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State of Oregon
Department of Environmental Quality — Memorandum

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To: Port of Portland,
Swan Island, Portland Shipyard
ECSI No. 271

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Subject: Port of Portland, Swan Island Ship Repair Yard
Portland, Oregon
File Review Memo

INTRODUCTION AND BACKGROUND

The Portland Shipyard (PSY) is located on Swan Island on the north side of the Willamette River north of downtown Portland (approximately 2.5-miles downriver of the Broadway Bridge, see Figure 1). The PSY is located at latitude 45°34' and longitude 122°43'30" in township T1N range R1E south-1/2 Section 17 and north-1/2 Section 20. The PSY is located between Willamette River Mile 8 and 9 in the Portland Harbor (Figure 2). The address of the PSY is 5555 N Channel Avenue.

The PSY occupies most of the north, west, and south perimeter of Swan Island, and consists of 94-acres of upland property (Figure 3). The SRY also includes Berth 311 located on the north side of Swan Island Lagoon[1]. The PSY property also includes approximately 106-acres of submerged lands (Figure 3). The PSY is the largest industrial facility on Swan Island, and is owned by the Port of Portland (Port). As of January 1, 1996, Cascade General, Inc. (Cascade General) has been responsible for all operations, maintenance, tenant management, and environmental permitting and reporting. A number of other businesses operate on Swan Island in addition to the PSY. Some of the other larger facilities on Swan Island include: Freightliner Corporation, Boise Cascade, DSU Peterbuilt and GMC Inc., Mack Trucks, Inc., C. H. Murphy Company, Pacific Detroit Diesel Allison Company, and Cummins Engine Company.

The PSY is zoned IH (heavy industrial), and the land use of the surrounding properties is also industrial. The PSY is bordered to the south by the vacant Northwest Marine property, bordered to the west and north by the Willamette River, and to the east by Swan Island Lagoon (Figure 3). Some of the larger facilities across Swan Island Lagoon on the mainland include: U. S. Coast

[1] Berth 311 consists only of the concrete pier/lay berth with two access points constructed on wooden pilings. There is no upland area associated with Berth 311.

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Guard facility, U. S. Navy facility, United Parcel Service, Fred Devine Diving and Salvage, Land O' Lakes/Cenex, Lynden Farms, Oregon Freightways, and OK Delivery Systems (Figure 3).

The Port is planning to enter DEQ's Voluntary Cleanup Program (VCP) under the Intergovernmental Agreement between the Port and DEQ. The Port is negotiating the possible sale of the PSY to Cascade General. The Port will lead the contemplated studies required to determine the extent of soil, groundwater, and sediment contamination and to evaluate and complete remedial actions, if any, needed to obtain a No Further Action determination from DEQ. Cascade General will provide input to the Port, as needed, on these issues and will be responsible for compliance with Oregon's regulations. The Port plans to either continue work under the Intergovernmental Agreement or enter into a Formal Agreement with DEQ to conduct a Remedial Investigation/Feasibility Study (RI/FS). The scope of the RI/FS will be described in detail in a Work Plan to be appended to the Formal Agreement.

Several documents were reviewed for the preparation of this memo including DEQ Water Quality, Air Quality, and Hazardous and Solid Waste files. A list of documents reviewed is provided as Attachment 1.

HISTORICAL SITE OPERATIONS

Swan Island was a low-lying island in the middle of the Willamette River prior to development. The Port bought the island in 1922 and shortly after undertook dredge and fill operations which, filled the perimeter of the island, created a landbridge to the mainland, and increased the size and elevation of the island. The Port began construction of Portland's first airport on Swan Island in 1926. The airport operated on Swan Island until approximately 1941.

After closure of the airport, the island was largely vacant until March 1942 when the Port leased the PSY to the U.S. Maritime Commission. The Maritime Commission then contracted with Kaiser Company, Inc. for the acquisition, construction, and operation of a shipyard facility. The Kaiser Company built sanitary and storm drainage lines (discharging to the Willamette River), an electrical distribution system, and potable water system as part of site redevelopment during World War II. Kaiser received a permit from the U.S. Engineers Office in 1942 to dredge a basin to accept the 14,000-ton dry dock (currently Dry Dock 1). The war-time ship building operations were located at the present site of the PSY's Building 4. Ships were launched between the present location of Dry Dock 3 and 4 (Figure 3). During World War II nearly 150 Type T2 tankers were built at the facility. Shipbuilding at the facility boomed, reaching a maximum production rate of one launch per week during the war.

With the end of World War II, shipbuilding efforts largely stopped. After the war, Kaiser used the facility for ship repair and other industrial purposes until 1947. Kaiser was required to remove debris and structures from the site at the termination of the lease.

The assets of the property were declared surplus by the War Assets Administration (successor to the Maritime Commission) and were advertised for sale nationally in February 1947. The Federal government began leasing building and property space in October 1947. Tenants used

the building and property for a variety of purposes including:

- ship dismantling;
- steel fabrication/steel storage;
- manufacturing;
- printing;
- chemical, paint, insulation, roofing supply, and war surplus storage;
- service station; and
- general office space.

The U.S. General Services Administration sold all improvements and transferred Swan Island back to the Port of Portland in December 1949. During 1948 and 1949 the Port rebuilt much of the facility and constructed a new pier. In 1950, the Port began operations of a ship repair facility known as the Swan Island Ship Repair Yard. Along with the conversion from a shipbuilding facility to a ship repair yard, the Port planned to develop much of Swan Island into an industrial park.

The Port added dry dock and ship repair facilities to the existing shipyard along the north end of the island in the late-1940's and 1950's. A large utility tunnel and Substation 1 were constructed in 1957 when the original boiler was installed. Construction of additions and new structures continued at the PSY during 1960's and early 1970's. The airport terminal was demolished in 1964.

In 1972 Port contractors installed an air barrier within the Swan Island Lagoon. The air barrier provided diffused air in an underwater curtain to contain floating oil and debris in the lagoon. Once contained the materials were skimmed from the water surface. The air barrier was later taken out of operation because it was not effective in controlling floating oil and debris.

The original ballast water treatment plant was installed in 1973 and included heating tanks, API oil/water separators, and lined finishing ponds. A large employee parking lot was constructed in the south-central portion of the site in 1977.

In 1978, the Port dredged a basin in preparation for the installation of Dry Dock 4. Maintenance dredging was also conducted in 1978 in the vicinity of Dry Dock 1 and 3. Berths 312, 313, 314, and 315 were constructed along the river-side of Swan Island in 1978. Dry Dock 4 was installed in 1979. In 1979, the PSY also underwent further modification with the expansion of the original ballast water treatment plant.

In August 1988, the Port leased the 20-acre N. Channel Avenue Fabrication Site (Fabrication Site, Figure 3) to ARCO for the fabrication of oil production facility modules to support oil exploration activities in Alaska. ARCO used the site until approximately spring 1990. Fabrication activities included: welding, finish painting, application of fire retardant, pipe hydrotesting, x-ray examination of equipment, and equipment and parts storage.

Dry Dock 2 was not used after 1985, and was decommissioned and sold in 1990. Additional maintenance dredging was performed near Dry Docks 1, 3, and 4 in the 1990's.

During 1995, Cascade General was awarded the operations contract for the PSY. Starting on January 1, 1996, Cascade General took over all operations, maintenance, tenant management, and environmental responsibility, including permit and reporting responsibilities for the PSY. A description of current activities at the PSY is presented in section entitled CURRENT SITE OPERATIONS.

HISTORIC DREDGING AT THE PSY

Prior to the Port's first development of Swan Island, the main channel of the Willamette River flowed on the northeast side of the island. With the development of Swan Island in the 1920's, a new river channel was established in its modern position, southwest of the island. Much of the near-surface and shallow soils of Swan Island are the materials dredged from establishing the new river course.

The Port abandoned most of the Kaiser shipways in the 1950's and used the five southernmost shipways (nos. 4, 5, 6, 7, and 8) for dredge material disposal until 1957. Dredging to support the installation of Dry Dock 3 occurred in 1957. The old shipways areas were completely filled by 1962. A summary of historic dredging activities at the PSY is presented as Table 1. More than 266,000 cubic yards of sediment have been dredged from the PSY since the 1960's.

Extensive dredging of the Willamette River navigation channel northwest of Swan Island, of the Swan Island Lagoon, and of the navigation channel south of Swan Island occurred in the 1960's. Significant quantities of dredge spoils from the navigation channel, along with smaller quantities from Pier A (Berth 301); Berths 303, 304 and 305; and Pier C (Berths 309 and 310), were used to fill portions of Mocks Bottom. Dredged materials removed from Dry Dock 4 in the late-1970's may have also been used as fill in Mocks Bottom. From 1980 to about 1989, dredged materials from the PSY and other locations were used to fill the south end of Swan Island Lagoon (also referred to as the "old west channel") to its current configuration.

Dredging activities continued into the 1990's at the three dry docks. The Dry Dock 1 basin was last dredged in 1992, over 50 years after the dry dock was constructed. The Dry Dock 3 basin was last dredged in 1994, some 13 years after it was dredged in 1981. The Dry Dock basin 4 was last dredged in 1992, some 14 years after it was first dredged in 1978. No berths have been dredged from between 1991 and 1998.

The Port estimated sedimentation rates at the dry dock to range between 0.3 to 0.5 feet/year at Dry Docks 1 and 3 and between 0.4 to 0.7 feet/year at Dry Dock 4. The Port notes that Best Management Practices implemented starting in the early 1990's reduced the rate of sedimentation in the dry dock basins. The Port also notes that most sedimentation occurs during major flood events, like the February 1996 flood.

Nearly 130,000 cubic yards of dredge material were removed from Dry Dock 1, 3, and 4 since Fall 1992[2]. The sediments removed during these dredging projects were analyzed using dredge material testing guidelines and the State Characteristic Hazardous Waste and Pesticide rules. The dredge material was found to be unacceptable for unconfined in-water disposal. It was accepted for confined in-water disposal and placed in the contained in-water disposal area at Ross Island (Willamette River mile 14-16). Water quality monitoring was conducted during dredging and disposal operations to monitor the migration of disturbed material.

INDUSTRIAL PROCESS DESCRIPTION

The shipbuilding and ship repair industries use a wide variety of manufactured components in addition to basic construction materials. Both industries apply similar manufacturing practices, processes, facilities and support shops. Most ship yards contain the following facilities: dry docks; ship building positions; piers and berthing positions; workshops (e.g., machine, electrical, pipe, assembly, paint and blast, carpenter, and sheet metal shops); work areas (e.g., steel storage, platen lines, and construction areas); warehouses, utility services, and offices.

Ship Repair Process

Ship repair processes typically include: ship conversions, overhauls, maintenance programs, damage repair and equipment repair. Typical maintenance and repair operations include:

- Blasting and repainting the ship's hull, freeboard, superstructure and interior tanks and work areas.
- Major rebuilding and installation of machinery such as engines, turbines, pumps, generators, pump stations.
- System overhauls, maintenance, and installation (e.g., flush piping system, testing, and installation).
- System replacement and installation of new systems such as navigational, communication, etc.
- Propeller and rudder repairs, modification, and alignment.
- Creation of new machinery spaces through cut outs of existing steel structures and additional of new walls, stiffeners, etc.

Shipbuilding and Ship Repair Support Shops and Services

Common shipbuilding and ship repair yard support shops and services include:

- Pipe Shop- The pipe shop(s) is responsible for manufacturing and assembling piping systems. Some of the processes occurring in a pipe shop include: welding, pipe bending and cutting, flux removal, blasting, pickling, painting, galvanizing, and pressure testing.
- Machine Shop- The machine shop(s) serves the entire yard's machining needs, and perform functions ranging from rebuilding pumps to turning propeller drive shafts.
- Sheet Metal Shop- The sheet metal shop(s) is generally responsible for fabricating and installing ductwork. The shop cuts, shapes, bends, welds, stamps, and paints sheet metal.

[2] Cited historic dredging quantities and dates are based on contracted values. The Port advises the actual values are as follows: approximately 17,000 cubic yards were dredged from Dry Dock 1 in 1992, approximately 78,500 cubic yards were dredged from Dry Dock 4 in 1992, and approximately 21,000 cubic yards were dredged from Dry Dock 3 in 1994. Thus the total quantity of dredged material removed from the three dry docks since the Fall of 1992 was approximately 116,500 cubic yards.

- Electrical Shop- The electrical shop(s) typically installs, rebuilds, builds and tests electrical components and equipment. Electrical shops generally have plating tanks, lacquer dip tanks, and electrical and specialized testing equipment.
- Plate Shop- Plate shops are typically areas and processes in the ship yard that provide steel parts cutting, bending and sub-assembly. The types of machinery commonly found in the plate shops are cutting machines, steel bending machines, shearing machines, presses, hole punching equipment, and furnaces for heat treatment.
- Production Service Shops- Production service shops provide: carpentry, scaffolding erection, crane operations, rigging, facility and equipment maintenance, and other production support activities.
- Utility Service- Some ship yards include on-site facilities for utility generation and distribution such as steam, fuel, electrical substations, etc.

Based on information from the Port and Cascade General staff, the following support activities occurred at the PSY: painting, surface preparation, welding, metal fabrication, metal machining, electrical repair, carpentry, pipe fitting, engine and boiler repair, propeller repair, hot dip cleaning with caustics, steam cleaning, truck repair, and utility services. The Port advises there is no information to support that the activities occurred at the PSY: pipe pickling and galvanizing, plating, or lacquer dipping.

Raw Material Inputs and Pollutant Outputs at Ship Yards

Raw material inputs to the shipbuilding and repair industry are primarily steel and other metals, paints and solvents, blasting abrasives, and machine and cutting oils. In addition, a wide variety of chemicals are used for surface preparation and finishing such as solvent degreasers, acid and alkaline cleaners, and cyanide and metals bearing plating solutions. Pollutants and wastes generated typically include volatile organic compounds (VOCs), particulates, waste solvents, oils and resins, metal bearing sludges and wastewater, waste paint, waste paint chips, and spent abrasives. The major shipyard activities that generate wastes and pollutants are presented in Table 2.

The Port advises there is no information indicating metal plating occurred at the PSY. Therefore, the Port does not believe cyanide, metal-bearing plating solutions, and the generation of metal bearing sludges and wastewater should be a concern at the PSY.

CURRENT SITE OPERATIONS

The current operations at the PSY consist of ship repair and ship maintenance of privately owned and government vessels from the United States and overseas. Ship repair and maintenance are conducted in the three dry docks and 15 berths located along the perimeter of the PSY. The upland areas of the PSY house the support services for both ship repair operations and maintenance of the facility infrastructure.

