered by the federal Oil Pollution Act of 1990 to provide comment on Alyeska's PWS operations, promoting environmentally safe operation of the Valdez Marine Terminal and the TAPS tanker traffic in PWS.

- Budget: Averages more than $4 million per year (provided by Alyeska under a signed contract that ensures PWSRCAC's absolute independence from Alyeska).
- Members include the Alaska State Chamber of Commerce; Alaska Wilderness Recreation & Tourism Association; Chugach Alaska Corporation; the cities of Cordova, Homer, Kodiak, Seldovia, Seward, Valdez and Whittier; the communities of Chenega Bay and Tatitlek; Cordova District Fishermen United; the boroughs of Kenai Peninsula and Kodiak Island; Kodiak Village Mayors Association; Oil Spill Region Environmental Coalition; and Prince William Sound Aquaculture Corporation.

PRUDHOE BAY: A coastal feature of the Beaufort Sea, approximately 250 miles north of the Arctic Circle and 1,300 miles south of the North Pole. Also used generally to describe a land area of petroleum development of Alaska's North Slope: 18th largest field in the world. Largest field in North America.

PUMP STATIONS: Original design called for 12 pump stations with four pumps operating at each pump station. PS 11 was never built. PS 5 was built as a relief station. Eight stations were operating at startup (PS 1, 3, 4, 6, 8, 9, 10 and 12). PS 8 pump building was destroyed by an explosion and fire on July 8, 1977, that occurred during startup; the station was re-commissioned on March 7,

1978. PS 2 was commissioned October 2, 1979; PS 7 was commissioned December 1, 1980.

PUMP STATIONS, Crew: Crews vary per station; typically six to 25 employees. Personnel include security, maintenance, technician and safety employees. Shifts are generally one week on/one week off, or two weeks on/two weeks off.

PUMP STATIONS, Crude Oil Tank Capacity: PS 1: 420,000 bbl; PS 5: 150,000 bbl; all others: 55,000 bbl.

PUMP STATIONS, Electrification and Automation (E&A): Pump Stations 1, 3, 4, and 9 have been upgraded to use electrical (instead of diesel) power and are now automated (controlled remotely by Operations Control Center (OCC)). Pump Stations 5 and 7 are using legacy equipment.

E&A upgrades include:
- Three new electrically driven mainline pump/motor modules or MLUs at each station.
- Power generation modules at PS 1, 3, and 4 which include turbine drivers.
- Transmission line and substations for power supply from North Slope Central Power Facility at PS 1 and from GVEA at PS 9.
- Electrical distribution system and modules.
- Tie-ins and interconnecting crude oil and fuel gas piping and supports.
- Essential facilities for cold restart provided or maintained as appropriate.
- Upgraded relief control system actuators.
- Upgraded fire and gas systems.
- New onsite control, data gathering and data transfer systems.
- Upgraded pressure protection and process safety command system.

PUMP STATIONS, Fire Systems:
- Airfield rescue and fire training provided at stations with airports.
- Pump stations with airports have designated fire-fighting trucks for the airfields.
- Types: Halon, NOVAC, water and foam, dry chemical, wet chemical and carbon dioxide.

PUMP STATIONS, Fuel Requirements: 30,000 to 60,000 gallons per day, average, per station (fuel oil equivalent).

PUMP STATIONS, Permanent Living Quarters: Permanent living quarters at PS 3, 4, 5, 6 and 7. PS 9 personnel live in nearby communities.

PUMP STATIONS, Recirculation: In order to add heat to the crude oil, the oil is re-circulated within the pump station. This results in additional heat being added to the crude before leaving that pump station.

PUMP STATIONS, Power: All stations generate electrical power, with power plants ranging from 1.3 MW at PS 1 to 4.7 MW at PS 6, depending on availability of commercial power, presence of topping unit, and/or vapor recovery system. PS 8 and 9 also purchase commercial power.

PUMP STATIONS, Refrigerated Foundations: PS 1, 3, 5 and 6.

PUMP STATIONS, Status as of May 2016:
- PS 1, 3, 4 and 9 operating.
- PS 5 operating as relief station.
- PS 7 on warm standby, used in the winter to increase crude oil temperature.
- PS 2 ramped down July 1, 1997.
- PS 6 ramped down August 8, 1997.
- PS 8 ramped down June 30, 1996.
- PS 10 ramped down July 1, 1996.
- PS 11 was not built, but has maintenance facilities.
- PS 12 ramped down April 1, 2005.

PUMP STATIONS, Turbines: Turbine engines drive the pumps. See TURBINES.

PUMPS, Booster: All pump stations have booster pumps to move oil from the storage tanks to the mainline. (PS 1 has two mainline booster pumps to boost oil pressure). PS 5 has two injection pumps.

RECIRCULATION: See PUMP STATIONS, Recirculation.

The pipeline begins at Pump Station 1 in Prudhoe Bay.

R

REGULATORY AGENCIES: The following agencies have jurisdiction over various aspects of TAPS. **The asterisk denotes a member of the Joint Pipeline Office (JPO):*

- Alaska Department of Environmental Conservation*
- Alaska Department of Fish and Game*
- Alaska Department of Labor & Workforce Development*
- Alaska Department of Natural Resources*
- Alaska Department of Public Safety
- Alaska Department of Transportation & Public Facilities
- Alaska State Fire Marshal*
- Regulatory Commission of Alaska
- Federal Aviation Administration
- Federal Energy Regulatory Commission
- Federal Maritime Commission
- Interstate Commerce Commission
- Local Boroughs and Municipal Governments
- U.S. Army Corps of Engineers
- U.S. Coast Guard
- U.S. Department of Commerce, National Oceanic and Atmospheric Administration
- U.S. Department of Interior, Bureau of Land Management*
- U.S. Department of Labor, Occupational Safety and Health Administration*
- U.S. Department of Transportation, Office of Pipeline Safety*

• U.S. Environmental Protection Agency*
• U.S. Fish and Wildlife Service*
• U.S. National Transportation Safety Board

RESTORATION, Area Revegetated: Nearly 7,750 acres (through 1997).

RESTORATION, Basic Data:
• Area: Approximately 550 acres.
• Camps, pad restoration: 14.
• Fertilizer used: 5,500 tons.
• Grass seed used: More than 450 tons.
• Seedlings planted: 83,500.
• Soil samples, random: 15,000 to test for regeneration.
• Trees transplanted: 24,000.

RESTORATION, Visual Impact Stipulations: See VISUAL IMPACT STIPULATIONS.

RIGHT-OF-WAY USE GUIDELINE (RUG) PROGRAM: TAPS crosses hundreds of tracts of public and private land, has above and below-ground segments and is designed to accommodate transportation crossings at documented public trails. Alyeska adopted a policy for protecting the safe operation of TAPS and respecting the rights of public and private landowners along the TAPS ROW while assuring the public's right-of-entry under the law.

Alyeska requires those wanting linear use of the ROW or its numerous access roads to register for permission under the Right-Of-Way Use Guideline (RUG). Perpendicular pipeline crossings with vehicles under 1,500 pounds or non-vehicular, low-impact modes of transportation may proceed without Alyeska permission. While on the ROW, individuals must be in possession of a copy of the RUG plus government issued photo identification to be presented if requested by TAPS security officer or employee.

The ROW was not designed to be used as a roadway and can be hazardous. Depending upon security conditions, TAPS work activity or weather, portions of the ROW may be closed to the public. Blocking Alyeska access roads is not allowed. Hunting, trapping or shooting along the pipeline ROW is also prohibited.

RIGHT-OF-WAY WIDTH:
• Federal lands: 54 feet (buried pipe); 64 feet (elevated pipe).
• State lands: 100 feet.
• Private lands: 54 feet to 300 feet.

ROAD CROSSINGS, Pipeline: 21 north of Yukon River; 23 south. The crossing at the Glenn Highway in Glennallen is refrigerated.

S

SAFETY MANAGEMENT SYSTEM: Managing a pipeline, like other manufacturing and industrial activities, requires a systematic approach to conduct safe operations. Alyeska is following the recommendation of the U.S National Transportation Safety Board by adapting the Pipeline Safety Management System (SMS). This can maximize safety performance and serve as a model to risk-prone industries. SMS provides operators with a structured, comprehensive, regular method of assessing risks of operations, learning from experience and continuously improving pipeline safety.

SMS will help a TAPS operators more effectively manage all the aspects of pipeline safety through a ten step multi-faceted approach.

1. Leadership and management commitment
2. Stakeholder engagement
3. Risk management
4. Operational controls
5. Incident investigation, evaluation and lessons learned
6. Safety assurance
7. Management review and continuous improvement
8. Emergency preparedness and response
9. Competence, awareness and training
10. Documentation and record keeping

Alyeska will incorporate PSMS into its existing safety management processes, ensuring operators integrate learnings from industry trends, incident findings and recommendations, regulatory notices and advisories, internal audits and evaluations or changes in operations. The result is a comprehensive system that is a catalyst for safety management and allows for flexible and scalable solutions.

SAFETY, Philosophy: The management and employees of Alyeska Pipeline Service Company believe that:

- All occupational injuries and illnesses are preventable.
- All Alyeska personnel have a personal responsibility for their own safety and the safety of their co-workers.
- If an employee or contractor observes or knows of an unsafe condition(s), he or she will appropriately and respectfully intervene to mitigate that condition(s). If the unsafe condition(s) cannot immediately be addressed or mitigated, it will be immediately reported up the chain of command.
- No business objective is so important that it will be pursued at the sacrifice of safety.
- Safe conduct is a condition of employment at APSC.
- Safety is an integral part of every job performed on TAPS.
- APSC will have the best safety performance in the industry.

These statements represent Alyeska's fundamental safety beliefs that are vital to Alyeska's business. Internalizing these beliefs will ensure that "nobody gets hurt."

SECTION 29: Prior to the construction of TAPS, Alyeska made a commitment to the Alaska Native community to recruit, train, employ and promote Alaska Natives. This

commitment was defined in Section 29 of the Federal Agreement and Grant of Right-of-Way for the Trans Alaska Pipeline System. Section 29 recognizes that Alaska Natives as landowners, like all private landowners, must be compensated for land use and occupancy. Instead of cash payments, Alaska Natives opted for jobs and job training opportunities (see ALASKA NATIVE PROGRAM).

SERVS (Ship Escort/Response Vessel System): The mission of SERVS, which was established July 10, 1989, is to prevent oil spills by assisting tankers in safe navigation through Prince William Sound and to protect the environment by providing effective response services to the Valdez Marine Terminal and Alaska crude oil shippers in accordance with oil spill response agreements and plans.

SERVS, Boom: More than 49.7 miles of various types of oil containment and recovery boom are available at SERVS.

SERVS, Enhanced Tractor Tugs: See ENHANCED TRACTOR TUGS (ETTs).

SERVS, Fishing Vessels: 450+ vessels.

SERVS, Non-Mechanical Response Equipment:
- ADDS pack: 2 Airborne Dispersant Delivery Systems; treatment potential: 2,600 bbl/payload.
- Helitask Airborne Dispersant Systems (2): Treatment potential 4,200 gallons/payload.
- Heli-torch: 2 airborne ignition systems.
- Spill spray: 3 meter-controlled dispersant spray units; onboard tankage 3,000 gallons concentrate liquid.

SERVS, Pre-staged equipment: Hatcheries and sensitive areas: Lake Bay, Cannery Creek, Solomon Gulch, Main Bay, Sawmill Bay, Valdez Duck Flats and 10 sensitive areas in the Port of Valdez.
- Others: Naked Island, Port Etches, Whittier, Cordova, Chenega Bay and Tatitlek.

SERVS, Prevention/Response Tugs: See PREVENTION/ RESPONSE TUGS (PRTs).

SERVS, Response Barges: 9.
- Open water barges: 5.
- Dedicated Nearshore Barge: 1.
- Lightering Barges: 1.
- Deck Barge: 1.
- Small Product Storage Barge: 1.
- Total storage capacity: More than 900,000 bbl.

SERVS, Response Centers: Chenega Bay, Cordova, Tatitlek, Valdez and Whittier.

SERVS, Skimmers: Approximately 108 skimming units.
- Skimming capacity: Ranges from greater than 2,000 bbl/ hour to small systems for operating in shallow water.
- Total recovery capacity: More than 75,000 bbl/hour.
- *Valdez Star* oil spill recovery vessel: 123-foot vessel with dynamic-inclined-plane skimming system with a design skimming capacity of 2,000 bbl/hour.

SERVS, Vessels (Other): SERVS has five vessels besides the PRTs and ETTs. These five include docking tugs and the Endurance, a utility vessel.

SERVS, Wildlife Hazing: Capture and rehabilitation plans are in place for spill response support.

SHIP ESCORT/RESPONSE VESSEL SYSTEM: See SERVS.

SLACKLINE: Oil flow that does not completely fill a pipeline.

SOIL SURVEYS, Pre-Construction:
- Bore holes: 3,500, approximately.
- Soil samples: 15,000, approximately.

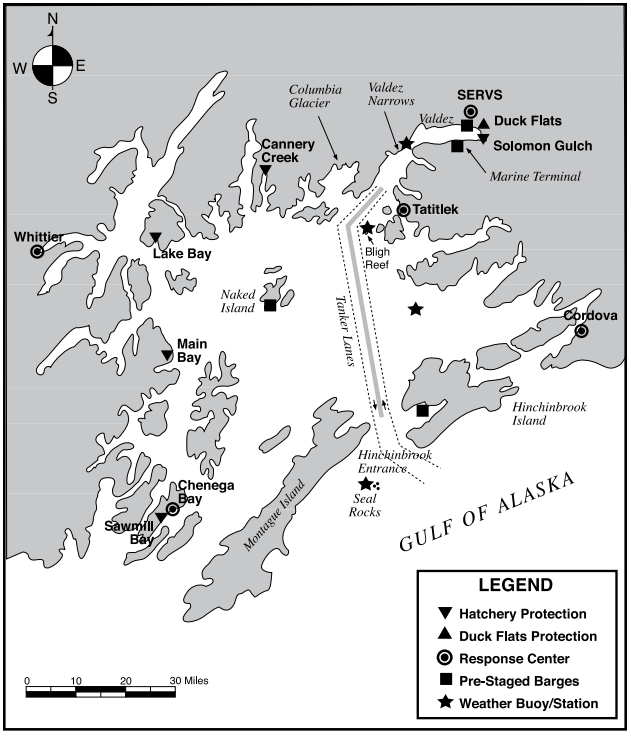
SPILLS, Reported: The table below lists the yearly totals for crude oil spills that are reported by regulation to agencies. These spills include Alyeska and shipper vessel spills that occurred on TAPS.

STRATEGIC RECONFIGURATION (SR): Strategic Reconfiguration refers to a project that today is known as Electrification and Automation (E&A). The project began in 2001 and concentrated on reducing physical infrastructure and simplifying operations and maintenance. The project's focused on creating more efficient operations while maintaining or enhancing safety, operational integrity and environmental performance. The system is modular and scalable and with flexibility for future increases or decreases in throughput. PS 9 near Delta Junction was first to receive the upgrade, and came online with new equipment in February 2007. PS 3 was next, brought online in December 2007. PS 4 came online in May 2009. PS 1 pumps came online in October 2015, and as of April 2016, some work cutover work remained at that station.

SUCTION PRESSURE: Pressure of the oil as it enters a pump station.

REPORTABLE SPILLS BY YEAR

Year	# of Spills	Amount (barrels)
1977	34	1,932
1978	24	16,013
1979	43	5,566
1980	55	3,531
1981	32	1,508
1982	30	39
1983	17	4
1984	32	78
1985	31	27
1986	40	38
1987	37	4
1988	35	14
1989	26	251,712
1990	31	6.06
1991	54	11
1992	55	19.5
1993	65	8.6
1994	44	324
1995	6	2
1996	12	814
1997	5	2
1998	5	.5
1999	4	.07
2000	3	3.9
2001	11	6,857
2002	3	.1
2003	3	.31
2004	0	0
2005	0	0
2006	3	1.33
2007	4	21.64
2008	1	.10
2009	2	.93
2010	2	2580.12
2011	4	308.39
2012	4	5.92
2013	5	1.26
2014	0	0
2015	5	5.33



Map of Prince William Sound showing tanker lanes, hatcheries and duck flats, response centers, pre-staged barge locations that contain spill response equipment, and weather buoys and stations.

TANKER VAPOR CONTROL SYSTEM: Berths 4 and 5 are fitted with vapor recovery arms to collect vapors released during tanker loading. Operation of the system began in March 1998.

TANKERS, Aids to Navigation and Safety:

- Major light house, light towers, differential GPS coverage, radar reflectors, racons, fog signals, buoys, day markers and strobe beacons.
- The U.S. Coast Guard maintains a vessel traffic service which includes radio/telephone communications with vessels, GPS-based transponder surveillance system in the Gulf of Alaska approaches and Prince William Sound, and two radar sites providing coverage in Port Valdez, the Valdez Narrows and Valdez Arm.
- Vessels are escorted through Prince William Sound.
- Ice navigation rules/restrictions and wind restrictions apply to tanker operations in the Sound.

TANKERS, Alyeska Role: The tankers that carry oil from the Valdez Marine Terminal are not owned by Alyeska. The role of Alyeska is to operate the the Terminal and SERVS on behalf of the tanker Owners. Alyeska, through SERVS, is contracted as a primary response action contractor to provide services in the event or threat of an oil spill from a tank vessel carrying crude oil that has been transported by TAPS.

TANKERS, Approach Routes:
- Gulf of Alaska to Prince William Sound to Port Valdez, via Hinchinbrook Entrance following dedicated traffic lanes to Valdez Arm and Valdez Narrows.
- Hinchinbrook Entrance: 6.4 to 6.8 miles clearance.

TANKERS, Classification:
- General purpose: Up to 25,000 dwt.
- Super tanker: 25,000 to 150,000 dwt.
- Very large crude carrier (VLCC): 150,000 to 300,000 dwt.
- Ultra large crude carrier (ULCC): More than 300,000 dwt.

TANKERS, Draft of Largest Tankers: 85 feet.

TANKERS, Escorts: Outbound laden tankers are escorted by two tugs from the terminal to Cape Hinchinbrook, a distance of approximately 77 miles, with one tug remaining on station at Cape Hinchinbrook until the tanker proceeds 17 miles into the Gulf of Alaska. One of the tugs is attached (tethered) to the tanker for the first 20 miles to provide immediate assistance if required. Inbound tankers (in ballast) are provided a standby sentinel escort from the Gulf of Alaska to the terminal. Alyeska invested more than $75 million in new escort tug technology and tug construction. The cornerstone of the 11-tug escort fleet includes two 10,000-hp Voith Schneider tractor tugs and three 10,000-hp Z-drive tugs. The tanker escort system in Prince William Sound uses best available technology in accordance with State of Alaska and federal laws.

TANKERS, Largest Berthed and Loaded to Date: 270,000 dwt.

TANKERS, Natural Phenomena Affecting Movements:
- High winds: The Valdez Narrows is closed to all tanker traffic if the winds exceed 40 knots.
- Cape Hinchinbrook: When the winds exceed 45 knots or the seas exceed 15 feet, Hinchinbrook Entrance is closed to laden tankers.
- Glacier ice: The U.S. Coast Guard Prince William Sound Vessel Traffic Center may impose ice routing measures as appropriate. These may include moveable one-way zones, daylight-only restrictions or closure to tankers (see also COLUMBIA GLACIER).