The Port advises that currently, raw materials and products used for ship repair are bought to the PSY by truck. Most of the raw materials and products are delivered directly to the dry docks and berths where work is being performed. The remaining raw materials and products are delivered to Cascade General's procurement group for distribution and delivery to buildings for centralized

distribution. Paints are delivered and stored in the Paint Inventory Warehouse located in Building 72. They are distributed, as needed, to the dry docks, Building 73, or several small structures next to Building 73. Empty paint containers are stored in the Consolidation Yard south of Building 73 and then managed offsite by a permitted waste recycler. Abrasive blasting material is delivered directly to one of two hoppers (one near Berth 305 and one near Building 73). From the hoppers, the abrasive blasting material is placed in blast pots and used to remove paint from metal surfaces. Used abrasive blasting material is recovered with vacuum bottles or is swept up and then placed in 20 cubic yard drop boxes for subsequent management offsite by a recycler. Procurement purchases and distributes small quantities of solvents on an as needed basis to machine shops and other locations throughout the PSY. Waste materials from these shops and from vessels are placed in barrels or containers that are labeled and transferred to the Hazardous Waste Storage Area for subsequent management offsite by permitted waste haulers.

Sand Blasting and Painting Operations

One of the primary activities at the PSY is sand blasting and repainting the hull of ships in dry dock. Most of the sand blasting at the PSY takes place in the dry docks. A subordinate amount of parts and equipment sand blasting occurs at berths and in upland areas of the facility. Sand blasting is the most common method for paint removal and surface preparation. Five hundred to 600 tons of sand blast grit are typically used on a large ship. Iron slag, copper slag, coal slag, steel grit and steel shot are common blasting abrasives. The grit is tested before and after use to determine the leachability of the metals. Metallic abrasives are available in varying ranges of hardness and size. Air nozzle blasting (or dry abrasive blasting) is most commonly used at the PSY.

The Port estimates that about 25 percent of the abrasive blasting conducted at the PSY occurs at the dry docks. Curtains are placed around each dry dock, while in use, to prevent airborne dust, debris, and grit from entering the river. The remainder occurs at berths (mainly interior blasting of tanks) and several upland locations. Upland abrasive blasting of parts and equipment is conducted in or near Building 73. Based on input by the Port and Cascade General, copper slag has been the principal blasting abrasive used at the PSY. Steel shot is also used as an abrasive material, mainly inside vessels and in a blast booth in Building 73.

Prior to 1985, the dry docks were not thoroughly cleaned prior to sinking. However, the Port reports that most of the abrasive blast material was generally removed for operational purposes before every sinking. Prior to 1993, the dry docks were thoroughly cleaned prior to every third sinking. Starting in 1993, thorough dry dock cleaning was conducted prior to every sinking. Currently, dry dock cleaning consists of the removal of all loose debris, equipment, and materials. The dry dock is then swept and the abrasive blasting material is removed from the deck. The dry dock is then visually inspected by the dockmaster before it is lowered into the river.

The current National Pollutant Discharge Elimination (NPDES) permit for the PSY requires analyses of surface water runoff and used sandblast from the dry docks. Table 3 summarizes analyses of used sandblast and surface water runoff from the dry dock at the PSY from 1985 through 1993. Samples of the used sandblast have also been analyzed for leachable metals.

The used sandblast also contained materials (i.e., mainly paint) from the hull of ships cleaned by sand blasting. Table 4 summarizes EP Toxicity test results from used sandblast samples collected in 1985 and 1988.

Historically, the majority of painting occurred at berths or in upland areas. Currently, the majority of the painting at the PSY takes place in the dry docks. A smaller amount of painting occurs in upland areas at the facility, particularly in the vicinity of Building 73 (Paint Booth). A paint shed was also located at Berth 305. Five thousand to 10,000 gallons of paint are typically used on a larger ship. Facility operations typically use over 200,000 gallons of paint annually. Paint generally is delivered to the PSY in 5-gallon buckets and stored at the Paint Warehouse (Building 72).

Dry Docks

The U. S. Navy built Dry Dock 1 in Vancouver, Washington in 1941, and moved it the PSY in 1942. Dry Dock 1 is currently leased by the Port, and has operated in its current location since its installation at Swan Island.

Dry Dock 2 was built in 1921 and purchased by the Port for the St. John's Ship Yard. Dry Dock 2 was moved to the PSY around 1950. Dry Dock 2 received ships until 1984, and was decommissioned and removed from the PSY in 1990.

Dry Dock 3 was constructed in approximately 1959 and placed into operation at the SRY in 1961. Dry Dock 3 has operated in its present location since its installation at Swan Island.

Dry Dock 4 was built in Japan and installed at the PSY in 1979. Dry Dock 4 is the largest floating dry dock on the West Coast and is 982 feet in length. Dry Dock 4 has also operated in its present location since its installation at Swan Island.

Berths

A network of 15 berths or lay-up areas is located alongside the PSY's riverbank on both the Willamette River and Swan Island Harbor side of the island. The berths are outfitted with 16 electrically-powered cranes in a variety of sizes and lift capacities. The cranes operate on tracks that are laid along the berths and allow them to move between berths. The berths are also used for maintenance that does not require lifting the vessel out of the water. This includes cleaning tanker vessel tanks, engine maintenance, outfitting, deck and tank painting, and other activities.

Fabrication

Steel fabrication of ship parts takes place mainly in Building 4. Building 4 contains 10 bays, where pipefitting, carpentry and other fabrication work is performed.

Ballast Water Treatment Facility-

The Ballast Water Treatment Plant (BWTP) is an on-shore aboveground storage and treatment facility for oily water generated by ships. The BWTP began operations in 1979 and receives ballast water only from ships being serviced at the PSY. The ballast water is

approximately 90% water and 10% crude oil or other petroleum products. Some ballast water contains elevated concentrations of metals. The BWTP consists of four cookers, six oil/water separators, and four reclaimed oil tanks. The total storage and processing capacity is approximately 200,000 barrels. The BWTP is completely self-contained and diked, including a floating containment boom on the water side.

Ballast water and oil are received by the BWTP via trucks and pipes originating from the dry docks and berths. The truck loading and unloading area is located adjacent to the treatment plant and is surrounded by a concrete berm. Any spills associated with truck transfer to the BWTP should be contained and processed in the plant. Concrete berms surround ballast headers at the dry docks and berths. Ballast water transfer from ships to the collection system is first outlined and reviewed for compliance with federal and local regulations.

The ballast water goes through a settling and skimming process, then is heated in the cookers and additional oil is skimmed and the water goes through an API separator. The water is then conveyed to a holding tank and sampled. If the water in the holding tank meets the permit requirements, then it is discharged to the Willamette River via an Outfall 001 at Berth 313. If the water in the holding tank does not meet the permit requirements, then it is discharged to the sanitary sewer. The acceptably treated ballast water is discharged to the river approximately once a month. The treated ballast water that does not meet permit requirements is stored and discharged to the City's sanitary sewer system approximately once a year.

Oil recovered from the skimming and treatment processes is stored in holding tanks, periodically tested and sold to recyclers. Residual sludge in the BWTP tanks is removed and concentrated with a sludge press. The partially dewatered sludge is disposed of offsite.

Discharges to the river from the BWTP are monitored under the NPDES permit for flow, oil and grease, pH, and total suspended solids.

Prior to 1979, ballast water was conveyed to two in-series ponds which were skimmed for oil and discharged to the river. The two ponds were located in the footprint of Building 72.

Stormwater Treatment System

In 1996 and 1997 new facilities were installed at the PSY to collect and treat contaminated stormwater collected from the three dry docks. Prior to the installation of these facilities, sand blast, paint chips, and other pollutants generated during repair operations all entrained in stormwater ran off the dry docks into the Willamette River. The new facilities, placed into full operation in 1997, allow the contaminated stormwater runoff from the dry docks to be pumped into a holding tank, treated, and then discharged to the river.

The stormwater treatment system consists of a 100,000-gallon holding tank, water clarification, pH adjustment, and filtration using a sand filter. The treated effluent is discharged to the Willamette River via Outfall 002. The line conveying treated stormwater and treated water from the BWTP converge and combine into one outfall at Berth 313.

The stormwater treatment system accepts only wastewater generated at the dry docks. Three types of wastewater are generated at the dry docks: 1) process wastewater (e.g., water from ship repair and maintenance), 2) stormwater, and 3) non-maintenance and non-repair wastewater (e.g., non-contact cooling water, bilge water, domestic wastes). The stormwater treatment system accepts process wastewater and stormwater, but not the third type of wastewater.

Permitted Outfalls

The PSY runs eight permitted outfalls to the Willamette River, identified as Outfalls 001 through 008 in the NPDES Permit (Figure 4). A detailed discussion of the outfalls and the NPDES Permit can be found in the section of this memorandum titled "REGULATORY HISTORY/ISSUES".

Prior to the latest modification of the NPDES Permit in 1997, three permitted outfalls existed at the PSY. With the 1997 modification, two of the three outfalls were abandoned. One of the two abandoned outfalls was located east of Dry Dock 3 and carried backup compressor cooling water. The second of the two outfalls was located adjacent to Berth 302 and carried backup condenser water and boiler blowdown. These two outfalls were abandoned due to the replacement of the old boilers and compressors with new models that did not discharge water.

Stormwater Drains and Outfalls

On-site stormwater is collected by an extensive network of catch basins, oil/water separator and pipelines that discharge to the Willamette River and Swan Island Lagoon in a series of over 45 outfalls (Figure 4). The City of Portland's stormwater system, which collects runoff from the remainder of Swan Island, conveys stormwater from the area surrounding the southern portion of Building 4. The discharge for this stormwater pipeline is located near Berth 314.

Stormwater falling inside the BWTP area containment dike is routed to the rainwater sump. The sump is controlled by floats that activate the sump pump at a specified high-water level. From the rainwater sump, stormwater is pumped to the rainwater tank in the northwest corner of the BWTP before treatment.

Utility Service

Utility services provided to the PSY from off-site sources include: electricity, natural gas, water, sanitary sewer disposal, telephone, and fiber optic lines. Utility services provided to the PSY from on-site sources include: compressed air, steam, and oxygen. The Central Utility Building (CUB) provides steam and compressed air for the facility. Two boilers are used to generate steam for distribution through a network of above and underground pipes for use on ships and at the Ballast Water Treatment Plant. Four 600 horsepower air compressors are used to generate compressed air for use throughout the facility.

Fuel for the CUB boilers consists of natural gas and Bunker C. Natural gas is the primary fuel, and is supplemented by Bunker C mainly during interruptions of gas service during peak demand periods. Bunker C is stored in two steel 20,000-gallon capacity steel underground storage tanks located adjacent to the north side of the CUB.

Utility stations for all services are found at numerous locations along all dry docks and berths for hookup of the vessels and support for maintenance activities.

There are five main electrical substations at the PSY. They were constructed between 1950 (Substation 1) and 1989 (new Substation 5). Substation 1 is located near Building 60 and contains three transformers, none of which contain PCBs. Substation 3 is located near the head of Dry Dock 1 and contains two silicon-filled transformers. Substation 4 is located north of Building 10 and contains one silicon-filled transformer. Substation 5 is located west of Building 10 and contains two silicon-filled transformers. Substation 6 is located near Berth 305 and contains two transformer, neither of which contain PCBs.

A utility tunnel is located between the BWTP and Berth 313. Compressed air, steam, and water lines are located in the tunnel.

Card Lock Fuel System (Facility 496)

Two 6,000-gallon double-wall fiberglass underground storage tanks were installed in a nested pit in 1989 at the southwest corner of Building 63. The tanks hold diesel and gasoline, and are used to fuel site equipment and vehicles.

Hazardous Waste Management

Two hazardous waste accumulation and storage area are located at the PSY. The first area is located south of Building 73, and is used for consolidating paint wastes. The second area is located adjacent to Berth 305 and is used for the storage of all hazardous waste generated at the PSY. Both areas are paved with asphalt or concrete, are bermed, and are enclosed by cyclone fence.

Small Container Shed

Three small container storage areas exist at the PSY. The three areas do not store hazardous waste.

- Oil Storage Shed- Up to 30 drums are stored in the oil storage shed next to Berth 305. The drums contain lubricating oil used for crane maintenance.
- Chemical Storage Shed- The chemical storage shed is located next to the CUB and contains products used for boilers, compressors, and cooling water.
- Machine Shop Storage Shed- The machine shop storage shed is used to store petroleum products and antifreeze used in the machine shop.

Best Management Practices

The Port and their primary contractors completed a series of operational improvements and Best Management Practices (BMPs) starting in 1987 designed to prevent contaminants from

entering the water or contaminating the land. These BMPs were revised and expanded in the 1990's. Some of the more important BMPs implemented at the PSY include:

- BMP certification and training,
- Recycling and waste minimization,
- Risk evaluation,
- "No Dumping" policy,
- Hazardous waste management training,
- Catch basin control and cleanup,
- Dry dock cleaning before every submerging,
- Grit material and paint over spray containment,
- Collection of high pressure wash and blast water,
- Sanitary waste disposal,
- Containment booms,
- Oily bilge water and ballast water management,
- Dry dock stormwater collection and treatment,
- Yard worker awareness,
- General yard cleanup and yard sweeping,
- Designated paint mixing areas,
- Over water protection,
- Abrasive blast grit storage and disposal,
- Liquid discharges to dry dock floors, and
- Aquatic protection while raising dry docks.

ENVIRONMENTAL SETTING

Topography

The site is essentially flat with minor crowning toward the center of the island to encourage drainage. Much of the site is paved with the exception of the 22-acre industrial fabrication yard along the south side of the island and the 34-acre filled area at the south end of the Swan Island Lagoon.. The elevation of the PSY is 40-feet above mean sea level. Portions of the PSY are within the 100-year flood plain.

Regional and Local Geology

The Port of Portland's PSY is located near the western boundary of the Portland Basin. The nearby Portland West Hills, Tualatin Mountains, and Portland Hills fault mark the western edge of the basin. The PSY is underlain by fill, fine sand, and silt. Fill materials are largely dredged materials. Up to 20-feet of mainly fine-grained sandy fill materials were placed on Swan Island. A portion of these dredged materials came from the Willamette River starting in 1923 when the Port relocated the main navigation channel to the west side of Swan Island and raised Swan Island to an elevation of 32 feet above mean low water. Dredged materials were also placed on the north end of the PSY in the 1950's when the Port installed Dry Docks 2 and 3.

The sandy dredge fill is underlain by silty and fine-grained sand alluvium to a depth of approximately 100-feet bgs. The alluvium is underlain by differentially cemented

conglomerates, sandstones and siltstones of the Tertiary-aged Troutdale Formation/Sandy River Mudstone. The Troutdale Formation is expected to occur beneath the site at a depth of at least 100-feet bgs, but is laterally discontinuous in the area and may first occur at a greater depth. The Troutdale Formation/Sandy River Mudstone is expected to be over 300-feet thick in the area, and underlain by the Tertiary Columbia River Basalt Group.