TANKERS, Number Loaded per Month: 20 average (2015).

TANKERS, Size that can be Berthed and Loaded: Berths 4 and 5: 270,000 dwt.

TANKERS, Traffic Lanes:
- Depths along: 600 to 1,000 feet average; 350 feet minimum (in Valdez Narrows).
- Distance separating: 1 mile.
- Width: 3/4 mile.
- Valdez Narrows: One-way traffic; clearance 1,000 yards from Middle Rock to southeast shore.

TELLURIC CURRENTS: Electrical currents in the earth's surface, caused by the same phenomenon that generates the Northern Lights.

THERMAL EXPANSION: Change in pipe length due to change in crude oil temperature.
- Tie-in temperature: Actual pipe temperatures at the time when final welds were made which joined strings of pipe into a continuous line.
- Hot position: Pipe at maximum oil temperature (145 F).
- Cold position: Pipe at minimum steel temperature (minus 60 F, pre-startup).
- Each 40-foot length of pipe expands 0.031 inches with each 10 F rise in temperature and contracts the same

distance with each 10 F drop in temperature.
- Longitudinal expansion of typical 720-foot straight aboveground segment from minimum tie-in temperature to maximum operating temperature: 9 inches. Note: Due to anchoring, the pipeline does not expand lengthwise but shifts laterally on the aboveground supports (see ZIGZAG CONFIGURATION).
- Maximum aboveground lateral movement:
  - Tie-in to hot position: 8 feet.
  - Tie-in to cold position: 4 feet.
- Thermal stress: Maximum 25,000 psi where belowground pipeline is fully restrained by the soil (the maximum longitudinal stress due to change in temperature from pipe temperature at tie-in to maximum oil temperature).

THROUGHPUT: The amount of North Slope crude oil transported from PS 1 to the Valdez Marine Terminal.

THROUGHPUT, Average (2015): 508,446 bbl/day, or 21,185.2 bbl/hour, or 14,830 gallons/minute.

THROUGHPUT, History: See table below.

THROUGHPUT, Maximum Daily: 1.14 million bbl average (with four pump stations operating). Rates exceeding 750,000 bbl require addition of drag reducing agent (DRA).

TOPPING UNIT: Mini-refinery that produces turbine fuel. Topping units are located at PS 6, 8 and 10, and all are ramped down. The unit at PS 10 was ramped down in 1995, the unit at PS 8 in 1996 and the PS 6 unit in 1997.

TURBINES, Fuel Requirements, Avon:
- Gas-fired units: 4.3 million standard cubic feet/unit/day, average.
- Liquid-fired units: 30,000 gal/unit/day, average, (rim cooled); 24,000 gal/unit/day, average, (non-rim cooled).

TURBINES, Power Ratings: (Sea level, 59 F):
- Avon gas generator: 24,600 exhaust gas horsepower.
- Reaction turbine: 18,700 brake horsepower (rim cooled); 15,300 brake horsepower (non-rim cooled).
- The only remaining Avon in service is located at PS 7. It is liquid only fired and used for winter recycle operation. The unit is currently set up as a non-rim cooled unit.

TURBINE GENERATORS, Electrical: PS 1 has one Siemens SGT 400 12.9 MW and one Rolls Royce 401KB7S 5 MW turbine generator. PS 3 and PS 4 each have two Siemens SGT 400 12.9 MW turbine generators. The units provide electricity to the station for essentials such as heat and lighting, as well as power for operation of the newer electrical pumps. At PS 1, both units are natural gas fired. At PS 3 and 4, one unit each is fired on natural gas only, while one unit each can be fired on natural gas or liquid (diesel) fuel. Liquid fuel is only used when the natural gas line is out of service. At PS 1, the SGT 400 is the normal turbine generator in service. The Rolls Royce-powered turbine generator is a backup, and Prudhoe-area grid power can be imported, if necessary. At PS 3 and 4, one unit at each station is normally in operation during summer months, and both units are normally in operation at each station during the winter months when pump recycle is being utilized.

The fuel consumption of a gas fired Siemens SGT 400 is about 3.5 million standard cubic feet per day at full load. The fuel consumption for a liquid fired unit operating near full load is about 20,000 gallons per day. A gas fired Rolls Royce 501KB7S running at full load consumes approximately 1.7 million standard cubic feet per day.

Year	Daily Average	Yearly Total	Cumulative Total
1977	610,408	112,315,078	112,315,078
1978	1,088,078	397,148,560	509,463,638
1979	1,282,025	467,939,079	977,402,717
1980	1,516,022	554,864,192	1,532,266,909
1981	1,523,368	556,029,380	2,088,296,289
1982	1,619,973	591,290,205	2,679,586,494
1983	1,645,699	600,680,701	3,280,266,701
1984	1,663,353	608,787,098	3,889,053,799
1985	1,780,561	649,904,636	4,538,958,636
1986	1,823,144	665,447,508	5,204,406,144
1987	1,963,770	716,776,052	5,921,182,196
1988	2,032,928	744,051,738	6,665,233,934
1989	1,884,829	687,962,558	7,353,196,492
1990	1,793,082	654,474,774	8,007,671,266
1991	1,822,4623	665,198,902	8,672,870,168
1992	1,746,969	639,390,499	9,312,260,667
1993	1,619,780	591,219,747	9,903,480,414
1994	1,587,459	579,422,667	10,482,903,081
1995	1,522,918	555,864,927	11,038,768,008
1996	1,435,971	525,565,207	11,564,333,215
1997	1,334,293	487,017,022	12,051,350,237
1998	1,206,799	440,481,529	12,491,831,766
1999	1,078,101	393,506,885	12,885,338,651
2000	999,324	365,752,587	13,251,091,238
2001	992,285	362,183,985	13,613,275,223
2002	1,000,916	365,334,233	13,978,609,456
2003	993,276	362,545,886	14,341,155,342
2004	935,108	342,249,701	14,683,405,043
2005	891,104	325,252,788	15,008,657,831
2006	759,081	277,064,405	15,285,722,236
2007	740,170	270,161,990	15,555,884,226
2008	703,551	257,499,836	15,813,384,062
2009	672,028	245,290,119	16,058,674,181
2010	619,655	226,174,050	16,284,848,231
2011	582,895	212,756,749	16,497,604,980
2012	547,866	200,518,907	16,698,123,887
2013	534,480	195,085,253	16,893,209,140
2014	513,441	187,406,088	17,080,615,228
			Data as of May 31, 2016
	534,953	81,312,836	17,347,510,779

U

ULTIMATE STRENGTH: The stress level at which the pipe will fail/rupture or "break." The ultimate strength of the steel is determined by testing during manufacture of the pipe.

V

VALDEZ MARINE TERMINAL (TERMINAL): The Terminal, the southern terminus of the trans-Alaska pipeline, is located on ice-free Port Valdez at the northeastern end of Prince William Sound. The Terminal occupies approximately 1,000 acres on the southern shore of Port Valdez. The facility was designed to load tankers and to provide the storage capacity in TAPS to allow production on the North Slope to operate without impact-related delays from the marine transportation system. The Terminal today operates with two tanker loading berths, with 14 storage tanks with a working inventory capacity of 6.6 million barrels (bbl) of crude oil.

VALDEZ MARINE TERMINAL, Cost to Build: $1.4 billion.

VALDEZ MARINE TERMINAL, Elevation: Sea level to 660 feet. All facilities except berths are 15 feet or higher.

VALDEZ MARINE TERMINAL, Emergency Shutoff Valves: Crude oil loading onto a tanker can be shut down in less than 10 seconds at loading rates up to 100,000 bbl/hour.

VALDEZ MARINE TERMINAL, Firefighting: Alyeska Pipeline's Fire/Rescue Brigade won the overall skills competition at the Alaska Fire Conference for 15 consecutive years. The team trains annually to provide on-scene fire, technical rescue and medical response to the Terminal. The fire brigade's capabilities and

equipment include:
- Fire boats: 6 (tugs equipped with firefighting equipment).
- 3 industrial fire engines; 1 Squad (rescue truck/ fire engine pumper); 1 foam tanker, 1 ambulance, 4 mobile fire response trailers.
- Personnel training: All terminal technicians trained to incipient level; advanced training for exterior and interior level fire brigade members; annual refresher for all three levels.
- Systems: Portable extinguishers, water and foam systems, Halon, NOVEC.
- The brigade performs rescue stand-by for over 2,000 confined space entries annually.
- The brigade is part of the Source Control team that provides emergency response to the pipeline.

VALDEZ MARINE TERMINAL, Fuel Requirements: All terminal and SERVS operations (fuel oil equivalent) 500 bbl/day, average.

VALDEZ MARINE TERMINAL, Holding Tanks (Crude):
- Capacity: 510,000 bbl each; 9.18 million bbl total volume.
- Dimensions: Height 63.3 feet, diameter 250 feet.
- Floor thickness: 1/4-inch steel plate (on concrete ring wall).
- In service: Fourteen.
- Number: 18.
- Roof: Fixed, conical.
- Roof supports: 61 columns, 24 inches in diameter.
- Slosh zone: 3 feet, 9 inches.
- Space enclosed: 1.2 acres each, approximately.
- Wall thickness: Graduated from 1-1/8 inch steel bottom ring, to 1/2 inch top ring.

Valdez Marine Terminal (VMT).

VALDEZ MARINE TERMINAL, Holding Tanks (Crude) Containment Dikes:
- Capacity: 110 percent capacity of both tanks, which accounts for water and snow accumulation.
- Number of tanks in each: 2.
- Reinforcing steel: 52 miles in each, diameter 1/2 to 3/8 inch.

VALDEZ MARINE TERMINAL, Stack Heights: Boiler, 300 feet; incinerators (four) 108 feet.

VALDEZ MARINE TERMINAL, Tanker Vapor Control System: See TANKER VAPOR CONTROL SYSTEM.

VALDEZ MARINE TERMINAL, Vapor Recovery: Five rotary

compressors each rate at 13,500 standard cubic feet/minute. Two compressors are dedicated to recovering vapors from storage tanks, two compressors dedicated to recovering vapors from tanker berths and one swing compressor that can provide either function.

VALDEZ NARROWS, Clearance: 1,000 yards: Middle Rock to southeast shore.

VALVE, Block: When closed, the valve can block oil flow in either direction. Block valves include manual gate valves, remote gate valves, and station block valves (suction valves and discharge valves).

- Manual gate valve: Block valve that is operated manually; placed in check valve segments periodically to provide more positive isolation than can be provided by check valves during pipeline maintenance.
- Remote gate valve (RGV): A remotely controlled block valve for the primary purpose of isolating segments of the line in the event of a catastrophic pipeline break. Valve operating times are either 4 or 8 minutes to fully open or fully close.
- Station block valve: A gate valve installed at the inlet (suction) side and the outlet (discharge) side of the pump station or terminal to isolate the facility from the pipeline in the event of an emergency.

VALVE, Check: A valve that operates one-way and prevents the reverse flow of oil. Check valves are designed to be held open by flowing oil and to drop closed automatically when oil flow stops or is reversed. To increase operating efficiency, some check valves are held fully open mechanically, thus lifting valve clappers entirely free of the oil stream, reducing turbulence. Actuators fitted to these valves receive signals from flow or pressure sensors to drop the valve clappers free. Once the clappers have been released, the actuated check valve functions as a normal check valve to stop flow reversal. Approximately one-half of the mainline check valves are fitted with hydraulic actuators. The remainder have manual actuators only.

VALVE, Pipeline:

- Check: 83.
- Gate: 71 (62 remotely operated, 9 manually operated).
- Block: 24.
- Total: 178.

VALVE, Pressure Relief: A valve designed to open automatically to relieve pressure and keep it below a designated level.

VALVE REPAIR PROGRAM: The program's goal is to evaluate the conditions of TAPS valves, actuators, and operators as appropriate and to implement a comprehensive maintenance program to ensure long-term system integrity.

VALVES, Pump Stations and Terminal:

- Size: 2 to 48 inches.
- Design pressure: Varies to meet process conditions. (Class 150# through Class 2500#).
- Type: Gate, ball, check, plug, etc.
- Number of motor-operated valves: Approximately 1,000.

VAPOR RECOVERY: See VALDEZ MARINE TERMINAL, Vapor Recovery.

VERTICAL SUPPORT MEMBERS (VSM): Pipe embedded in the ground to support the aboveground pipe in areas of

thaw-unstable permafrost. Some VSMs contain heat pipes to remove heat and keep the ground frozen.

- Number: 78,000.
- Depth embedded: 15 to 70 feet.
- Distance between: Anchor supports, 800 to 1,800 feet; standard supports, 60 feet, approximately.
- Number fitted with heat pipes: 61,000 (122,000 individual heat pipes, 2 per VSM where fitted).

VESSEL OF OPPORTUNITY PROGRAM: Alyeska Pipeline, through the Ship Escort/Response Vessel System (SERVS), contracts with more than 400 vessels around Prince William Sound to provide oil spill response support. The Vessel of Opportunity program was started in 1990, to employ local residents in oil spill response, especially those working in the fishing industry. Today, the boats and their crews are an integral part of Alyeska's response readiness. Every year, vessels of opportunity participate in rigorous training that lasts several days. Crews spend time in the classroom learning oil spill and emergency response basics. Then they head on water for hands-on experience. They work with SERVS personnel on response barges to load up their own boats with equipment, and then practice deploying boom, setting up skimmers, and rehearsing other recovery tactics. Additionally, many vessels participate in drills and exercises to ensure they are prepared to respond in case of an actual incident. Vessel Administrators have offices in Cordova, Whittier, Kodiak, Homer, Seward and Valdez.

VISUAL IMPACT STIPULATIONS:

- Access roads: 12° maximum allowable grade.
- Buffer strips (undisturbed land):
  - 300-foot width of undisturbed land along streams.
  - 500-foot width required between state highways and material sites.
  - 1/2 mile required between workpads and parks, refuges, etc.
- Right-of-way visibility: Maximum straight length permitted visible from highway: 600 feet.

W-Z

WATERFLOOD: An oil field term referring to a system of pumping water into the oil reservoir behind the produced oil to maintain reservoir pressure and ultimately recover more oil.

WELDS, Pipe:

- Double joints: 42,000 (a "double joint" is two pipe sections welded into a single length before transport to the field for placement in the line).
- Field girth welds: 66,000.
- Passes for field girth welds: 7 for 0.562-inch pipe; 6 for 0.462-inch pipe.

YIELD STRENGTH: The stress level above which the pipe will yield, bend and/or stretch.

ZIGZAG CONFIGURATION: Aboveground sections of the pipeline are built in a zigzag configuration to allow for expansion or contraction of the pipe because of temperature changes. The design also allows for pipeline movement caused by an earthquake.

Map, TAPS

The Trans Alaska Pipeline System.

history, TAPS:

The following is a chronology of significant events during operations of the Trans Alaska Pipeline System.

1968

Mar. 13 Atlantic Richfield Company (ARCO) and Humble Oil and Refining Company (now Exxon Company, U.S.A.) announce Prudhoe Bay discovery well.

June 25 Confirmation well announced by ARCO and Humble.

July 29 Pipeline field study team arrives in Alaska under authority of a transportation subcommittee of an ARCO-Humble North Slope Coordinating Committee.

Oct. 28 Atlantic Pipeline Company (a subsidiary of Atlantic Richfield), Humble Pipe Line Company (a subsidiary of Humble Oil and Refining Company), and BP Exploration U.S.A., Inc. (a subsidiary of British Petroleum Company, Ltd.) enter into an "agreement for a planning study and for engineering design and construction of the Trans-Alaska Pipeline Project."

1969

Feb. 7 Atlantic Pipeline, Humble Pipe Line and BP Oil Corporation (formerly BP Exploration U.S.A., Inc.) approve an amendment to their original agreement, electing to proceed with design and construction, and changing the name of the project to "Trans Alaska Pipeline System." The acronym "TAPS" is coined.

Feb. 10 Atlantic Pipeline, Humble Pipe Line and BP Pipeline Corporation (a subsidiary of BP Oil Corporation) announce plans to build an 800-mile trans-Alaska pipeline.

June 6 TAPS files for federal right-of-way permits over public lands.

Sept. 13 First 48-inch pipe arrives in Valdez from Japan.

Oct. 22 Humble Pipe Line, Atlantic Pipeline, and BP Pipeline are joined by Amerada Hess Corporation, Home Pipeline Company, Mobil Pipeline Company, Phillips Petroleum Company and Union Oil Company of California in joint venture.

December Road from Livengood to the Yukon River was built (winter of 1969-1970).

1970

April Lawsuits are filed by environmental groups and others to block pipeline construction.

Aug. 27 Trans Alaska Pipeline System Agreement made and signed by Atlantic Pipeline Company, BP Pipeline Corporation, Humble Pipe Line Company, Amerada Hess Corporation, Home Pipeline Company, Mobil Pipeline Company, Phillips Petroleum Company and Union Oil Company of California all referred to as "TAPS Owners."

Aug. 27 TAPS Owners form Alyeska Pipeline Service Company, a separate corporation.

Aug. 27 Agreement made to design and construct the trans-Alaska pipeline. Alyeska Pipeline Service Company appointed as contractor and agent for the construction project.

1971

Jan. 1 Atlantic Pipeline Company (TAPS Owner) stock reissued to ARCO Pipeline Company.

1973

Nov. 16 Trans Alaska Pipeline Authorization Act (TAPAA) becomes law.

1974

January Home Pipeline Company (TAPS Owner) stock reissued to six other oil pipeline companies.

Jan. 3 Federal right-of-way grant issued.

Apr. 29 Construction of road from Prudhoe Bay to Yukon River begins.

May 3 State right-of-way lease issued.

Sept. 29 Road from Prudhoe Bay to Yukon River completed.

Dec. 19 Humble Pipe Line Company (TAPS Owner) stock reissued to Exxon Pipeline Company.

1975

Mar. 27 First pipe laid at Tonsina River.

Oct. 11 Yukon River Bridge completed.

Oct. 26 Pipeline project 50 percent complete.

1977

May 20 Operating agreement established between Alyeska Pipeline Service Company (as agent) to operate and maintain TAPS on behalf of TAPS Owners.

May 31 Final pipeline weld near PS 3.

June 20 First oil flows from PS 1 (10:26 a.m. AST, pig in trap; 10:27 a.m. AST, pig depart signal).

June 24 Oil front at PS 3 (12:56 p.m.).

June 25 Oil front at PS 4 (7:50 a.m.).

June 28 Oil front at PS 5 (6:23 a.m.).

July 1 Oil front at PS 6 (6:30 p.m.).

July 4 Nitrogen leak detected ahead of oil front, MP 489.12 (near PS 8 north block valve). Oil flow stopped.

July 7 Pipe repair, MP 489.12. Pipe and elbow cracked from injection of super cooled nitrogen. Pipe replaced.

July 7 Oil front at PS 8 (9:24 p.m.).

July 8 PS 8 pump building destroyed by explosion and fire; one fatality; oil loss, 300 bbl.

July 19 Oil leak (heavy equipment accident) at CV 7, 1,800 bbl.

July 20 Oil front at PS 9 (10:37 a.m.).

July 22 Oil front at PS 10 (4:46 a.m.).

July 26 Oil front at PS 12 (3:48 a.m.).

July 28 Oil reaches the Terminal (11:02 p.m.).

Aug. 1 *ARCO M/V Juneau* departs Valdez with first oil.

1978

Feb. 15 Oil spill caused by sabotage at Steele Creek, MP 457.53, 16,000 bbl.