Soils

The near surface soils at the PSY are composed of silty and sandy alluvium and local dredge material. The U.S. Soil Conservation Service's Soil Survey of Multnomah County classifies the shallow soil at the PSY as "Urban Land, 0 to 3 percent slopes".

Sediments

River sediments in the vicinity of the PSY can be divided into four distinct regimes based on the Port's 1998 sediment investigation:

1) Willamette River Side of the PSY- Sediments are generally sandy. There is some physical disturbance of near-surface sediments and there is surface dwelling benthos. These conditions appear consistent with the fact that river currents are higher in the main river channel.

2) Dry Dock Area- Sediments consist of silts. There is considerable physical disturbance of near-surface sediments and there is surface dwelling benthos. These conditions appear consistent with the fact that river currents are expected to be lower in this area allowing for the deposition of finer sediments and that these sediments are highly disturbed by ship traffic and the movement of the dry docks.

3) Swan Island Lagoon- Sediments are generally soft and unconsolidated. There is limited evidence of physical-disturbance and the benthos are surface dwelling. These conditions appear consistent with the negligible flow through the lagoon allowing for the accumulation of finer-grained sediments.

4) Downstream of the PSY- Sediments consist of layers of very fine sands and silts. There is little physical disturbance and there are deep-dwelling benthos. This area appears to be physically stable because river currents are low and the impacts of boat and ship traffic are limited because the water is deep.

Hydrogeology

Groundwater occurs at a depth of between 17 to 21-feet bgs beneath the PSY. Groundwater depth changes with the seasons and can be influenced by river stage. Both the Troutdale Formation and the Columbia River Basalt Group are significant aquifers in the region. The Willamette River is a major regional discharge body for groundwater.

The Port reports two components control groundwater flow beneath the site. One component is parallel to and in the same direction as streamflow in the Willamette River. The second component is laterally outward from the center of the island to the Willamette River and Swan Island Lagoon.

Groundwater elevations fluctuate with changes in both seasonal precipitation and river levels.

Willamette River and Portland Harbor

The Portland Harbor (Figure 2) represents the final reach of the Willamette River just upstream of the confluence with the Columbia River. Historic dredging made the river channel deeper and wider. Most of the harbor's river bank has been stabilized and heavily developed by mainly industrial operations. Streamflow throughout the Willamette Basin is largely dominated by seasonal patterns of rainfall. The Corps of Engineers estimates that the average annual discharge into the Portland Harbor is 33,000 cubic feet per second with the high flow period (November through April) accounting for 60- 90% of the annual flow.

The water surface elevation in the Portland Harbor fluctuates daily due to tidal influences of the Columbia River. Water velocities in the Portland Harbor are low compared to other reaches of the river; and average 0.33 feet per second and range from 0.16 to 0.56 feet per second.

Most of the suspended sediments carried into the Portland Harbor by the river are fine-grained silts and clays, as opposed to the coarser-grained sands found in the Columbia River. In their 1998 "Portland Harbor Sediment Data Review", the Port concluded bed load transport in the Portland Harbor is considered negligible due mainly to channel dimensions, bed material, and water velocities. Possible bed load suspended load transport will be further investigated by DEQ in a proposed harbor-wide study.

The sediment transport capacity of the Willamette River within the Portland Harbor may be relatively low due mainly to low water velocities. Despite the suspected low transport capacity, sedimentation rates during most of the year tend to be low because suspended sediment concentrations are low. In addition, the suspended sediments tend to be silts and clays, which have a tendency to remain in suspension.

Given the low transport capacity of the river in the harbor, sediments deposited on the bottom tend to remain there and not be transported to other locations. However, several areas of the Portland Harbor are subject to active sedimentation which are controlled mainly by hydraulic factors. One of these areas of active sedimentation is the north end of Swan Island by the PSY dry docks. Sedimentation occurs in the dry dock area because water velocities are lower than they are in the main river channel. A significant percentage of the sediment deposited in the dry dock area is associated with flooding events, like the February 1996 flood, that carry large suspended sediment loads into the Portland Harbor. Sedimentation also occurs in Swan Island Lagoon, again because of low water velocities in this backwater portion of the river. The principal source of sediments to the lagoon is likely from outfalls that discharge stormwater containing suspended solids.

The Port advises that typical water velocities in the vicinity of PSY are expected to be lower than those measured by the USGS upstream of the PSY at the Morrison Bridge. The water velocities measured by the USGS generally range from 1- to 3-feet per second at the

Morrison Bridge. The river channel at the Morrison Bridge is approximately the same depth as it is near the PSY, but it is 300- to 500-feet narrower. Near the PSY, where the river channel is approximately 1500-feet in width, typical water velocities are expected to be lower, probably in the range of velocities observed by both the USGS and the Port (0.5- to 0.6-feet per second).

Wetlands

There are a variety of wetlands in the area of Swan Island. These wetland areas include riverine, tidal, open-water, and beach bar areas; and palustrine scrub and emergent wetlands.

The existing land use on Swan Island and Mocks Bottom is industrial/commercial. The University of Portland is located on top of Waud Bluff less than 0.25-mile north of the PSY. The nearest residence is located less than 0.3-mile north of the PSY in the University Park neighborhood.

REGULATORY HISTORY/ISSUES

Six DEQ files were found and reviewed for the Port's PSY. A review of the six files follows.

1) Environmental Cleanup Site Information (ECSI) File No 271, Port of Portland, Ship Repair Yard

One of the most significant elements of this file is DEQ's June 1990 Preliminary Assessment (PA). The PA described site history, regulatory issues, and environmental concerns. The PA concluded that the main concern at the PSY is centered around the possibility that contaminated sediments may pose a threat to health and the environment, namely through the surface water route.

The PA discussed the Port's current National Pollutant Discharge Elimination System (NPDES) permit that authorized waste discharge from three outfalls (Outfall 001, 002, and 003)[3]. Outfall 001 is for compressor cooling water. Outfall 002 is for condenser water and boiler blowdown. Outfall 003 is for treated ballast water. The NPDES permit also required cleaning and monitoring of the dry docks to ensure that sandblast does not enter the river or affect water quality.

The PA also discussed the Port's Oil Spill Prevention, Containment, and Countermeasure (SPCC) Plan for the PSY that includes the ballast water treatment plant, the piping and transfer system, the Central Utility Building, card lock fuel systems, and other possible spill areas. The SPCC is reviewed and updated once a year.

The PA included a review of DEQ files. Some of the more significant citations include:

- 1979, Port's Inventory of PCB Transformers- The Port tested 40 transformers for PCBs and identified seven as PCB transformers (under 40 CFR 761). The Port planned to replace the seven PCB transformers and develop a plan for inspection and maintenance for the others.

[3] See the review DEQ's Water Quality File (page 19 of the memorandum) for the current outfall designation and source.

- April 1982, Release to River- 897.6 barrels of material were accidentally released to the river. The material contained 50 mg/L of suspended solids and up to 13.2 mg/L oil.
- October 1985, Notice of Violation (NOV)- DEQ issued a NOV of the NPDES permit stating that one of the PSY's dry docks had not been cleaned in accordance with permit conditions.
- April 1986, Port's Application to Dispose Special Waste- Metro approved the Port's application to use sand blast as daily cover at Metro's landfill so long as the Port complies with Metro's requirements.
- November 1987, NOV- DEQ issued a NOV resulting from the report of an oil slick on the river in January 1987. The NOV required a plan to prevent future oil spills.
- September 1988, DEQ's Letter Regarding Environmental Audit- DEQ's letter to the Port describes several concerns DEQ had with PSY operations including:
  -Concern regarding hazardous waste determination of the sand blast and paint removed during sand blasting. DEQ suggested material be tested quarterly using SW 846 methods for the following parameters: total and extractable lead, arsenic, cadmium and tri-butyl tin.
  -Concern regarding the handling and disposal of sanitary wastes offloaded from ships at the PSY.
  -Concern whether cleaning compounds that were used in power washing at the dry docks, and whether the wash water was prevented from entering the river.
  -Concern whether PSY contractors were hazardous waste generators.
- October 1989, Notice of Noncompliance (NON)- DEQ issued a NON of the NPDES permit resulting from the lack of containment devices in place around a ship being sand blasted in a wet berth. The NON led to a formal plan for wet berth sandblasting.
- March 1993, EPA's Field Evaluation of Water Pollution Abatement Program Involving Sandblasting Activities at Northwest Marine Iron Works- EPA inspected sand blasting operations at the PSY and concluded that, even with best management practices, some sand blast material would likely end up in the river. However, EPA made several suggestions that would further minimize the amount of sand blast discharge to the river.

The ECSI file included a number of other important elements in addition to the PA. A summary of some of these other important elements follows:

- November 20, 1996, DEQ Memo to the File- The purpose of this memorandum was to document data viewed in Port files to update the existing ECSI file. The memo included data from the September 1991 pre-dredge dry dock sediment sampling. The memo suggested further review of the Port file and that the site be prioritized for appropriate response. The data suggested that the site may be a high priority for investigation and cleanup.
- December 12, 1996, DEQ Letter to the Port- DEQ's request for information documenting sediment sampling and disposal activities and copies of environmental investigations.

- February 1997, Port/Cascade General Letter Response to DEQ's December 1996 Letter- The letter contained sediment sampling data associated with pre-dredging and dredging activities from 1991 through 1994.
- April 14, 1997, DEQ's Draft Strategy Recommendation- DEQ concluded that despite the 1992-1994 removal of approximately 130,000 cubic yards of contaminated sediments from Dry Docks 1, 3, and 4, large quantities of contaminated sediments likely remain around the dry docks. DEQ recommends conducting a Remedial Investigation/Feasibility Study specifically targeting sediment contamination. Draft Strategy Recommendation was finalized October 23, 1997.

2) Underground Storage Tanks (UST) Files

DEQ's 1990 Preliminary Assessment indicated at least 16 underground storage tanks (USTs) existed at PSY (Figure 5).

DEQ's UST database lists 14 registered USTs at the PSY. The size, contents, and status of the 14 USTs is presented in Table 5.

DEQ's Leaking UST Files include two files for the PSY.

File No.26-89-166- DEQ's file contained information regarding USTs at the PSY:

Berth 305 UST- The Port discovered petroleum contaminated soil (PCS) during an August 1989 removal of a 12,700-gallon diesel UST near Berth 305 (UST # 2, Figure 5). Approximately 190 cubic yards of PCS were removed from the tank excavation and taken to St. John's Landfill for disposal. No contamination was detected in confirmatory soil samples and groundwater was not encountered during the cleanup. DEQ issued a No Further Action determination for the UST July 24, 1992.

Southwest Corner of Building 64 UST- The Port discovered PCS during an August 1989 removal of a 1,000-gallon gasoline UST near the southwest corner of Building 64 (UST # 11, Figure 5). Approximately 30 cubic yards of PCS were removed from the tank excavation and taken to St. John's Landfill for disposal. Confimatory soil samples were below DEQ's UST Matrix cleanup levels and no groundwater was encountered during the cleanup. DEQ issued a No Further Action determination for the UST July 24, 1992.

UST Between Buildings 50 and 43- The Port discovered PCS during an August 1989 removal of one 1,000-gallon diesel, one 2,000-gallon gasoline and one 500-gallon gasoline USTs located between Buildings 50 and 43. The three USTS were nested together in a single tank pit (USTs 6, 7, and 8; Figure 5). Approximately 200 cubic yards of PCS were removed from the tank excavation and taken to St. John's Landfill for disposal. No contamination was detected in confirmatory soil samples and groundwater was not encountered during the cleanup. DEQ issued a No Further Action determination for the USTs July 24, 1992.

North Side of Building 4 UST- The Port discovered PCS during an August 1989 removal of a 300-gallon diesel UST north of Building 4. DEQ issued a No Further Action determination for the UST July 24, 1992. Confimatory soil samples were

below DEQ's UST Matrix cleanup levels and no groundwater was encountered during the cleanup. No PCS was removed during the tank decommissioning. DEQ issued a No Further Action determination for the UST July 24, 1992.

Southwest Corner of Building 10 UST- The Port discovered PCS during an August 1989 removal of a 500-gallon diesel UST near the southwest corner of Building 10 (UST #5, Figure 5). Approximately 12 cubic yards of PCS were removed from the tank excavation and taken to St. John's Landfill for disposal. Confimatory soil samples were below DEQ's UST Matrix cleanup levels and no groundwater was encountered during the cleanup. DEQ issued a No Further Action determination for the UST July 24, 1992.

UST Between Building 60 and the Lips Propellers Facility- The Port discovered PCS during an October 1989 removal of a 10,000-gallon diesel UST and 250-gallon diesel UST located between Building 60 and LIPS Propellers facility (UST # 9, Figure 5). The Port concluded the PCS was due to releases from the larger UST. Approximately 228 cubic yards of PCS were removed from the tank excavation and taken to St. John's Landfill for disposal. Due to site constraints, all of the PCS could not be removed. DEQ required additional investigation to define the extent of contamination because the high concentrations of the residual PCS (up to 50,000mg/kg TPH). Four consecutive quarters of groundwater monitoring were conducted, and no volatile aromatic hydrocarbons were reported. DEQ issued a No Further Action determination noting the pocket of contamination. DEQ noted that should site conditions change allowing access to the contamination, the Port is responsible for further evaluation of the remaining PCS and any cleanup necessary at that time.

File No. 26-93-6019- DEQ's file contained information regarding one of two 20,000-gallon #6 fuel oil USTs used as backup for the Central Utility Building boiler. In April 1993 the Port (through their environmental consultant, Hahn & Associates) reported a release from the tank (UST #12, Figure 5). The release was discovered in the concrete vault over the manway access to the tank. The release was reported due to a leaking fitting in an oil return line. The Port estimated that approximately 35-gallons of product were released. Some of the product had pooled in the vault and was removed, but since the floor of the vault was not impermeable, some oil drained into the soil beneath the shallow vault.

After completing a subsurface investigation to determine the extent of the contamination, the Port's consultants concluded that the PCS was limited to the area immediately adjacent to the vault and was less than 7 cubic yards in volume. The Port concluded that the PCS did not pose an immediate threat to human health or the environment and did not impact groundwater. The Port recommended that since the PCS was inaccessible, that DEQ allow for "pocket in place" closure.

Since DEQ did not consider the PCS inaccessible, the Department requested removal or risk-based closure. In January 1998 the Port's consultant completed a Tier 2 Risk-based Corrective Action (RBCA), and concluded that the site did not pose

unacceptable risk to human health or the environment. DEQ rejected the January 1998 RBCA largely because it was based on default parameters used in the ASTM RBCA guidance rather than DEQ's RBCA guidance. The most recent file element was DEQ's February 1998 request that the Port perform additional cleanup, recalculate the RBCA values using the Department's values and methods, or select another approach for evaluating risk. Additional soil removal was performed by the Port at the end of 1998. The Port is preparing a report documenting this soil removal action for submittal to DEQ.