Feb. 16 Pipe repair MP 457.53.

March 7 PS 8 recommissioned (11:05 a.m.).

1979

June 10 Oil leak caused by pipe settlement at MP 166.43, Atigun Pass, 1,500 bbl.

June 13	*ARCO M/V Heritage*, 1,000th tanker to load.
June 15	Oil leak caused by pipe settlement at MP 734.16, 4,000 bbl.
June 19	Pipe repair, MP 734.16.
July 1	First commercial injection of DRA into pipeline at PS 1.
Aug. 18	Curvature pig (super pig) stuck in line at CV 29.
Sept. 25	CV 29 opened; stopple and bypass installed; curvature pig removed.
Oct. 2	PS 2 commissioned.
October	Yukon River Bridge opened.

1980

Jan. 22	One billionth barrel arrives at the Terminal.
Feb. 11	Oil leak from leaking valve at the Terminal east tank farm, 3,200 bbl.
May 12	Oil leak from relief tank valve, 238 bbl.
Sept. 20	Monument to pipeline construction workers dedicated at the TERMINAL .
Dec. 1	PS 7 commissioned.
Dec. 29	*M/V Thompson Pass*, 2,000th tanker to load.

1981

Jan. 1	Oil leak from drain connection failure at CV 23, 1,500 bbl.
Nov. 10	Two billionth barrel arrives at the Terminal.
Dec. 15	First Kuparuk field oil delivered to PS 1.

1982

June 7	RGV 121A, uncommanded closure.
June 19	*M/V Philadelphia*, 3,000th tanker to load.
June 20	5th anniversary of TAPS operations.

1983

July 21	Three billionth barrel arrives at the Terminal.
Nov. 8	*M/V Tonsina*, 4,000th tanker to load.

1984

Mar. 20	Removal of stuck scraper pig at CV 4 and relocation of pig trap from PS 5 to PS 4.
Nov. 1	Removal of stuck pig at PS 10.

1985

Jan. 11	*M/V Overseas Boston*, 5,000th tanker to load.
Mar. 11	Four billionth barrel arrives at the Terminal.
Apr. 22	MP 200 final tie-in of 48-inch permanent reroute (404.7 feet added to total pipeline length); reroute due to pipe settlement.
Nov. 2	Milne Point field start-up.
Nov. 9	Two primary generators damaged by fire in generator room at PS 1.

1986

Mar. 5	*ARCO M/V Sag River*, 6,000th tanker to load.

Apr. 18	Union Oil Pipeline Company (TAPS Owner) becomes Unocal Pipeline Company.
Sept. 15	Five billionth barrel arrives at the Terminal.
Nov. 18	"Tee" damaged by scraper pig at PS 10. Tee replaced.
Dec. 15	Lisburne field start-up.
Dec. 24	Sohio Pipeline Company (TAPS Owner) becomes Sohio Alaska Pipeline Company.

1987

Apr. 1	First high-definition corrosion pig run.
Apr. 19	*M/V Atigun Pass*, 7,000th tanker to load.
June 20	10th anniversary of TAPS operations.
Sept. 29	Buckled pipe replaced, Atigun Pass, MP 166.4.
Oct. 3	Endicott field start-up.

1988

Jan. 1	BP Pipelines, Inc. (TAPS Owner) merged into Sohio Alaska Pipeline Company (TAPS Owner).
Jan. 14	Highest daily throughput of 2,145,297 bbl.
Feb. 16	Six billionth barrel arrives at the Terminal.
May 2	*Chevron M/V Mississippi*, 8,000th tanker to load.
September	PS 2 pump manifold pipe replacement project complete.
October	Atigun Pass releveling project, MP 167; pipe settled due to erosion of ground below.

1989

Jan. 3	Oil spill, *M/V Thompson Pass*, 1,700 bbl; crack in vessel's hull.
Mar. 1	Sohio Alaska Pipeline Company (TAPS Owner) becomes BP Pipeline (Alaska), Inc.
Mar. 24	*Oil spill, M/V Exxon Valdez*, 250,000 bbl; vessel runs aground at Bligh Reef.
May 27	*Texaco M/V Florida*, 9,000th tanker to load.
June 1	First ultrasonic corrosion pig run.
June 30	Seven billionth barrel arrives at the Terminal.
July 10	Ship Escort/Response Vessel System (SERVS) established for oil spill prevention and response in Prince William Sound.
August	Feasibility study for Atigun floodplain pipe replacement project done to replace 8.5 miles of mainline pipe between MP 157 and 165.5.

1990

Feb. 8	Alyeska and Regional Citizens' Advisory Council (RCAC) signed contract.
June	Construction complete on the Terminal incinerator repair project.
June 12	Deadleg repair/replacement, PS 1.
July 31	*Exxon M/V New Orleans*, 10,000th tanker to load.
Aug. 25	1,000th SERVS escort.
September	PS 3 corrosion repair; station temporarily bypassed.
September	Construction begins on 8.5-mile Atigun Floodplain Pipe Replacement Project.

Sept. 15	Project to inspect, recoat, and reinsulate 1,600 feet of insulated buried mainline pipe between MP 167.3 and 167.5 complete.
December	First shipment of pipe for Atigun Floodplain Pipe Replacement Project arrives in Valdez.

1991

Jan. 1	Eight billionth barrel arrives at the Terminal.
Feb. 28	ARCO Pipeline Company (TAPS Owner) becomes ARCO Transportation Alaska, Inc.
March	Concrete biological treatment tanks (BTT) placed in service at the Terminal.
September	Atigun Floodplain Pipe Replacement Project completed (MP 157-165.5).
Oct. 2	*M/V Overseas Boston*, 11,000th tanker to load.
Oct. 14	2,000th SERVS escort.

1992

January	Floor of crude oil storage Tank 5 at the Terminal replaced and cathodic protection installed.
April-May	Corrosion repairs to 2.5-mile section of pipe in the Chandalar Shelf.
June	First run of inertial pipeline pig.
June 20	15th anniversary of TAPS operations.
July 7	Nine billionth barrel arrives at the Terminal.
July 30	Full-scale aerial dispersant test in Prince William Sound.
Aug. 7	RGV 73 uncommanded closure, overpressuring the pipeline.

September	Tank 111 at PS 1 returned to service after bottom replacement project complete.
October	Recoating of superstructure for Berths 3 and 4 at the Terminal completed.
December	Completion of new roof for 40,000-square-foot dissolved air flotation (DAF) building at the Terminal.
Dec. 10	Fuel gas line (north of the Brooks Range) re-leveling project complete.
Dec. 28	*ARCO M/V California*, 12,000th tanker to load.

1993

Jan. 1	3,000th SERVS escort.
Jan. 20	Petro Star Refinery on-line in Valdez.
March	Construction of new tug dock at the Terminal complete.
June	PS 10, desalter for pretreating topping unit crude feed put in service.
June	PS 9, mainline pump no. 3 converted to half-head operation.
September	Recoating of the TERMINAL Berth 5 superstructure complete.
October	Completion of inspection, repair and recoating of last of 10 storage tanks at the Terminal. This completes the initial inspection of all major storage tanks at the Terminal.
Dec. 10	Fuel gas line pig launcher installed at MP 34.

1994

March	Tank 209 at PS 10 leaks 3,500 gallons of residual oil in tank farm.
Mar. 5	10 billionth barrel arrives at the Terminal.
May 13	*ARCO M/V Texas*, 13,000th tanker to load.
June 18	4,000th SERVS escort.
July 5	Alyeska selects method of tanker vapor control at the Terminal.

1995

Mar. 9	Valdez Emergency Operations Center/Escort Response Base opened.
Mar. 30	Alyeska employees work one million consecutive hours without a lost-time accident.
April	Alyeska completes major electrical improvement project (ANSC) line-wide.
May 24	PS 8 topping unit shut down.
Oct. 20	Alyeska and U.S. Department of Interior sign new Alaska Native Utilization Agreement.
Oct. 26	PS 7 idled for maintenance, three months.
December	Alyeska completed construction on new otter rehabilitation facility.
Dec. 12	11 billionth barrel arrives at the Terminal.
Dec. 31	*ARCO M/V Juneau*, 14,000th tanker to load.

1996

January	5,000th SERVS escort.
Apr. 20	Oil leak at CV 92 discovered, 800 bbl released.
Apr. 25	CV 92 leak repair begins.
June 30	PS 8 placed in ramped down status.
July 1	PS 10 topping unit placed in ramped down status.
August	Pressure pulsations felt in Thompson Pass created by slackline condition.
Sept. 17	Alyeska investigates pipe vibrations near pipeline MP 776.
Nov. 27	Alyeska responds to evidence of hydrocarbons detected by soil probes near MP 776; no spill found.

1997

January	Exxon Pipeline Company (TAPS Owner) becomes ExxonMobil Pipeline Company.
January	Temporary back-pressure system installed at the Terminal to stop pressure pulsations in Thompson Pass.
Jan. 1	Phillips Alaska Pipeline Corporation (TAPS Owner) stock reissued to Phillips Transportation Alaska, Inc.
June 20	20th anniversary of TAPS operations.
July 1	PS 2 placed in ramped down status.
Aug. 5	6,000th SERVS escort.
Aug. 8	PS 6 topping unit placed in ramped down status.
Aug. 12	*M/V Overseas Juneau*, 15,000th tanker to load.
Oct. 2	Permanent back-pressure control system operational.
Dec. 1	12 billionth barrel arrives at the Terminal.

HISTORY, TAPS

1998

Mar. 19 Tanker vapor control system brought into full operation at the Terminal.

Sept. 25-26 Pipeline shut down for 28 hours, 40 minutes to repair CV 122 and replace RGV 80.

Oct. 15 Alyeska and U.S. Department of Interior renew Alaska Native Utilization Agreement.