3) Air Quality File

In 1990 the Port was operating under a DEQ air quality permit (26-3224) at the PSY which limited emissions of volatile organic compounds (VOCs) from marine painting operations and boiler operation to 375 tons per year. Emissions estimates for 1986 and 1987 were 290 and 260 tons respectively. The annual use of paint is approximately 216,000 gallons. The boilers use over 50,000 gallons of residual oil and 7.9×10^9 therms of natural gas per year.

Cascade General was issued a Title V operating permit effective July 1, 1998. The permit covers 13 Emission Units and six Pollution Control Devices, emission limits and standards are established in the permit for VOCs, particulate matter (PM and PM10), hazardous air pollutants, chromium, and visible emissions. In addition, the permit establishes best management practices and monitoring requirements for operations at the PSY.

4) Water Quality File

The most significant elements of this file include:

NPDES Permit- The PSY operates under NPDES Permit number 101393 issued to Cascade General. The permit was last issued in July 1996, last modified in August 1997, and expires in June 2001. The permit authorizes Cascade General to construct, install, modify and operate a wastewater collection, treatment, control, and disposal system and discharge to public water adequately treated wastewater and stormwater only from the authorized discharge points listed in the permit and only in conformance with all the requirements, limitations, and conditions defined in the permit.

The NPDES Permit covers eight outfalls (or discharge points) at the PSY (Figure 4).

Outfall 001- Discharges treated water from the BWTP.

Outfall 002- Discharges treated stormwater and process water from the stormwater treatment system.

Outfalls 003 and 004- Discharges untreated noncontact cooling water from ships in Dry Dock 4 at sally ports in dry dock.

Outfalls 005 and 006- Discharges untreated noncontact cooling water from ships in Dry Dock 3 at sally ports in dry dock.

Outfalls 007 and 008- Discharges untreated noncontact cooling water from ships in Dry Dock 1 at sally ports in dry docks.

Besides the monitoring requirements, the NPDES Permit also includes several special conditions. The most significant of these special conditions include:

- Annual update and continued application of Best Management Practices.
- After operations on a vessel, the dry docks shall be thoroughly cleaned before submergence.
- Floating containment booms shall be placed around all ships while transferring fuel in the shipyard. Permanent booms shall be installed on the inside of the most out-board pier pilings and around all dry dock areas.
- Sanitary wastes shall be discharged to the City of Portland municipal sewage system.

5) Spill File

DEQ Spill No. D91-15- A petroleum oil spill at Berth 314 of approximately 150-gallons was first observed and reported in April 1991. The Port authorized Chempro's immediate dispatch to contain and cleanup the spill. The Port also notified both DEQ and the Coast Guard. Chempro deployed containment booms and then collected the floating product with absorbent pads. Chempro completed their containment and cleanup work five days after the spill was first reported.

Based on the spill file, the source of the spill was uncertain but suspected to come from a stormwater outfall originating from the Northwest Marine Ironworks facility. The source of the petroleum oil was suspected to be waste oil from the Exxon Benicia which was being handled by Northwest Marine Ironworks.

In addition to events documented in DEQ's Spill File, the following spills were noted in Cascade General's July 1997 Integrated Contingency Plan:

- April 9, 1996 oil spill from the stern of vessel at PSY during pumping of main engine lube oil sump. Approximately 15 to 25-gallons of heavy black oil were spilled into the river. Approximately 1,300 pounds of oil-soaked absorbent pads and sweeps were disposed of at an approved facility and approximately 2,500 gallons of oily river water was transported to the BWTP of treatment.
- July 8, 1996 oil spill from ship ballasting without authorization. Approximately two gallons of hydraulic or gear oil were discharged to the river. The absorbent pads and sweeps were disposed of at an approved disposal facility.
- September 3, 1996 oil spill at vessel in Berth 314. Approximately five to 10-gallons of oil were discharged to the river. The absorbent pads and sweeps were disposed of at an approved disposal facility.
- On April 18, 1997 wastewater generated from cleaning a chain locker on a ship in Dry Dock 4 was discharged to the river. The volume of wastewater released is unknown. A boom was deployed and absorbent pads were used to absorb contained debris.

6) Hazardous Waste File

Cascade General is currently responsible for the management of hazardous waste generated at the PSY. Cascade General is classified as a Large Quantity Generator, and holds the EPA Identification Number ORD-180761934. Once wastes are generated at the PSY, they are

characterized, labeled, and moved to the hazardous waste storage shed. Cascade General also manages the hazardous waste generated by its private contractors. Hazardous wastes at the PSY are typically grit blasting, welding, surface coating, painting and miscellaneous repairs.

The most significant elements of DEQ's Hazardous Waste file include the following file elements:

November 1992 Inspection- DEQ conducted an inspection in 1992 to determine the facility's compliance with DEQ Hazardous Waste Rules. DEQ noted that the majority of the hazardous waste generated by Cascade General at the PSY was from their painting operation.

December 1992 Notice of Noncompliance- DEQ issued a notice as a result of our November 1992 inspection listing a violation for improper hazardous waste storage.

January 1995 Inspection- DEQ inspected West States, Inc. recently terminated operation (ORD 173269788) at the PSY.

January 1995 Notice of Noncompliance- DEQ issued a notice as a result of our January 1995 inspection listing four violations for: no hazardous waste determination, failure to label, and waste storage without a permit.

July 1997 Cascade General Submittal- Cascade General submitted an Integrated Contingency Plan consisting of Spill Prevention, Containment, and Countermeasures Plan and a RCRA Contingency Plan.

November 1997 Notice of Violation, Compliance Order, and Assessment of Civil Penalty- DEQ's action resulted from a July 1997 inspection of the Fuel Processor facility in Portland. DEQ assessed a penalty against Cascade General of $14,500 for failure to make a hazardous waste determination and failure to properly manifest hazardous waste transported offsite for disposal. In the Compliance Order, DEQ required Cascade General initiate actions to correct any continuing violation and come into full compliance with hazardous waste regulations.

April 1998 Cascade General's Updated BMPs-

PREVIOUS INVESTIGATION AND CLEANUP

A number of previous environmental investigations and cleanups were conducted for the Port's PSY. A review of the some of the more significant investigations and cleanups follows:

1) Hahn & Associates' December 8, 1989 Environmental Review, N Channel Avenue Fabrication Site- The purpose of the work was to inspect and assess various areas of environmental concern through observation, interviews, and review of regulations. Hahn concluded that a limited amount of hazardous materials had been used onsite, and those hazardous materials were mostly petroleum hydrocarbons. Hahn recommended better drum labeling and management. Hahn recommended three areas of surface soil staining be removed and verification samples collected. The three areas were located under aboveground storage tanks and at an oil storage shed on the south end of the site (Figure 6).

2) DEQ's June 1990 Preliminary Assessment- See REGULATORY HISTORY AND ISSUES in this memorandum.

3) Hahn & Associates' July 24, 1990 Final Visit: Environmental Review, ARCO Alaska, Portland Fabrication Site- The purpose of the work was to inspect and assess site conditions after the cessation of ARCO's work. Hahn identified two additional areas of surface soil staining and an area of sand blast grit accumulation (Figure 7).

4) Hahn & Associates' May 31, 1991 Soil Sampling at Ballast Water Treatment Facility- Hahn reported that during the installation of a new sump at the BWTP, suspected petroleum contaminated soil was encountered. The soil was characterized as diesel range hydrocarbons containing up to 4,300mg/kg TPH-D. On May 7, 1991 approximately 10 yards of diesel contaminated soil were excavated and disposed at the Hillsboro Landfill. Apparently two confirmation samples were collected from the excavation walls and analyzed by hydrocarbon identification method (HCID). The two confirmation samples were non-detect.

5) Hahn & Associates' February 28, 1992 PCB Inventory and Disposal Recommendation- The purpose of the work was to inventory and develop disposal options for 25 electrical equipment pieces at Substation #1 near Building 60. Hahn collected and analyzed dielectric fluid, tar, wipe, and bulk soil samples. Hahn concluded the following:
   - 176 gallons of fluid and 3 cubic yards of concrete pad are PCB-containing (i.e., >500 ppm PCB).
   - Greater than 3,000 gallons of fluid are non-PCB (i.e., 1-44 ppm). Four cubic yards of soil are non-PCB containing (2.8- 5.4 ppm) and 5 cubic yards contain PCBs at concentration less than 1 ppm.
   - One tar sample contains 1 ppm PCB, and the other samples were non-detect.
   - 60 gallons of dielectric fluid are non-detect.

   Hahn recommended reviewing DEQ's rules and EPA's PCB Spill Cleanup policy.

6) Hahn & Associates' February 28, 1992 Level II Environmental Assessment, Soils Investigation- The purpose of the work was to assess soils in the vicinity of four 84,000 gallon above ground storage tanks used to store diesel and oil in the BWTP to determine if previous activities had impacted soils. Hahn concluded that petroleum contaminated soils exists in the area, but there is no discernible plume direction.

7) Hahn & Associates' August 21, 1992 Letter Regarding Disposal of Oil and Stoddard Solvent Contaminated Soil- Hahn's letter (and attached Application for Disposal of Special Waste to the Hillsboro Landfill) did not include either: 1) a location of where at the PSY the contaminated soil came from, or 2) any description of the investigation and cleanup of the contaminated soil. Hahn's application was for the disposal of 80 cubic yards of contaminated soil.

8) Hahn & Associates' October 30 ,1992 Level II Environmental Assessment, Soils Investigation- The purpose of the work was to assess soils in the vicinity of two hazardous waste storage areas after petroleum contaminated soil was discovered in early 1992. The two waste storage areas are located on Figure 8. Hahn advanced six soil borings in the two areas and collected and analyzed soil samples for petroleum hydrocarbons. Hahn concluded that

the petroleum contaminated soils were restricted to surface and near-surface soil (i.e., less than 1-foot below ground surface). Hahn further concluded that the elevated levels of petroleum hydrocarbons may be due to disseminated asphalt in the near-surface soils.

9) Hahn & Associates' November 9, 1992 Investigation and Excavation of Contaminated Soils- The purpose of the work was to characterize, supervise the excavation and assist in the disposal of petroleum contaminated soil discovered during parking lot resurfacing north of Building 50 next to an on-site electrical substation (Figure 9). After characterizing the soils, nearly 70 cubic yards of contaminated soil were excavated to a depth of 5-feet below ground surface and transported to the Hillsboro Landfill. Three confirmation samples were collected and analyzed for TPH and Stoddard solvent. All three confirmation samples were non-detect.

10) Hahn & Associates' May 28, 1993 Soil Investigation, Tank 10 and Pipe Areas- The purpose of the work was to assist in the cleanup of two areas of petroleum contaminated soil in the BWTP. Hahn collected 20 soil samples in the vicinity of Tank 10 (12 characterization and 8 confirmation samples) and 14 soil samples in the vicinity of the pipe area (8 characterization and 6 confirmation samples). Approximately 20 tons of contaminated soil were excavated in the vicinity of Tank 10 and disposed of at Hillsboro Landfill. All confirmation samples were either non-detect or below 500ppm TPH. Approximately 46 tons of contaminated soil were excavated in the vicinity of the pipe area and disposed of at Hillsboro Landfill. All confirmation samples were either non-detect or below 500ppm TPH.

11) Hahn & Associates' March 31, 1994 Soil Remediation, Ballast Water Treatment Plant- The purpose of the work was to assist with the characterization and excavation of petroleum contaminated soil at the BWTP. The Port wanted to remediate known petroleum contaminated soil at the BWTP before placing concrete beneath new above ground storage tanks scheduled to be installed. Hahn oversaw the excavation and characterization of 50 cubic yards of petroleum contaminated soil from the area. The contaminated soil was transported to Rabanco Landfill in Washington for disposal. Hahn concluded that at least two areas of petroleum contaminated soil still existed at the BWTP, and those areas were inaccessible due to the existence of large above ground tanks.

12) EPA's November 1994 Site Inspection Report- In November 1994, EPA, through its contractor Roy F. Weston, Inc. (Weston) conducted a non-sampling site inspection of the PSY. The objectives of the Site Inspection were to:

- Identify potential sources of contamination at Swan Island.
- Determine the existence of significant migration pathways and human and/or ecological environmental targets.
- Identify appropriate data to evaluate sources and migration pathways.

Weston concluded the following:

- Historic dry dock and wastewater discharges are the most significant sources of contamination and there was potentially direct migration of contaminants to surface water. The main contaminants are likely metals and organic components of waste oil.

- No drinking water wells were identified onsite, and paving is expected to limit the infiltration of contamination into the subsurface, reducing impacts to groundwater.
- The Willamette River and associated wetlands are the primary target for pollutants. Contaminant migration to the Willamette has been confirmed by direct observation and analytical data.
- Most of the island is covered in concrete or asphalt, limiting exposure to potentially contaminated soil.
- Pavement is expected to limit the transport of airborne particles and reduce volatilization in soils, minimizing the likelihood of air migration. Sandblast overblow, although currently controlled, has been identified as an air migration route in the past.

Weston advised that that there is evidence that past activities at the PSY have impacted the Willamette River. Further sampling of river surface water and sediment would confirm and characterize contamination.

13) CH2MHILL's May 1998 Portland Shipyard (PSY) Upland Sampling Results- The purpose of the work was to assess if historical or current activities resulted in the release of hazardous substances to upland soils at the PSY. An additional purpose was to assess if there is a correlation between constituents detected in river sediments near the facility and constituents detected in upland soils. Sample locations were selected based on historical and current activities in areas. Soil samples were collected from 16 soil borings at seven areas at the facility (Figure 10).

Results from the seven areas are summarized as follows:

N. Channel Avenue Fabrication Site- Five soil borings were advanced and soil samples were collected at 0-2-feet bgs and directly above the water table. The samples were analyzed for TPH, PCBs, metals, and solvents. Three of the shallow soil samples contained TPH in excess of 500mg/kg (up to 3010mg/kg). One of the shallow soil samples contained 49mg/kg arsenic and 0.1mg/kg PCBs. None of the deep samples contained elevated analytes.

Main Parking Lot- Two soil borings were advanced and soil samples were collected at 0-2-feet bgs and directly above the water table. The samples were analyzed for TPH, PCBs, and metals. One of the shallow soil samples contained 451mg/kg TPH. None of the other samples contained elevated analytes.

Tank Farm BWTP- One soil boring was advanced and soil samples were collected at 0-2-feet bgs and directly above the water table. The samples were analyzed for TPH, PCBs, and metals. The shallow sample contained 0.05mg/kg PCBs and 569mg/kg TPH. The deep sample contained 0.4mg/kg PCBs and 1030mg/kg TPH.

Paint Shed/Blast Booth Area/Berth 313- Five soil borings were advanced and soil samples were collected at 0-2-feet bgs and directly above the water table. The

samples were analyzed for TPH, PCBs, and metals. One of the shallow soil samples contained 644mg/kg TPH.

Substation 3 Area- One soil boring was advanced and soil samples were collected at 0-2-feet bgs and directly above the water table. The samples were analyzed for TPH, PCBs, and metals. None of the samples contained elevated analytes.

Buildings 43, 50, 80 Area (Steam Cleaning Basin)- One soil boring was advanced and soil samples were collected at 0-2-feet bgs and directly above the water table. The samples were analyzed for TPH, PCBs, and metals. The shallow soil samples contained 558mg/kg TPH.

Building 10 and Grit Silo Area- One soil boring was advanced and soil samples were collected at 0-2-feet bgs and directly above the water table. The samples were analyzed for TPH, PCBs, metals, and solvents. None of the samples contained elevated analytes.

14) Port's July 1998 Portland Harbor Sediment Data Review- The Port reviewed DEQ's 1998 Portland Harbor Sediment Study and other readily available sediment data from the Portland Harbor, comparing the data to a range of conservative, effects-based screening levels from other regions. The report also included a comprehensive review of historic development of the harbor and a discussion of Portland Harbor hydraulics and sediment/contaminant sources and transport.

The Port's key conclusion was that chemicals existing in Portland Harbor sediments close to the contaminant sources have the greatest potential to cause adverse effects. The Port further concluded that contaminated sediments in Portland Harbor should be addressed as discrete sites rather than as one large site.

The Port recommended additional biological testing be conducted before further decisions are made regarding listing the harbor on EPA's National Priority List or any state lists. The Port recommended biological testing be used to establish a ~~uniform~~ basis for addressing the cleanup of sediments in the Portland Harbor. ~~The Port~~ recommended DEQ take the lead in the effort and DEQ seek to integrate sediment cleanup activities into a broader set of watershed restoration strategies for the river.

15) Port's (Striplin Environmental Associates) November 11, 1998 Portland Shipyard Sediment Investigation Data Report- The Port and Cascade General jointly funded a sediment investigation conducted in the spring of 1998 in support of the Port's anticipated sale of the facility to Cascade General. Data from the investigation, along with existing sediment data, provide a relatively comprehensive characterization of the current distribution of chemicals in surface and subsurface sediments.

The sediment investigation had three objectives:

1) Obtain data required to characterize surface and subsurface sediment quality in the vicinity of the PSY.
2) Develop site-specific sediment quality criteria.
3) Identify potential sources of sediment contamination.

In support of their work, the Port and Cascade General reviewed the following four previously completed sediment investigations:

1) Port of Portland Post Dredge Characterization Studies, 1992 and 1994 (Hartman Associates, Inc. 1995).
2) U.S. Army Corps of Engineers, 1997 (data only). Sediment Quality Evaluation, Columbia River Channel Deepening (River Mile 6.2-10.3).
3) DEQ and EPA Region 10, 1998 (data only). Site Investigation Portland Harbor District of the Willamette River (Weston 1998).
4) Cascade General, Inc. Environmental Report. Dames & Moore, February 1998.

Combining the spring 1998 sediment investigation with the four previously completed sediment investigations provided the Port and Cascade General with the following database in the vicinity of the PSY:

- Surface bulk chemistry characterized at 94 locations.
- The physical, geochemical, and biological features of near-surface sediments characterized using sediment profile imaging at 63 locations.
- Variations in sediment characteristics and bulk chemistry with depth characterized at over 30 locations.
- Sediment bioassays conducted at 57 locations.
- Benthic surveys conducted at 13 locations.

In the referenced report, the Port and Cascade General concluded the following:

1) Sediment Characteristics- Using physical, geochemical, and biological characteristics of the sediments in the vicinity of the PSY, the Port and Cascade General identified near-surface sediment regimes in the vicinity of the PSY. The four regimes are discussed in the ENVIRONMENTAL SETTING section of this memorandum. The Port and Cascade General also concluded that subsurface sediments in the vicinity of the PSY show similar characteristics. A soft silt/clay layer extends from the surface to an average depth of four to six feet, and is underlain by stiffer sandy and/or clay sediments likely representing the native river bottom.
2) Sediment Chemistry- The database indicated the presence of chemicals in sediments associated with past and present PSY operations, as well as chemicals not associated with past or present PSY operations. Using three of the four sediment regimes discussed above, the Port and Cascade General concluded:
    - Willamette River side of the PSY- Sediments principally contain polynuclear aromatic hydrocarbons (PAHs) that may be associated with discharge from the BWTP and dry dock activities.
    - Dry Dock area- Sediments principally contain metals (e.g., TBT, copper, zinc, and nickel) associated with ship repair activities and lesser amounts of PAHs.

Data indicate these contaminants are present in the highest concentration in the near-surface sediments immediately adjacent to the dry docks.

- Swan Island Lagoon- Sediments are impacted with fewer chemicals associated with ship repair activities, and chemicals vary with location. Sediments principally contain PCBs, PAHs, and metals. The Port and Cascade General concluded that contaminant sources other than the PSY are likely responsible for contributing to the contaminant load in Lagoon sediments.

3) Biological Indicators of Ecological Risk- The results of the sediment bioassays conducted at over 52 locations in the vicinity of the PSY indicate that the sediments that have the potential for adverse effects are limited in extent, located near the shoreline in close proximity to potential sources, and are not entirely due to past and present operations conducted at the PSY.
4) Site-Specific Sediment Quality Standards- The Port and Cascade General combined the referenced sediment database with data previously collected from the down-river McCormick & Baxter site and calculated sediment quality criteria in the form of apparent effect thresholds (AETs). AETs are used to determine whether the concentration of a specific chemical in sediments may be harmful to sediment dwelling organisms. An AET is defined as the concentration of a chemical above which a significant adverse biological effect always occurs in the data set used for their calculation. AET values are generated for each chemical and type of biological test. The AET developed by the Port and Cascade General using PSY and McCormick & Baxter data are presented in Table 6.

The Port and Cascade General concluded that considerable site characterization data are currently available for the PSY, but the following three data gaps exist that need to be filled in future investigations:

1) Bulk Chemistry of Surface Sediments- Several locations in Swan Island Lagoon need additional surface sediment bulk chemistry characterization. The sediments immediately underlying the dry docks were also not characterized. The Port and Cascade General recommended 5 to 10 additional surface sediment samples be collected.
2) Bulk Chemistry of Subsurface Sediments- The vertical distribution of chemical concentrations needs further characterization. The Port and Cascade General recommended that 3 to 5 additional sediment cores be collected.
3) Bioaccumulation Potential- The Port and Cascade General recommended that bioaccumulation tests be conducted on TBT and potentially PCBs to assess potential risks to aquatic and human health. The Port and Cascade General recommended bioaccumulation testing be conducted on two freshwater species that are ecologically relevant to the Willamette River using sediments collected from 5 to 10 locations.

16) Bridgewater's December 23, 1998 Conceptual Site Model and RI/FS Conceptual Plan- Portland Shipyard- Bridgewater presented a conceptual site model and a conceptual plan for an RI/FS work plan for the PSY in a December 23, 1998 submittal to DEQ. Bridegwater's conceptual site model identifies potential sources of contamination, contaminant migration and exposure pathways, and human and ecological receptors. Bridgewater concluded that the

principal sources of contamination are associated with ship hull and parts surface preparation and painting, and ballast water treatment. Bridgewater concluded that secondary sources of contamination are associated with general PSY operations (e.g., chemical storage and electrical substations).

Bridgewater concluded the following six areas in the upland portion of the PSY contain contaminants above levels of concern:

- Channel Avenue Fabrication Site- arsenic and TPH
- BWTP- TPH, aromatic volatile organic compounds, PCBs and PAHs
- Building 10- TPH
- Paint Shed/Blast Booth Area/Berth 313- arsenic and TPH
- Building 43,50,80 Area (Steam Cleaning Basin)- arsenic and TPH
- Substation 1- PCBs

Bridgewater concluded the following contaminants exist in the three sediment areas surrounding the PSY:

- Willamette River Side of the PSY- PAHs and phthalates
- Dry Dock Area- metals, PAHs, and phthalates
- PSY Side of Swan Island Lagoon- PCBs, metals, and PAHs

Bridgewater also concluded that TBT is present in sediments in the vicinity of the PSY, especially near the dry dock area.

Bridgewater's potential contaminant migration and exposure pathways for the site are presented in Figures 11 and 12.

17) Cascade General's (Aquatic Biology Associates, Inc.) February 12, 1998 Benthic Invertebrate Community Study- Cascade General contracted Dames & Moore to collect sediment samples from 16 locations in the vicinity of the PSY. Samples were collected from nine locations in the main channel of the Willamette River from as far upriver as the Fremont Bridge (River Mile 11, Figure 2) to as far downriver as the railroad Bridge (River Mile 7, Figure 2). Samples were also collected from five locations in the immediate vicinity of the PSY. Two samples were archived.

Bridgewater completed an analysis of the benthic community study in a letter report dated February 22, 1999 titled "Analysis of Portland Shipyard Benthic Community Survey Data". In their analysis, Bridgewater summarized the following:

- Abundance- Benthic organisms exhibited a wide range of abundance, but the general abundance is low in comparison to other river and lake systems. Bridgewater concluded that one factor that contributes to low abundance of the benthic community is the presence of fine-grained, soft sediments in near-shore areas.
- Community Diversity- The diversity of the benthic community in the study area is also low. The benthic community is dominated by oligochaetes (61 to 91 percent of total abundance) and chironomids (5 to 29 percent of the total abundance).

Bridgewater also concluded that fine-grained, soft sediments also contributed to the lack of benthic diversity.

- Sediment Physical Characteristics- Sediment around the PSY and in the Lagoon contained high amounts of silt and clays, typically greater than 90 percent. Sediment in the main channel of the river were generally coarser in nature with less than 60 percent silt and clay. Total carbon in sediments collected near the PSY averaged about 2 percent. Bridgewater also concluded that periodic low dissolved oxygen events occur in the study area sediments.

Bridgewater concluded that the available data from Cascade General's survey established benthic conditions in the vicinity of PSY. The presence of fine-grained sediments, moderately low total organic carbon concentrations, and low dissolved oxygen concentrations are factors that appear to contribute a low diversity and abundance of benthic species. It is unclear from the benthic community survey results whether or not the low abundance and number of benthic species can be attributed to historical activities conducted at the PSY, other nearby industrial facilities, and/or stormwater and combined sewer overflow discharges. Sediment toxicity tests conducted as part of the 1998 PSY sediment investigation found very little toxicity in the *Hyalella azteca* test and no toxicity in the chironomid test, indicating that other factors may be regulating benthic community structure.

SOURCES OF CONTAMINATION

Potential general sources of contamination released from PSY activities include:

1) Dry Dock and Berth Operations- Management practices implemented in the 1990's have largely reduced the amount of contamination released from dry dock and berth operations. However, past dry dock operations and berth operations have contaminated river sediment and possibly upland soil and groundwater. These dry dock and berth operations include: ship hull washing (dry docks only), abrasive blasting, painting, ship repairs and outfitting. The principal contaminants of interest resulting from these operations are metals, paints, and tributyl tin. The secondary contaminants of interest are petroleum hydrocarbons (e.g., waste oils) and solvents.

2) Upland Ship Repair Operations- Recently implemented management practices have also reduced the amount of contamination possibly released from upland ship repair operations. However, past land operations have likely contaminated soil and possibly groundwater. These operations may include: abrasive blasting, surface preparation, painting, and machining/fabrication. Surface preparation and painting are thought to have occurred mainly at Building 73 and the paint shed. The principal contaminants of interest resulting from these operations are metals, paints, petroleum hydrocarbons, solvents, caustic solutions, and plating solutions and wastes.

3) Wastewater and Stormwater Discharge- Recent management practices and permit requirements have reduced the amount of contamination released during discharge of wastewater and stormwater. However, past discharges have likely contaminated sediments and possibly soil and groundwater at the site. The original Ballast Water Treatment plant, and particularly the unlined ponds, have contaminated soil and possibly groundwater at the

PSY. The principal contaminants of interest resulting from wastewater and stormwater discharge are petroleum hydrocarbons, metals, and phthalates.

4) UST Releases- Currently only four USTs exist at the site. One 6,000-gallon gasoline and one 6,000-gallon diesel USTs are located at the Card Lock facility near Building 63. Cascade General advises that the two USTs are modern double-walled fiberglass tanks that comply with EPA's recent requirements for USTs. The other two tanks at the PSY are 20,000-gallon steel USTs that contain Bunker C. These two tanks are located near the CUB and serve as a backup fuel source for the CUB boilers.

   The USTs are modern tanks that are not expected to leak. However, past releases from on-site UST have contaminated soil and possibly groundwater at the site. The principal contaminants of interest associated with the USTs are petroleum hydrocarbons (motor fuel, heating oil, and waste oil and their associated primary constituents BTEX and PAHs and possibly metals, PCBs, and solvents). USTs containing solvents also may have existed onsite.

5) Surface Runoff- Recent management practices have reduced the amount of contamination released from surface runoff. However, past runoff has likely contaminated sediments and possibly soil and groundwater at the site. The principal contaminants of interest associated surface runoff are metals, petroleum hydrocarbons, polychlorinated biphenyls (PCBs), and paints.

6) Utility Service- Utility service distribution at the PSY may have resulted in contaminated soil and possibly groundwater and sediments. Contamination may have resulted from line leaks, spills, and other methods. The PCB-containing electrical equipment in on-site electrical substations are a particular concern. The principal contaminants of interest associated with utility services are PCBs and petroleum hydrocarbons.

7) Storage of Equipment, Materials, and Waste- Contamination of soil and possibly groundwater and sediments may have resulted from the improper storage of equipment, materials, and/or wastes. Spills may have resulted from improper management. Storage and management of chemical wastes such as paint are a particular concern. Historic abrasive blasting material storage areas include Building 73, the Grit Hopper Staging area, and the Channel Avenue Fabrication site. The principal contaminants of interest associated with storage are metals, petroleum hydrocarbons, solvents, and paints.

8) Contamination from Historic Operations- Contamination of soil, groundwater and sediments may have resulted from historic operations. The principal historic operation posing concern is the Kaiser Company's ship building during the 1940's. Potentially contaminated area include Building 4, the area north of Building 4, and the former shipways. The principal contaminants of interest associated with historic operations are metals, petroleum hydrocarbons, PCBs, and solvents.