1999

Jan. 27 *Nanuq*, enhanced tractor tug, arrives at Valdez to join SERVS' fleet.

May 21 7,000th SERVS escort.

May 22 *Tan'erliq*, enhanced tractor tug, arrives at Valdez to join SERVS fleet.

June 26 *ARCO M/V Spirit*, 16,000th tanker to load.

July 10 10th anniversary of SERVS.

Sept. 11 Pipeline shut down for 25 hours, 49 minutes to replace RGV 60.

2000

February *M/V Alert*, prevention/response tug, arrives at Valdez to join SERVS' fleet.

April Pipeline movement at MP 170.

Apr. 27 13 billionth barrel arrives at the Terminal.

May *M/V Attentive*, prevention/response tug, arrives at Valdez to join SERVS fleet.

June Scraper pig removed seat ring from CV 74.

June 30 Mobil Alaska Pipeline Company (TAPS Owner) stock reissued to Williams Alaska Pipeline Company, LLC.

July *M/V Aware*, prevention/response tug, arrives at Valdez to join SERVS' fleet.

Aug. 1 ARCO Transportation Pipeline Company (TAPS Owner) stock reissued to Phillips Transportation Alaska, Inc.

Summer Extensive rebuilding of Berth 4 at the Terminal.

Sept. 16 Pipeline shut down to replace CV 74 and the M-2 valve at PS 9.

Oct. 7 Shutdown to test remaining valves needed to complete the five-year test program for all mainline valves.

2001

July 11 *M/V Polar Endeavor*, first Millennium class double-hull tanker, arrives at the Terminal.

July 19 8,000th SERVS escort.

Summer Extensive renewal of Berth 5 at the Terminal.

Aug. 21 SERVS receives Distinguished Achievement award in recognition of outstanding third-party oil spill response to the grounding of the *F/V Windy Bay* in Prince William Sound.

Sept. 22 *M/V Marine Columbia*, 17,000th tanker to load.

Sept. 22 Pipeline shut down for mainline valve maintenance and integrity test and performance evaluation of two 48-inch mainline RGVs.

Oct. 4 Bullet hole at MP 400 leaks 258,000 gallons of oil. More than 178,000 gallons recovered and reinjected into the pipeline.

Oct. 25	Alyeska and U.S. Department of Interior renew Alaska Native Utilization Agreement.
November	TERMINAL Tank 94 raised 2 feet (ballast water tank, 250-foot diameter).
Nov. 2	First oil from Northstar field received at PS 1.
Nov. 9	*Chevron M/V Mississippi*, final tanker load after 30 years of service and 1,002 sailings, all ports (432 from the Terminal).

2002

June 20	25th anniversary of TAPS operations.
July 25	Pipeline shut down to replace RGV 39.
Aug. 1	Valdez Marine Terminal office building dedication.
October	Phillips Transportation Alaska, Inc. (TAPS Owner) becomes ConocoPhillips Transportation Alaska, Inc.
Oct. 10	Laden tanker Kenai assisted by escort vessels when mechanical problems developed at Hinchinbrook Entrance.
Oct. 30	Main firewater distribution line at the Terminal relined.
November	TERMINAL tank 93 raised two feet (ballast water tank, 250-foot diameter).
Nov. 3	7.9 earthquake at MP 588. Damaged shoes and VSM crossbeams repaired and replaced. No oil spilled.
Nov. 26	State of Alaska renews pipeline right-of-way for 30 years.

2003

Jan. 20	14 billionth barrel arrives at the Terminal.

April	Alyeska Pipeline receives the American Petroleum Institute's 2002 Environmental Large Operator Award and recognition for improved safety performance (29 percent reduction in OSHA recordables over a three-year period).
July 23	9,000th SERVS escort.
Oct. 10	*M/V Marine Columbia*, 18,000th tanker to load.

2004

Mar. 31	Williams Alaska Pipeline Company, LLC (TAPS Owner) stock reissued to Koch Alaska Pipeline Company, LLC.
April	Alyeska Pipeline receives the American Petroleum Institute's 2003 Environmental Large Operator Award and recognition for improved safety performance (47 percent reduction in OSHA recordables over a three-year period).

2005

April	Alyeska Pipeline receives the American Petroleum Institute's 2004 Environmental Large Operator Award (no Pipeline Performance Tracking System (PPTS) releases).
Dec. 14	10,000th SERVS escort.
Dec. 21	15 billionth barrel arrives at the Terminal.

2006

April	Alyeska wins the American Petroleum Institute's Distinguished Environmental and Safety Award, API's highest recognition for a pipeline operator. Alyeska

also received the 2005 Environmental Large Operator Award (zero releases).

Apr. 11 *M/V Kodiak*, 19,000th tanker to load.

August Smart pig run from PS 1 to PS 4, successful.

September Smart pig run from PS 4 to the Terminal, not successful due to wax build up. Rerun scheduled for March 2007.

Dec. 22 Scraper pig 67 came apart in line at PS 7.

2007

Jan. 9 Pipeline restarted after leak on bypass piping stopped.

Feb. 9 Alyeska starts up new pumps at PS 9, the first station to receive upgraded equipment.

March Smart pig launches at PS 4.

Mar. 22 Smart pig completes review of TAPS.

May 14 Project work at PS 3 stabilizes pipeline.

June 20 30th anniversary of TAPS operations.

Nov. 1 TAPS crews wrap up repairs to storm damage to right-of-way.

Dec. 17 New pumps started at PS 3: Second station to receive upgraded equipment.

2008

Jan. 23 Operations Control Center begins 24/7 operations in Anchorage.

Feb. 7 BWT successfully connects to vapor recovery system, substantially reducing the risk of fire and explosion associated with flammable vapors in the tanks, and also eliminating a major source of emissions at the Terminal.

Apr. 3 Alyeska installs pressure containing sleeve to repair areas of external corrosion near PS 1.

June 28-29 Pipeline shut down to replace RGV 72.

Aug. 13 Alyeska wraps up cathodic protection project near Valdez.

Aug. 16-17 Pipeline shut down for routine maintenance, including pig trap replacement at the Terminal.

Aug. 19 SERVS assists *F/V Northern Mariner* that went aground on northeast side of Flemming Island.

Nov. 5 Federal Transportation Worker Identification Credential (TWIC) program implemented at the Terminal.

2009

Jan. 28 11,000th SERVS tanker escort.

April Alyeska receives 2008 American Petroleum Institute's Distinguished Operator Award (Large Operator), among the oil industry's top honors and reserved for pipeline operators that demonstrate excellence in safety, environment and integrity. Alyeska also won API's Distinguished Environment and Safety award for the fifth consecutive year.

May 21 New pumps started at PS 4: Third station to receive upgraded equipment.

July 10 SERVS marks 20th anniversary.

HISTORY, TAPS

2010

April Alyeska is awarded the 2009 American Petroleum Institute's award for top environmental performance in 2009.

2011

May 12 Alyeska Pipeline Service Company employees and contractors reach a major safety milestone: 10 million hours without a Day Away From Work Case (DAFWC).

July 2011 An Alyeska team completes the Low Flow Impact Study, a $10 million project designed to study and evaluate operational risks related to declining throughput.

Sept. 21 TAPS receives the 2011 Outstanding Environmental Engineering Geologic Project Award from the Association of the Environmental and Engineering Geologists.

2012

Jan. 9 Alyeska Pipeline Service Company receives a legislative citation for its response to the January 2011 booster pump piping leak at Pump Station 1.

March 16 Alyeska Pipeline wins a World's Most Ethical Companies Award from the Ethisphere Institute.

April The Alaska Legislature honors Alyeska Pipeline with a legislative citation for its Alyeska's World's Most Ethical Company award.

May Alyeska receives the Most Improved Projects Process Award for small projects (between $2-10 million) from Independent Project Analysis.

June 6 SERVS celebrates 12,000 tanker escorts.

June 20 Alyeska reaches its 35th anniversary of operations..

August 2 The 35th anniversary of first tanker leaving Valdez.

2013

March 5 Alyeska wins a World's Most Ethical Companies Award from the Ethisphere Institute for the second year in a row.

July Koch withdraws as TAPS owner.

2014

March 20 Alyeska wins a World's Most Ethical Companies Award from the Ethisphere Institute for the third year in a row.

August 13 17 billionth barrel arrives at Valdez Marine Terminal.

2015

February Vessel of Opportunity Program, managed by Alyeska's SERVS team, wins the Ocean Leadership Award from the Alaska SeaLife Center.

March At Governor's Health & Safety Conference, Alyeska wins a Governor's Safety Award of Excellence.

March 9 Alyeska wins a World's Most Ethical Companies Award from the Ethisphere Institute for the fourth year in a row.

December Alyeska finishes year with best safety performance on record, with Alyeska employees and contractors working a combined 5,827,988 hours with just four recordable injuries.

2016

March 7 Alyeska wins a World's Most Ethical Companies Award from the Ethisphere Institute for the fifth year in a row.

May 7 SERVS escorts 13,000th outbound laden tanker, the *Polar Endeavor*.

repairs, major:

Following is a chronology of major TAPS repair and project work since 1977:

1977

July 7 MP 489.12: Approximately 20 feet south of north block valve at PS 8; damage to 30° elbow and pipe from injection of super cooled nitrogen ahead of oil front during oil-in. Replaced with new elbow and two 6-foot pumps. Pipe reburied.

July 8 MP 489.24: Pump building at PS 8 destroyed in an explosion and fire; pipeline undamaged. Pump building was replaced and recommissioned on March 7, 1978.

September MP 388.00: North of Lost Creek; two bullet indentations. Covered with 48-inch diameter 3-foot welded split-sleeve.

1978

February MP 457.53: Steele Creek; 1-inch diameter hole (sabotage). Covered with 48-inch diameter, 22.5-inch bolted split-sleeve; subsequently covered with welded sleeve.