9) Potential Contamination in Dredged Fill Placed in Shipways and South End of Swan Island Lagoon- The Port filled the Kaiser Company's former shipways in the 1950's and early-1960's with dredged materials. The origin, volume and quality of the dredged material is uncertain. The Port also used dredged materials to fill the southern portion of Swan Island Lagoon in the 1960's, 1970's and 1980's. The origin, volume and quantity of the dredge material is uncertain.

HAZARDOUS SUBSTANCE CHARACTERISTICS

DEQ considers an important distinction between Chemicals of Potential Concern (COPC) and Chemicals of Interest (COI). COI are all the contaminants that could be present at the site resulting from past practices and activities and from suspected off-site sources of contamination impacting the site. COI are generally defined by knowledge of historical process, historical information regarding the site, and previous environmental investigations. COI are the comprehensive analytes targeted during site and contaminant characterization portions of the Remedial Investigation (RI). During the RI, all samples of environmental media are often analyzed for many or all COI until the site and contamination are both completely characterized.

COPC can be identified from the list of COI once the site and contamination has been completely characterized. COPC are those COI detected at concentrations exceeding either: 1) acceptable risk-based levels based on the site-specific exposure pathways and contaminant transport pathways, or 2) legally applicable or relevant and appropriate Federal and/or State regulations (ARARs). COPC are generally developed during the risk assessment.

Metals, petroleum hydrocarbons and their constituents (i.e., polynuclear aromatic hydrocarbons and volatile aromatic hydrocarbons), volatile organic compounds, phthalates, polychlorinated biphenyls, tributyl tin, and asbestos are the primary COI at the PSY.

Metals

The following nine metals have been identified as COI based on historic operations and previous environmental investigations: antimony, arsenic, beryllium, cadmium, chromium, copper, lead, nickel, and zinc. When absorbed into the body, these metals can be toxic. The ions of certain metals have an extraordinary chemical affinity for sulfur. Hence, when absorbed into the bloodstream, they seek out and combine with the sulfur present in certain of the body's cellular fluids. In particular, metals tend to alter enzymatic and protein action in the body. Certain metals such as copper and zinc are essential to metabolism; yet, exposure to aquatic organisms to these same elements at elevated levels can adversely affect development and heath, or even cause death.

Total Petroleum Hydrocarbons (TPH)

TPH compounds are a highly complex mixture of organic chemicals composed almost entirely of carbon and hydrogen. Gasoline range TPH is generally considered to have between four and 12 carbon atoms, while diesel contains 12 to 22 carbon atoms. Oil range TPH has an even greater number of carbon atoms. From a human toxicological standpoint, the most significant chemicals present in TPH are benzene and carcinogenic polynuclear aromatic hydrocarbons (cPAHs).

Benzene is a human carcinogen, but composes only a very minor portion of diesel range and oil range TPH. Benzene tends not to persist for long periods of time in the shallow subsurface due to its solubility and tendency to volatilize and degrade.

PAHs have low solubility in water and strongly partition to soil, sediments and organic material. PAHs show varying resistance to chemical, thermal, or biological degradation and tend to persist in the environment. PAHs tend to be moderately to strongly immobile once released into the environment. Eight of the 17 PAHs are carcinogens. PAHs can also cause non-carcinogenic harmful effects to human skin, body fluids, and the body's system for fighting disease. The toxicity of PAHs to aquatic organisms varies from lethal to non-lethal. Non-lethal affects on aquatic organisms may include cell damage, mutagenesis, and narcotic effects.

Volatile Organic Compounds (VOCs)

VOCs have high vapor pressure that allows them to evaporate quickly. In general, VOCs tend to be moderately or highly soluble in water, do not strongly partition to soils and sediments, and has a low tendency to bioaccumulate.

Other than the aromatic VOCs associated with TPH (i.e., benzene, ethylbenzene, toluene, and xylene), the VOC most likely to be expected at the former Riedel site is trichloroethene (TCE). TCE is a synthetic chemical widely used as a solvent for metal degreasing operations. TCE is a nonflammable liquid, evaporates easily, and has a sharp sweet odor. TCE is relatively resistant to biodegradation.

Although TCE readily volatilizes into the atmosphere, once the contaminant enters the subsurface it is expected to be mobile and persistent. Although high doses of TCE have been shown to cause cancer in laboratory animals, it is uncertain whether TCE is a human carcinogen. Exposures to elevated levels of TCE can cause liver and kidney damage. EPA's MCL for TCE in drinking water is 5ppb.

Phthalates

Phthalates are a group of organic esters that have been used for over 50 years mainly as plasticizers. As plasticizers, phthalates allow the production of plastic at low temperatures, thus preventing decomposition and corrosive gas production, while producing a tough, colorless plastic whose rigidity depends upon the quantity of plasticizer used. In addition to plastics, phthalates can also be found in a number of commercial products including cosmetics, insecticides, and aspirin.

Phthalates generally enter the environment through industrial waste waster, from disposal sites, directly from consumer products, and from burning plastics. Phthalates are moderately soluble in water, but tend to partition to soil and sediments. Phthalates can undergo biodegradation. Phthalates may bioaccumulate to some degree in aquatic organisms, but they are unlikely to biomagnify up the food chain.

Pentachlorophenol (PCP)

PCP has been used extensively as a pesticide and as a wood preservative. PCP is manmade, and produces a very sharp characteristic odor when hot. PCP is only slightly volatile and slightly soluble. PCP is currently regulated as a restricted use pesticide. PCP is widely distributed throughout the environment, but is mainly released from treated woods or at wood treating facilities.

PCP is relatively stable in the environment, but can undergo biological transformation. PCP strongly partitions to soil and sediments under acidic conditions.

Short term exposures to high levels of PCP can cause harmful effects in the liver, kidney, skin, blood, lungs, nervous system, and gastrointestinal tract. Large doses of PCP can be fatal.

Polychlorinated Biphenyls (PCBs)

PCBs are a family of man-made chemicals that contain over 200 individual isomers of varying toxicity. Because they don't burn easily and are a good insulating material, PCBs have been used widely as coolants and lubricants in transformers, capacitors, and other electrical equipment. The manufacture of PCBs in the United States stopped in the late 1970's because of evidence that PCBs accumulate in the environment and may cause health hazards. Commercial formulations of PCBs enter the environment as mixtures consisting of a variety of PCBs and impurities.

PCBs have low solubility in water and strongly partition to soil, sediments and organic material. PCBs have moderate to low volatility and tend to evaporate slowly. PCBs are quite resistant to chemical, thermal, or biological degradation and tend to persist in the environment. PCBs tend to be immobile once released into the environment. PCBs bioaccumulate and biomagnify in the ecological food web.

Although adsorption to solids and subsequent sedimentation may immobilize PCBs for a relatively long period of time in aquatic systems, redissolution (due to loss of aquatic phase as a result of, for example, volatilization and subsequent release from sediment) into the water column has been shown to occur in the environment. Substantial quantities of PCBs contained in aquatic sediments can therefore act as an environmental reservoir from which PCBs may be released over a long period of time.

EPA has determined that PCBs are probable human carcinogens. Animal experiments have shown that PCB mixtures produce adverse health effects including liver damage, skin irritations, reproductive and developmental effects, and cancer.

Tributyl Tin

Organotins are man-made polar ionic compounds containing one or more tin-to-carbon covalent bonds. Tributyl tin (TBT) is perhaps the most common organotin found in the environment. The biocidal properties of TBT were first recognized in the 1950's and resulted in the formulation of a variety of products and applications. TBT is most commonly used as

a pesticide (slimicides, fungicides, bacterialcides, and algicides). TBT has been included in anti-fouling paints since the 1960's and gained widespread application on pleasure boats, large ships and docks in the 1970's and 1980's.

In the 1970's anti-fouling paints were found to cause detrimental environmental impacts, and a number of countries began to impose use restrictions on TBT in the 1980's, including the US. The major ways TBT can be expected to enter the environment include: 1) leaching from painted vessels and structures, 2) fugitive paint and paint chips from vessel repair and dry dock facilities, and 3) TBT-containing ballast water releases. Once released into the aquatic environment, TBT tends to partition to sediment and biota. TBT tends to persist in the environment, especially in sediments and in the absence of sunlight.

The biological response of organisms to TBT can vary enormously. In addition to direct mortality, adverse impacts on a wide variety of aquatic organisms include reduced larval growth, sexual abnormalities, reproductive failure, gross morphological abnormalities, immune system dysfunction, nervous system disorders, and skin and eye disorders. The toxic effects of TBT to humans have not been well documented. Occupational exposure in various incidents has led to dermatitis and the irritation of eyes and the respiratory tract.

Asbestos

Asbestos is the name used for a group of six naturally occurring minerals made up of long, thin fibers. Asbestos fibers are very strong and resistant to heat and chemicals, which make them very stable in the environment. The properties of asbestos have led to extensive use in a wide variety of products. The most common exposure route for asbestos is inhalation.

Exposure to asbestos can increase the chances of getting two types of cancer: cancer of the lung tissue and mesothelioma (a cancer of the thin membrane that surrounds the lung and other internal organs). Besides causing cancer, breathing asbestos can cause asbestosis, a slow accumulation of scar-like tissue in the lungs and the membrane that surrounds the lungs.

CONTAMINANT MIGRATION PATHWAYS, EXPOSURE PATHWAYS, AND RECEPTORS

Contaminant Migration Pathways

Contaminant migration pathways are routes taken by contaminants as they migrate away from the source through environmental media. Considering the suspected potential sources of contamination discussed previously in this memorandum, the following principal contaminant pathways are suspected at the PSY:

1) Above Ground Air and Surface Water Runoff- Above ground air- and surface water runoff-related transport of contaminant releases from site operations to the Willamette River and to a lesser degree to upland soils. For example, overblow of abrasive blasting material at dry docks, surface water runoff carrying spills or abrasive blasting material, or wind carrying contaminated surface soils or abrasive blasting material.

2) Infiltration of Precipitation and Surface Runoff- Contaminant migration due to precipitation and surface runoff infiltrating and leaching through upland areas of surface and subsurface contamination. For example, rain infiltrating through contaminated soils in the BWTP.

3) Direct Releases- Contaminant migration due to direct releases. For example, chemical spills flowing across the upland surfaces to the river and sediments or direct releases from the BWTP.

4) Groundwater- Contamination migration due to either groundwater in contact with contaminated soil or contaminant releases infiltrating to groundwater. For example, contaminants from the unlined ponds at the former Ballast Water Treatment Plant migrating through the vadose zone soils to groundwater, and then to river sediment and the river via groundwater advection.

5) Suspension or Dissolution of River Sediments- Contaminant migration due to the suspension and redistribution of contaminants or contaminated sediments by river water or by activities caused by man (e.g., boat traffic) or biota (e.g., aquatic organisms disturbing sediments). Contaminant migration due to dissolution of contaminants and advection by river water.

6) Volatiles- Contaminant migration due to volatiles released from contaminated environmental media. For example, volatiles from UST releases migrating through vadose zone soils into on-site buildings.

7) Biota- Bioconcentration and bioaccumulation in organisms and the resulting potential for transfer and biomagnification along food chains.

Exposure Pathways

Exposure Pathways for Human Receptors- Assuming the PSY remains an industrial facility in the future, the primary pathways for human exposure at and in the immediate vicinity of the PSY include:

- direct contact with either contaminated upland soils or sediments,
- incidental ingestion/inhalation of contaminated soils and possibly sediments,
- incidental ingestion and/or dermal contaet with surface water contaminated by facility sources,
- direct contact, inhalation of volatiles or particulates, and/or incidental ingestion of particulates from direct releases,
- inhalation of volatiles and contaminated soil and/or groundwater and particulates from contaminated soils,
- ingestion and/or other exposure to contaminated groundwater, and
- consumption of aquatic species impacted by site contaminants.

Exposure Pathways for Ecological Receptors- Assuming the PSY remains an industrial facility in the future, the primary pathways for ecological exposure include:

- direct uptake of surface water and or sediments contaminated by facility sources, and
- ingestion of aquatic or benthic organisms in the river by aquatic or terrestrial consumers or decomposers.

Receptors

Human Receptors- Assuming the PSY remains an industrial facility in the future, the primary human receptors include:

- industrial site workers,
- trench workers,
- site visitors,
- workers and residents in the vicinity of the facility,
- subsistence fishers, and
- recreational users of the river.

Ecological Receptors- - Assuming the PSY remains an industrial facility in the future, the primary ecological receptors include:

- aquatic and benthic organisms in the river, and
- terrestrial wildlife.

DATA GAPS

Upland Data Gaps

1) BWTP- Soil and suspected groundwater contamination associated with the BWTP. Particularly the nature and extent of contamination associated with the former finishing ponds currently in the footprint of Bldg 72. Suspected COI include, but may not be limited to TPH, PCBs, and metals. Historical research is first needed to better describe the layout, operation and environmental conditions at the old BWTP.
2) N Channel Avenue Fabrication Site- Soil and potential groundwater contamination associated with historic and ARCO fabrication activities. Suspected COI include metals, sand blast grit, TPH and possibly solvents.
3) Building 73- An accurate and comprehensive accounting of the operations and environmental conditions at Building 73. Suspected COI include metals, TPH, and solvents.
4) Building 4- An accurate and comprehensive accounting of the operations and environmental conditions at Building 4. Suspected COI include metals, TPH, and solvents.
5) USTs and Underground Heating Oil Tanks (HOTs)- An accurate and comprehensive accounting of the status and environmental conditions of all former and present USTs and HOTs onsite. Suspected COI include TPH, but may include other chemicals such as glycol.
6) Paint Shed/Blast Booth Area/Berth 313- Soil and potential groundwater contamination. Suspected COI include TPH, metals, PCBs, and solvents.
7) Building 43, 50, 80 Area (Steam Cleaning Basin)- Soil and potential groundwater contamination. Suspected COI include TPH, PCBs, solvents and metals.

8) Electrical Substations- An accurate and comprehensive accounting of the status and environmental conditions at all former and present on-site substations. Suspected COI include PCBs and TPH.

9) Old Boiler- Historical research needed to identify the location and environmental conditions of the former boiler. Investigation may be necessary to verify the environmental conditions. Suspected COI are TPH.

10) Outfall 002 and 003- What is the status and environmental conditions at the outfalls formerly named as 002 and 003 in an old NPDES permit?

11) Hazardous Waste Storage Areas- An accurate and comprehensive accounting of the status and environmental conditions of the former and present hazardous waste storage areas.

12) Berth 305- An accurate and comprehensive accounting of the status and environmental conditions of the paint shed, drum storage area, and catch basin in the vicinity of Berth 305. Suspected COI include metals, TPH, and solvents.

13) Berth 311- What is the status and environmental conditions at Berth 311. What is the status and environmental conditions associated with the UST decommissioning at Oregon Freightways east of Berth 311.

Sediment Data Gaps

1) Bulk Chemistry of Surface and Subsurface Sediments- Additional sediment samples are needed to further characterize the bulk chemistry of surface and subsurface sediments. The location and number of samples should be sufficient to supplement the existing data to achieve adequate and representative coverage in the vicinity of the PSY.

2) Bioaccumulation Potential- Should bioaccumulation testing be conducted on suspected COI present in sediments at the facility?

3) Pre-1990 Dredge Spoils- Were most of the pre-1990 dredge spoils placed as upland fill at Mocks Bottom, the south end of Swan Island Lagoon, and former on-site shipways? Were the pre-1990 dredge spoils ever characterized? Are there any outstanding environmental concerns with the dredge spoils?

4) Sand Blast Grit Composition- What was the general composition of sand blast grit prior to 1985? Are the EP Tox values presented in Table 4 representative of past and present abrasive materials?

PROJECT STRATEGY AND RECOMMENDATIONS

The soil, sediment, and possible groundwater contamination at the PSY has been present for some time and does not appear to pose an imminent and increasing threat to human health or the environment. Therefore, no immediate emergency removal or interim remedial action is necessary at this time.

Based on the existing environmental data, the contamination present at the PSY poses a risk to human health and/or the environment. Therefore a Remedial Investigation/Feasibility Study (RI/FS, OAR 340-122-080 through -085) should be completed to provide the basis for selection of a remedial alternative and to resolve the data gaps identified in this memo. The purpose of the RI/FS includes:

- Obtain sufficient data to characterize the facility, including such elements as: waste management history; geology and hydrogeology; current and reasonably anticipated

future land use at the facility and surrounding properties; current and reasonably likely future beneficial uses of groundwater and surface water in the locality of the facility; and identification of ecological receptors and terrestrial habitats in the locality of the facility.

- Obtain sufficient data to complete the identification and characterization of the full nature and extent of the hazardous substances and impacted media at the facility.
- Obtain sufficient data to complete the baseline human health and ecological risk assessment.
- Obtain sufficient data to identify and allow evaluation of potential remedial options.

Specific recommendations to move the project forward and to fill the existing data gaps include the following:

1) Prepare a Work Plan for an RI/FS- The RI/FS work plan can be largely prepared using Bridgewater's December 1998 conceptual plan. The RI/FS work plan should also address the data gaps presented in this File Review Memo. The upland portion of the RI/FS is relatively straight-forward and can be completed using Oregon Administrative Rules (OAR) 340-122-080 through 340-122-115 and published DEQ guidance. In addition to the referenced OARs and published DEQ guidance, the sediment portion of the RI/FS should also comply with Appendix G- Sediment Assessment Methodology (SAM) of the Portland Harbor Sediment Management Plan. The SAM describes the following two phases of the RI for sediments:

   Phase I-
   -Define the nature and extent of contamination
   -Conduct effects-based (toxicity) ecological risk assessment
   -Conduct human health risk assessment (incidental ingestion and direct contact)
   -Determine sediment quality guidelines

   Phase II
   -Conduct human and wildlife fish consumption (bioaccumulation) risk assessment
   -Conduct site-specific biota-sediment accumulation function

2) Implement RI Work Plan-

Attachments:
Attachment 1- Files Reviewed

Figure 1- Vicinity Map
Figure 2- Boundaries of the Portland Harbor
Figure 3- Site Vicinity Map
Figure 4- Stormwater System
Figure 5- PPSY Underground Tank Locations
Figure 6- N. Channel Avenue Fabrication Site
Figure 7- N. Channel Avenue Fabrication Site 2
Figure 8- Former Norvac Waste Storage Area
Figure 9- Location Map, North of Building No. 50
Figure 10- Soil Sampling Locations
Figure 11- Conceptual site Model for Potential Human Exposures
Figure 12- Conceptual site Model for Ecological Exposures

Table 1- Historic Dredging Activities at the PSY (Portland Ship Yard)
Table 2- Material Inputs and Potential Pollutant Outputs for the Shipbuilding and Repair Industry
Table 3- Summary of Dry Dock Discharge Water and Sandblast Analysis
Table 4- Summary of EP Toxicity Results from Used Sandblast Samples Collected in 1985 and 1988
Table 5- Registered USTs at PSY
Table 6- PSY Site Specific Apparent Effects Thresholds (AETs)

Attachment 1
Files Reviewed

NOTE: DEQ Water Quality, Air Quality, Underground Storage Tank, Hazardous Waste, Solid Waste, and Cleanup files were extensively reviewed in the preparation of this memo. However, due to the quality and type of material contained in these files (correspondence, permits, newspaper clipping, notes; etc.), they have not been referenced specifically. A partial listing of reviewed documents is provided below in chronological order:

June 1990, DEQ, Preliminary Assessment, Port of Portland Ship Repair Yard.

November 1994, EPA (by Roy F. Weston), Site Inspection Report, Port of Portland- Swan Island, Portland, Oregon.

February 1997, Port of Portland, Notice of Site Assessment Review- Port of Portland – Ship Repair Yard.

April 1997, DEQ, Draft Site Assessment Program- Strategy Recommendation.

May 1998, CH2MHILL, Portland Shipyard Upland Sampling Results.

May 1998, EPA (by Roy F. Weston), Portland Harbor Sediment Investigation Report.

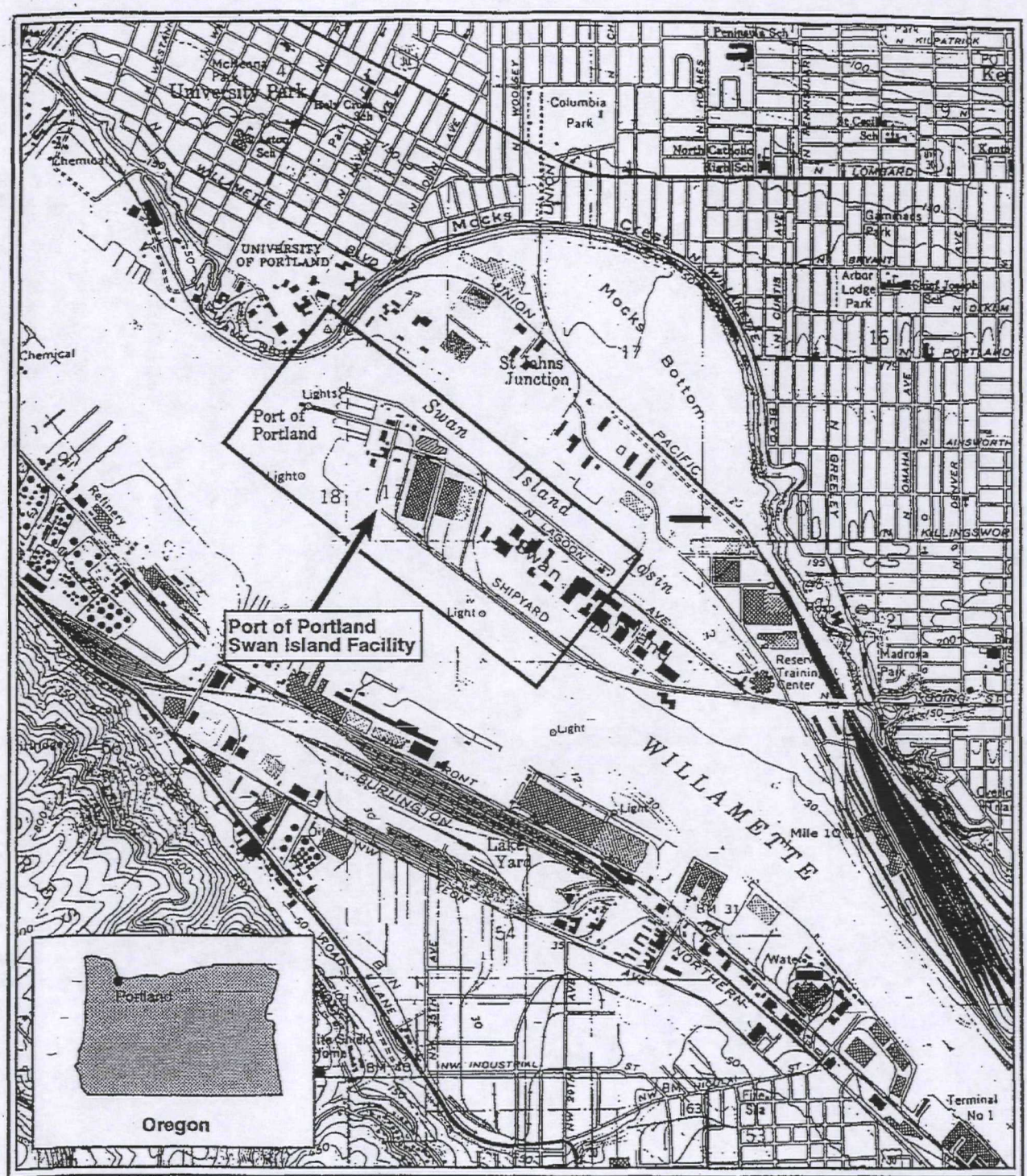
July 1998, Port of Portland, Portland Harbor Sediment Data Review.

October 1998, DEQ, Revised Site Assessment Program- Strategy Recommendation.

November 1998, Striplin Environmental Associates, Portland Shipyard Sediment Investigation Data Report.

December 1998, Bridgewater Group, Conceptual Site Model and RI/FS Conceptual Plan- Portland Shipyard.

March 1999, Bridgewater Group, Portland Harbor Benthic Community Survey Data Analysis.



0 1000 2000

Scale in Feet

Source: USGS 7 1/2' Quadrangle Series—Portland, Oregon (1977)

WESTON MANAGERS DESIGNERS/CONSULTANTS

4000-19-04-4100
December 1994

Port of Portland Swan Island Facility Vicinity Map

FIGURE 1

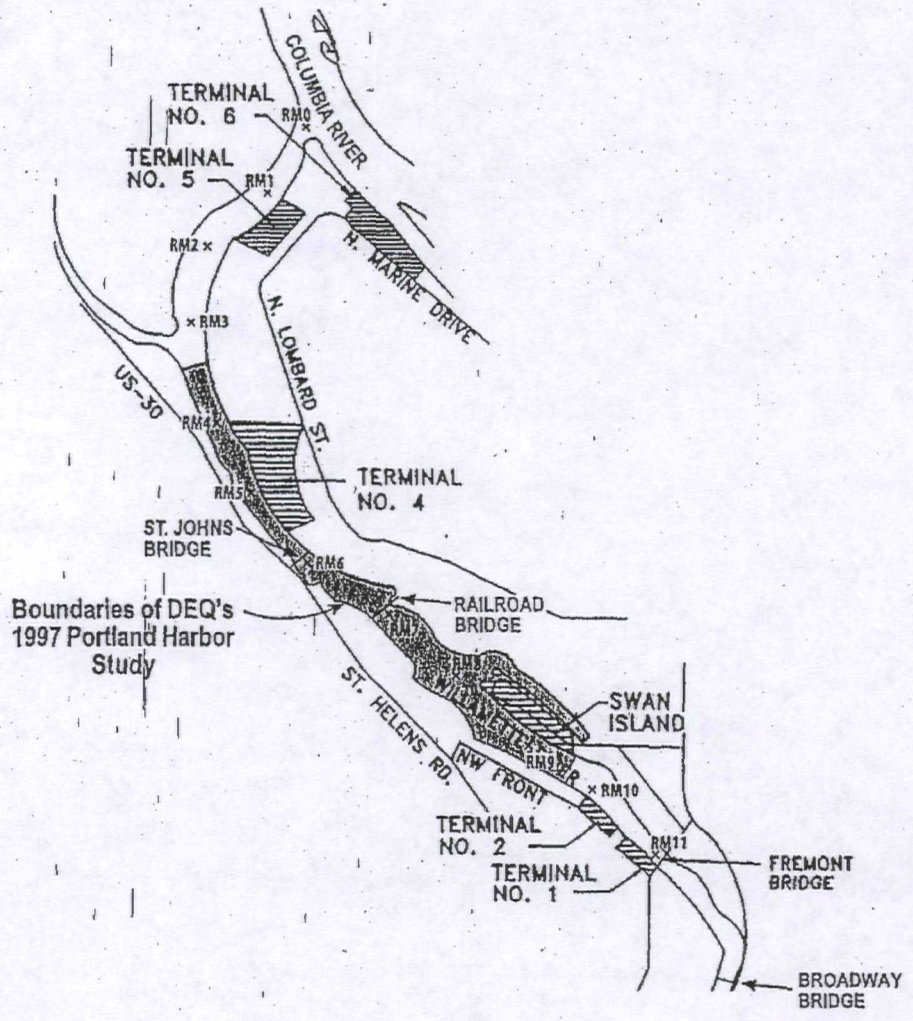
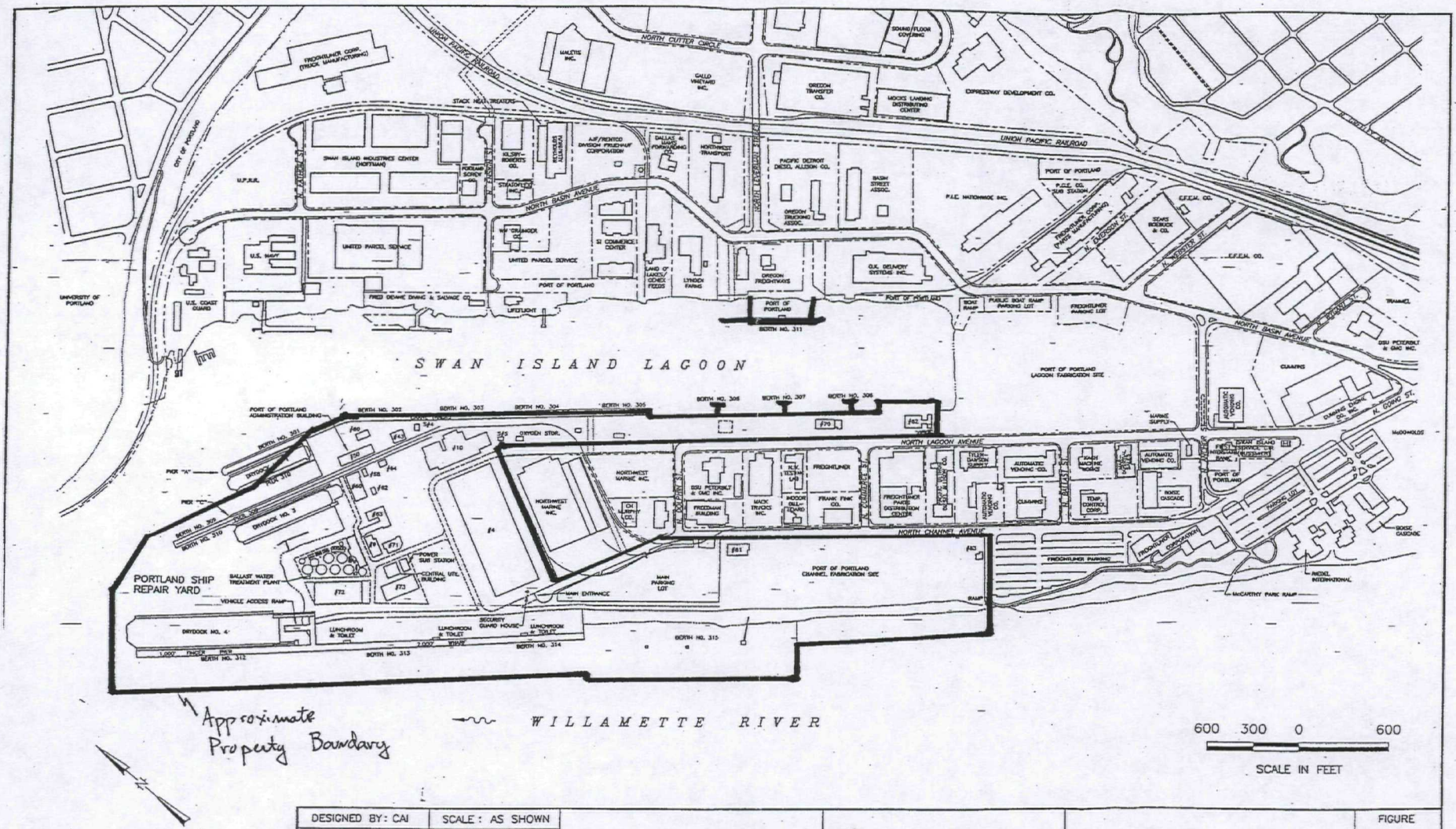