1979

June MP 166.43: North side Atigun Pass; hairline crack caused by buckle. Covered with 56-inch diameter, 6-foot welded split-sleeve; 19 steel supports installed. Pipe reburied.

June MP 734.16: 1 mile north of PS 12; hairline crack caused by buckle in pipe. Covered with 56-inch diameter, 6.1-foot welded split-sleeve; seven steel supports installed. Pipe reburied.

September MP 157.62 to MP 157.65: Instrument pig ("super pig") lodged in line at CV 29. Stopple and bypass installed, valve bonnet lifted, pig removed. Pipe reburied.

October MP 166.41: North side Atigun Pass; buckled pipe. Covered with 56-inch diameter, 6-foot welded split-sleeve. Pipe reburied.

1980

April MP 449.96: Indentation, possibly from bullet. Covered with 48-inch diameter, 18-inch welded split-sleeve.

May MP 159.70: Construction damage from backhoe during monitor rod installation. Covered with 48-inch diameter, 3.6-foot welded split-sleeve. Pipe reburied.

June MP 416.00: Approximately 2 miles south of PS 7; pipe settlement. Approximately 430-foot excavation; eight steel supports installed. Pipe not reburied.

August MP 752.00: Flash flood, 900 feet of overburden washed out; no damage. Pipe reburied.

November MP 720.00: Pipe settlement. Approximately 200-foot excavation; pipe lifted and concrete slurry added beneath pipe. Pipe reburied.

1981

No major repairs.

1982

April MP 168.40: South side Atigun Pass; pipe settlement. Approximately 300-foot excavation; concrete slurry added beneath pipe. Pipe reburied.

August MP 166.03: North side Atigun Pass; pipe buckle. Covered with 56-inch diameter, 6.5-foot welded split-sleeve. Pipe reburied.

1983

March MP 730.29: Pipe settlement. Approximately 102-foot excavation; nine concrete river weights removed, concrete slurry added beneath pipe. Pipe reburied.

April MP 200.24: Dietrich River channel; pipe buckle. River channel redirected temporarily; approximately 125-foot excavation; 56-inch diameter, 6-foot welded split-sleeve installed; five specially designed steel supports installed. Pipe reburied.

October MP 45.97: Pipe settlement. Approximately 200-foot excavation; concrete slurry added beneath pipe. Pipe reburied.

1984

March Removal of scraper pig stuck at CV 4 and relocation of pig trap from PS 5 to PS 4.

November Removal of stuck pig at PS 10.

1985

January MP 200: Temporary bypass tie-in, pipe settlement.

April MP 200: Final tie-in of 48-inch permanent reroute (404.7 feet added to total pipeline length, April 22). Reroute due to pipe settlement.

1986

Oct. 10 Steele Creek: Permanent welded sleeve installed over bolted split sleeve.

Nov. 18 PS 10: Replaced "Tee" damaged by stuck scraper pig.

1987

Aug. 25 Mechanical damage covered with 3-foot welded sleeve.

Sept. 29 MP 166.41 to 166.43: Atigun Pass. Replaced 234 feet of buckled pipe.

1988

No major repairs.

1989

January 30 sleeves installed for corrosion repairs.

1990

January 86 sleeves installed for corrosion repairs.

Nov. 23 MP 172.62: Dent covered by 6-foot welded sleeve.

Dec. 3 Mechanical damage covered with bolted clamp, later covered with a split "Tee" (part of Atigun floodplain pipe replacement project).

1991

January 18 sleeves installed for corrosion repairs.

Mar. 8 MP 779.47: Mechanical damage covered by 4-foot welded sleeve.

Apr. 6 MP 756.80: Mechanical damage covered by 4-foot welded sleeve.

September MP 157-165.5: Atigun Floodplain Pipe Replacement Project (FPRP) completed. Permanent reroute of 8.5 miles of mainline pipe due to corrosion.

1992

No major repairs.

1993

June 6 MP 775: Mechanical damage covered by 3-foot welded sleeve.

1994

July 22 CV 9: Bypass spool replaced and drain line repaired.

July 30 CV 86: Bypass and drain line repaired.

Sept. 30 CV 74: Drain line repaired.

1995

Mar. 15 CV 55: Replaced actuator.

June 8 CV 89: Replaced actuator.

July 14 RGV stem leak repaired.

Sept. 15 Extended Chena Hot Springs Road casing.

1996

Apr. 25 CV 92: Replaced bypass line.

1997

Feb. 8 Wilbur Creek: Installed "armadillo" sleeve; repair due to corrosion.

June 20 MP 775.75: Mechanical damage covered by 2.5-foot welded sleeve.

Oct. 9 MP 799.68: Corrosion repair covered by 4.8-foot welded sleeve.

1998

Mar. 19 Tanker vapor control system startup at the Terminal.

Sept. 25 Replaced RGV 80 and repaired CV 122.

1999

Apr. 26 MP 652: Two sleeves installed for corrosion repair.

Sept. 11 RGV 60: Replaced.

2000

May 26 MP 170: Completed reset and repair of tripped anchors, a result of the collapse of vapor pocket after pipeline restart.

June 1 MP 710.76: Mechanical damage covered by two, 2-foot welded sleeves.

Sept. 16 PS 9: Replaced CV 74 and M-2 valve.

2001

Sept. 22 Pipeline shut down for mainline valve maintenance and integrity test, and performance evaluation of two, 48-inch mainline RGVs.

Oct. 4 MP 400: Bullet hole repaired with hydraulic clamp. Clamp later replaced with a threaded O-ring fitting.

2002

July 10 Set full-close limit switches on valves along pipeline; changed out three valves in gas building at PS 3.

July 27 RGV 39: Pipeline shut down to replace valve.

Nov. 3 MP 588: Repaired or replaced damaged shoes and VSM crossbeams from 7.9 earthquake.

2003

July 18-19 Set full-close limit switches on RGVs; other pump station work.

Aug. 8-12 Set full-close limit switches on RGVs; other pump station work.

Aug. 15 Performed maintenance and tests on selected RGVs; OCC special commands.

Sept. 10-12 Set full-close limit switches on RGVs; other pump station work.

2004

July 10-11 Pig trap valve replacement at PS 4; set full-close limit switches on valves along pipeline.

Aug. 16-17 Tie-in work at PS 1 and PS 3 for Strategic Reconfiguration; performed maintenance and tests on selected RGVs; OCC special commands.

2005

June 19-20 Pig trap valve replacement at PS 4, due to factory defective valve installed in 2004. Installed new mainline CV at PS 7.

July 23-24 Tie-in work at PS 9 for Strategic Reconfiguration. Ramped down and isolated PS 12 and replaced mainline through the station. Isolated all buildings at PS 12 for future demolition/salvage.

2006

July 22-23 Isolated PS 10 from the mainline and installed a mainline 48-inch CV inside the manifold building. Replaced the 48-inch mainline check valve 109 located on the south bank of the Klutina River. Both these scopes were accomplished in the 36-hour shutdown.

October Flooding in the Valdez area causes extensive damage to ROW, state highway and most bridges in the southern 60 miles of the pipeline right of way. Repairs continued through 2007.

2007

No major repairs.

2008

June 28-29 Replaced RGV 72 and removed the Tees for SR configuration at PS 9.

Aug. 16-17 1,700 feet of bypass pipe installed at PS 2, permanently disconnecting PS 2 from TAPS.

2009

June 20-21 Replaced 62,000 pound valve at PS 3 used to redirect crude flow inside the pump station. Enhanced leak protection or mainline valves at PS 1.

July Removed dual functionality Tees from PS 3 suction and discharge headers, isolating the legacy pump building at PS 3 for future demolition/salvage. This leaves only the new electric drivers to move oil at this location. Also replaced 62,000 pound M2 valve and decommissioned Turbine Fuel Tank 137 from service at PS 3.

2010

June 19-20 Replaced M1 and S2 valves at PS 4.

July Removed dual functionality Tees from PS 4 suction and discharge headers, isolating the legacy pump building at PS 4 for future demolition/salvage. This completes the transition to the new electric drivers to move oil at this location. Decommissioned Turbine Fuel Tank 147 from service at PS 4.

Nov. 29-Dec. 11 Pump Station 5 Pig 99 incident.

2011

Jan. 8-20 PS 1 Booster Pump Building spill to containment resulted in two back-to-back shutdowns as crews engineered and installed aboveground bypass piping.

2012

June 1-2 Leading Edge Flow Meter modifications at Pump Stations 3 and 4; Mainline RGV stem seals replaced on three Remote Gate Valves; updates to PS11 Safety Integrity Pressure Protection System (SIPPS).

August Pump Station 6 straight pipe project completed.

2013

March 15 In-Line Inspection Tool launched from Pump Station 1, gathering data critical to Alyeska's integrity management program.

March 26 In-Line Inspection Tool re-launched from Pump Station 4 to Valdez, continuing effort to gather integrity management data.

June 8 Mainline valves along pipeline tested during 18-hour shutdown, ensuring performance as part of Alyeska's suite of tools for protecting TAPS and the environment.

July 26 Straight pipe project completed at Pump Station 10 during planned 6-hour shutdown.

August 9 Mainline valves along pipeline tested during 18-hour shutdown.

2014

June 20-21 During 24-hour major maintenance shutdown, crews perform power system modifications at PS1, isolate below-ground piping at PS3, perform power switch installation at PS4, test all mainline valves between Atigun Pass and PS5, and inspect power substation at PS9.

July 16 First crawler pig run conducted, testing potential of new technology to inspect segments of TAPS facility piping.

Aug. 29-30 During 36-hour major maintenance shutdown, teams tested all mainline valves between PS1 and 3, returned below-ground piping to service at PS3, installed two valves at PS5, removed suction relief dead-leg piping at PS7, and conducted SIPPS testing and work.

Sept. 14 Pig launcher installed at Pump Station 9, expanding Alyeska's ability to pig TAPS in smaller segments.

Nov. 14 Berth 4 overhaul completed.

2015

January Portable diesel-fired crude oil heater installed at Remote Gate Valve 65 for contingency heat during winter operations to help manage temperature during declining throughput volumes and mitigate ice accumulation incoming to Pump Station 7.

June 12-13 Replaced pig launcher valves at PS1; isolated belowground piping at PS4 to use new technology to conduct internal integrity inspection; tested all mainline valves between Isabel and Thompson passes to confirm valve sealing capability.

shutdowns, pipeline:

The following is a chronology of scheduled long-duration maintenance shutdowns and major unplanned shutdowns after oil first reached Valdez. For additional information on other shutdowns, contact Alyeska Pipeline.

1977

Aug. 2	40 min	Equipment malfunction.
Aug. 15	110 hr, 11 min	PS 9 sump overflow.
Sept. 20	59 min	Equipment malfunction.
Oct. 9	4 hr, 14 min	Producer shutdown.

1978

Jan. 10	4 hr.	Equipment malfunction.
Jan. 16	4 hr, 22 min	Equipment malfunction
Feb. 15	21 hr, 31 min	Sabotage, Steele Creek.
May 6	7 hr, 18 min	Equipment malfunction.

1979

June 10	53 hr, 37 min	Atigun Pass leak.

1980

May 12	3 hr, 37 min	PS 10 crude tank valve leak
Oct. 17	5 hr, 16 min	Scheduled maintenance.

1981

Jan. 1	15 hr, 38 min	CV 23 leak.

1982

Dec. 22	12 hr	Equipment malfunction.

1984

Mar. 20	57 hr, 40 min	Scraper pig stuck at CV 4. PS 4 trap relocation.

1985

Jan. 21	66 hr	MP 200 bypass tie-in.
Apr. 22	20 hr, 40 min	MP 200 final reroute tie-in of 48-inch pipe (404.7 feet added to total pipeline length).
Nov. 9	10 hr, 15 min	PS 1 explosion and fire.

1986

Sept. 26	31 hr, 50 min	Removed scraper pig at PS 10.
Nov. 18	16 hr, 54 min	Replaced "Tee" at PS 10.

1987

Sept. 29	24 hr, 6 min	Atigun Pass pipe replacement.

1989

Feb. 26	1 hr, 31 min	Power failure at PS 1.

SHUTDOWNS, PIPELINE

	32 min	PS 1 block line.
Oct. 20	5 hr, 16 min	Repair corroded pipe at MP 144.2.

1990

Mar. 21	4 hr, 10 min	PS 3, broken valve 320.
June 12	12 hr, 39 min	PS 1, valve D2 pipe replacement.

1992

Aug. 7	1 hr, 49 min	Uncommanded closure of RGV 73, electric short.

1994

Apr. 15	24 hr, 28 min	Replace 002 valve at Valdez and troubleshoot segment 4 RGVs.
Apr. 18	7 hr, 57 min	Work on PS 4 systronics master panel.

1995

Sept. 11	15 hr, 45 min	Scheduled maintenance.
Sept. 12	4 hr, 51 min	Completion of scheduled PS 2 maintenance.

1996

May 6	21 hr, 45 min	Scheduled maintenance.
July 12	10 hr, 25 min	Scheduled maintenance, preparations for PS 8 and PS 10 rampdown.
Aug. 1	8 hr, 40 min	Scheduled maintenance as part of ramping down PS 8 and PS 10.
Aug. 6	11 hr, 2 min	Schedule maintenance as part of ramping down PS 8 and PS 10.

1997

June 26	5 hr, 44 min	Communications failure with RGVs in segment 12.
Aug. 1	17 hr, 49 min	Scheduled maintenance for PS 2 and PS 6 rampdown preparation.
Aug. 8	19 hr, 29 min	Placed PS 6 in ramped down status.

1998

May 18	5 hr, 9 min	PS 1 in-rush vapor test and vibration test of the Terminal incoming relief piping.
Aug. 14	5 hr, 4 min	Communications failure, segment 10.
Sept. 25	28 hr, 40 min	Valve maintenance, replaced RGV 80 and repaired CV 122.

1999

Sept. 11	25 hr, 49 min	Valve maintenance, replaced RGV 60, tested 46 mainline valves and completed 165 other maintenance tasks.

SHUTDOWNS, PIPELINE

Nov. 13	8 hr, 6 min	Planned maintenance and autologic testing.

2000

Sept. 16	29 hr, 39 min	Planned line-wide maintenance shutdown.
Oct. 7	7 hr, 31 min	Planned line-wide shutdown for maintenance of mainline valve leak test.

2001

Sept. 22	21 hr, 4 min	Planned maintenance shutdown.
Oct. 4	60 hr, 30 min	Bullet puncture (sabotage) at MP 400.

2002

July 27	29 hr, 57 min	Planned maintenance shutdown to replace Remote Gate Valve 39.
Nov. 3	66 hr, 33 min	7.9 earthquake at MP 588.

2004

Jan. 24	5 hr, 51 min	Communications failure at valve 972.
July 10-11	31 hr, 36 min	Planned maintenance shutdown, including replacing two pig launcher valves at Pump Station 4.

Aug. 16	17 hr	Planned maintenance shutdown to install new infrastructure at pump stations 1 and 3, replace two pig trap valves and perform RGV maintenance and testing.

2005

June 19	35 hr, 42 min	Planned maintenance shutdown to install infrastructure at Pump Station 4 to prepare the station for Strategic Reconfiguration project, replace two pig trap valves at Pump Station 4 and install a 48-inch mainline check valve at Pump Station 7.
July 23	32 hr, 32 min	Planned maintenance shutdown to prepare Pump Station 9 for electric pump motors and install straight line pipe at Pump Station 12.

2006

July 22-23	36 hr	Planned maintenance shutdown. Replaced CV 109, and performed additional maintenance tasks.
Oct. 10	9 hr, 45 min	Communication failure at RGVs 117, 118, 119, 121 and 121A, due to flooding between PS 12 and the Terminal.
Nov. 15	16 hr, 25 min	Shutdown due to high inventory in Valdez.

Nov. 17	6 hr, 8 min	Shutdown due to high inventory in Valdez and problems at PS 4.
Nov. 18	22 hr, 30 min	Shutdown to build inventory at PS 1.

2008

June 28	28 hr, 49 min	Planned maintenance shutdown.
Aug. 16	35 hr, 37 min	Planned maintenance shutdown to install 1,700 feet of new 48-inch mainline pipe at Pump Station 2 and replace a pig trap at the Valdez Marine Terminal.

2009

June 20-21	33 hr, 58 min	Planned maintenance shutdown to remove unused pipe and replace a valve at Pump Station 3, test new equipment at Pump Station 4 and do leak protection work on valves at Pump Station 1.
July 18	36 hr, 30 min	Planned maintenance shutdown to install a pig launcher at Pump Station 8.

2010

May 25	79 hr, 38 min	Pump Station 9 crude tank 190 relief event/overfill.
June 19	33 hr, 58 min	Scheduled maintenance shutdown to install new aboveground piping connection to Kuparuk at Pump Station 1, and to disconnect legacy piping and replace two large valves at Pump Station 4.
July 31	31 hr, 35 min	Scheduled maintenance shutdown to replace a valve at Pump Station 9, replace gas supply lines to the pump station 3 and 4 turbine generators, and replace 6-inch bypass piping on a CV at Pump Station 1.

2011

Jan. 8	85 hr, 10 min	Booster pump piping leak at Pump Station 1 (restarted on interim basis).
Jan. 15	62 hr, 49 min	Installation of bypass piping at Pump Station 1.
Jan. 8-15	147 hrs. 59 min	Total duration of combined Jan. 8 and Jan. 15 shutdowns.
July 16	33 hr, 23 min	Scheduled maintenance shutdown to replace valves at Pump Station 4 and the installation of straight line pipe at Glennallen Response Base (Pump Station 11).

SHUTDOWNS, PIPELINE

Here is a closer look at long-duration maintenance shutdowns and unplanned shutdowns during the past 5 years.

2012

June 2	17 hrs, 42 min	Scheduled maintenance shutdown for mainline valve testing between pump stations 5 and 7 and SIPPS work at Pump Station 11.
July 28	18 hrs, 28 min	Scheduled maintenance shutdown.

2013

June 8	18 hrs, 46 min	Scheduled maintenance shutdown for main line valve testing, SIPPS upgrades at Pump Stations, fuel gas system work at Pump Station 3.
August 12	19 hrs, 20 min	Scheduled maintenance shutdown for valve testing in segments 7 to 9, SIPPS upgrades, work at PS04 & 05 and suction header work at PS09.

2014

June 20	21 hrs, 45 min	Scheduled maintenance shutdown for valve testing at Pump Station 5, legacy cut over at Pump Station 1 and installation of pig crawler blinds at pump station 3.
Aug. 29-30	36 hrs, 5 min	Scheduled maintenance shutdown for valve testing at Pump Stations 1 and 3, removal of pig crawler blinds at pump station 3, valve installation at Pump Station 5 and deadleg removal at Pump Station 7.

2015

June 12-13	36 hrs, 6 min	Scheduled maintenance shutdown for Pump Station 1 pig launcher valve replacement, mainline valve testing between Isabel Pass and Thompson Pass, isolation of crawler pig relief at Pump Station 4.
Aug. 21-22	33 hrs, 49 min	Scheduled maintenance shutdown for valve testing at Pump Stations 3 and 4, Pump Station 1 cutover from MCC to E&A, Pump Station 5 RGV-40 replacement.

2016

April 20	8 hrs, 52 min	Pipeline shut down due to fire at Pump Station 5's Tank 150 during inspection of tank pressure/vacuum vents.

For additional information on shutdowns, contact Alyeska Pipeline.

notes

Notes