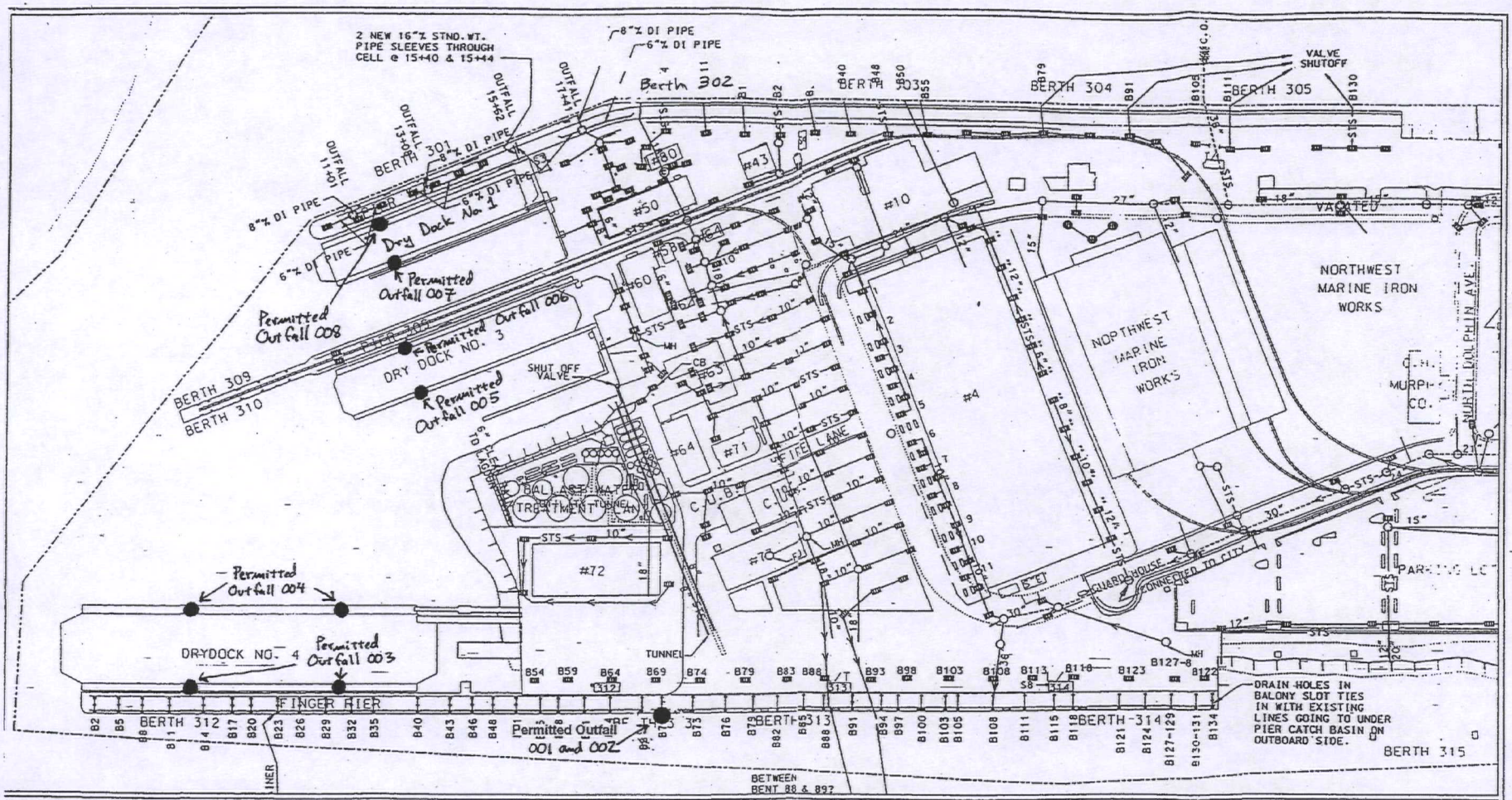
Figure 2
Boundaries of the Portland Harbor
Portland Harbor Sediment Data Review
Port of Portland



DESIGNED BY: CAI	SCALE : AS SHOWN	centurywest ENGINEERING CORPORATION	PORT OF PORTLAND PORTLAND, OREGON
DRAWN BY : RAW	DATE : 11/17/93		
CHECKED BY : W	FILE :		
PROJECT NO.: 4003804202			

SITE VICINITY MAP

FIGURE 3



Port of Portland - Swan Island Facility
Storm Water System
Ship Repair Yard

FIGURE 4

WESTON
MANAGERS ENGINEERS/CONSULTANTS

4000-19-04-4100
December 1994

PSRY UNDERGROUND TANK LOCATIONS

1. Crosby & Overton, legally abandoned
2. Port, unused, removed (26-89-166)
3. NMIW, legally abandoned } offsite
4. NMIW, legally abandoned }
5. Port, Diesel, removed (26-89-166)
6. Port, unleaded, removed }
7. Port, diesel, removed } (26-89-166)
8. NMIW, regular, removed }
9. Port, fuel oil, abandoned, to be sand filled, cannot remove (26-89-166)
10. Cascade General, regular, removed
11. Cascade General, unleaded, removed (26-89-166)
12. Port, boiler fuel }
13. Port, boiler fuel } (26-93-6019)
14. Port, glycol
15. Port, new fiberglass tank, diesel
16. Port, new fiberglass tank, unleaded

SHIP REPAIR YARD

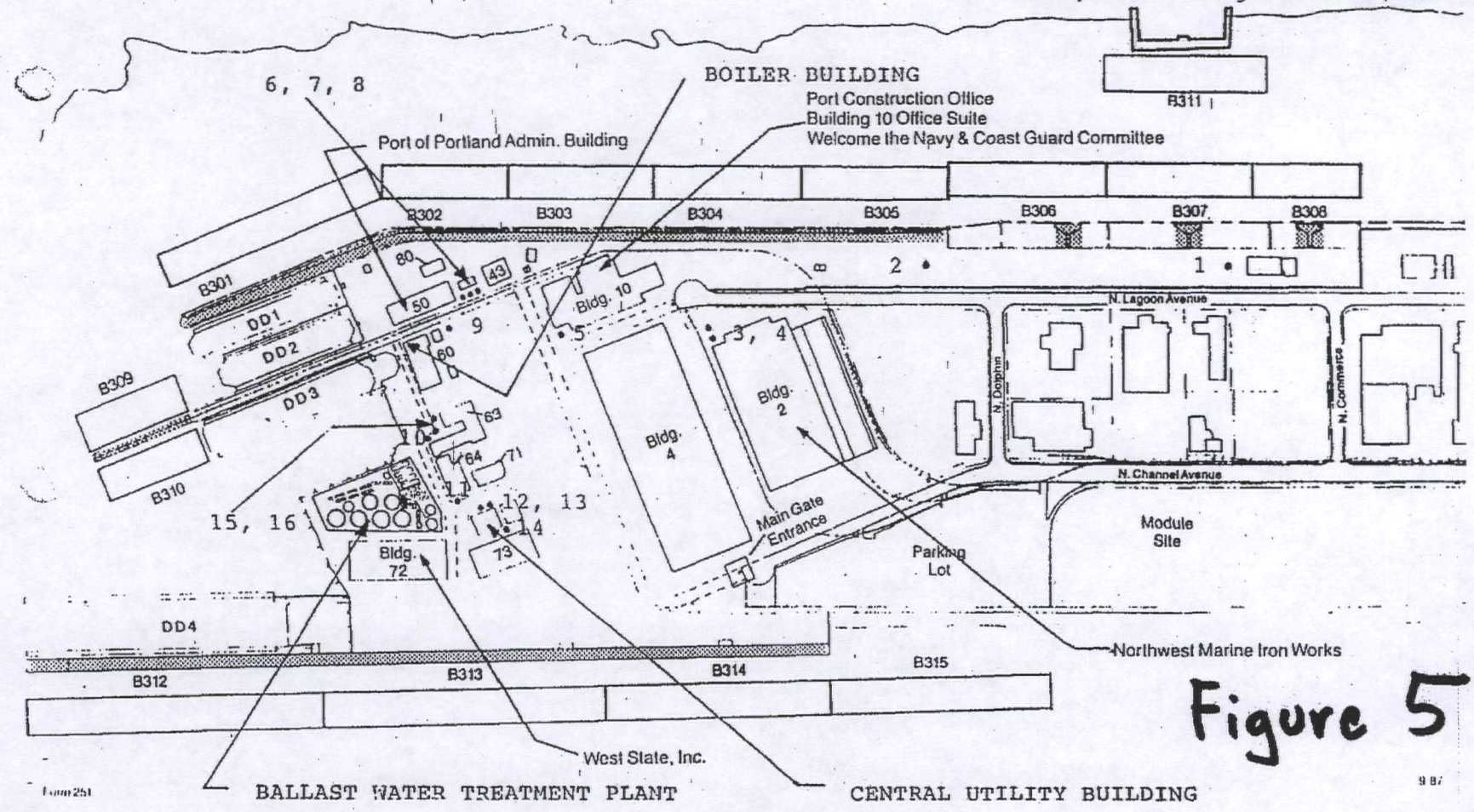
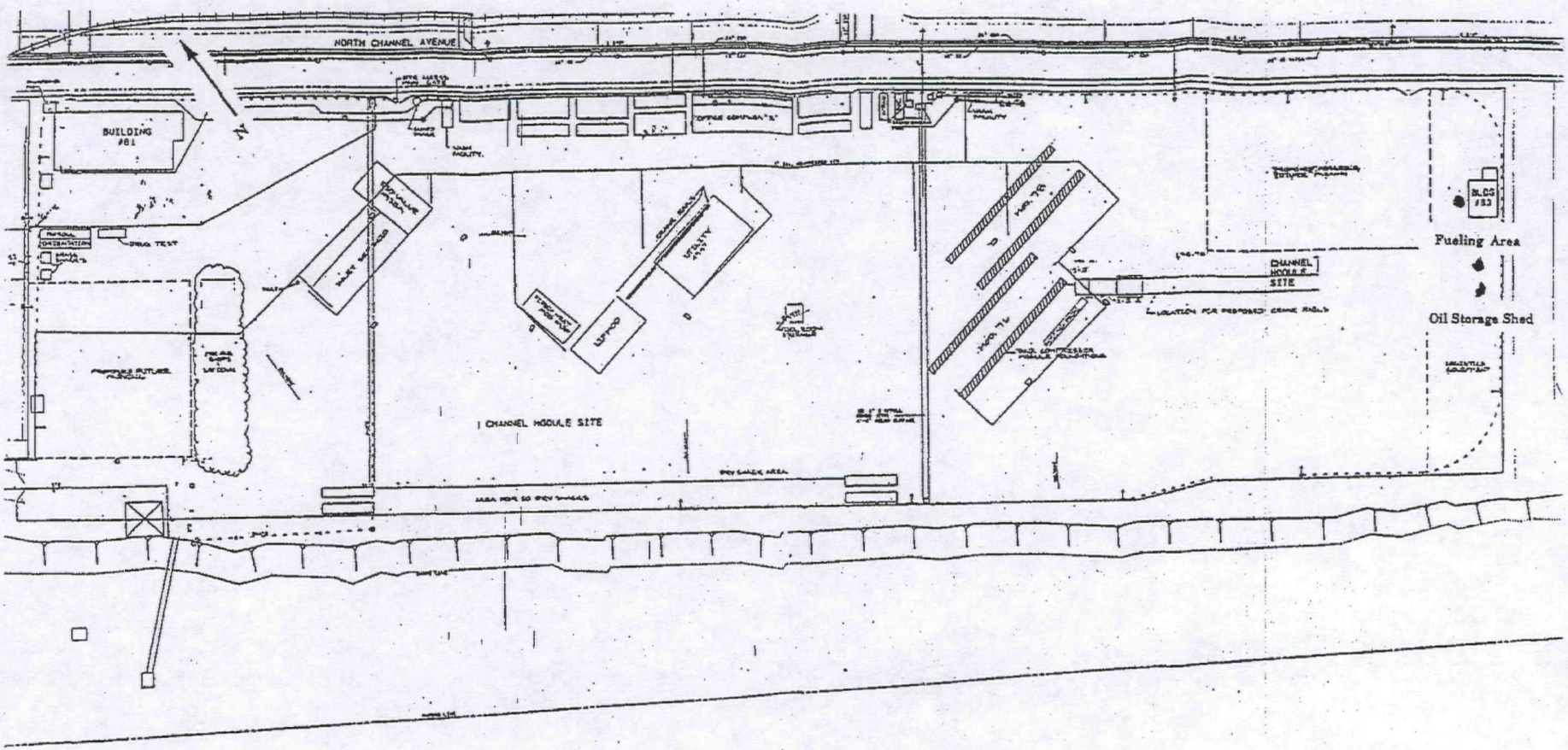


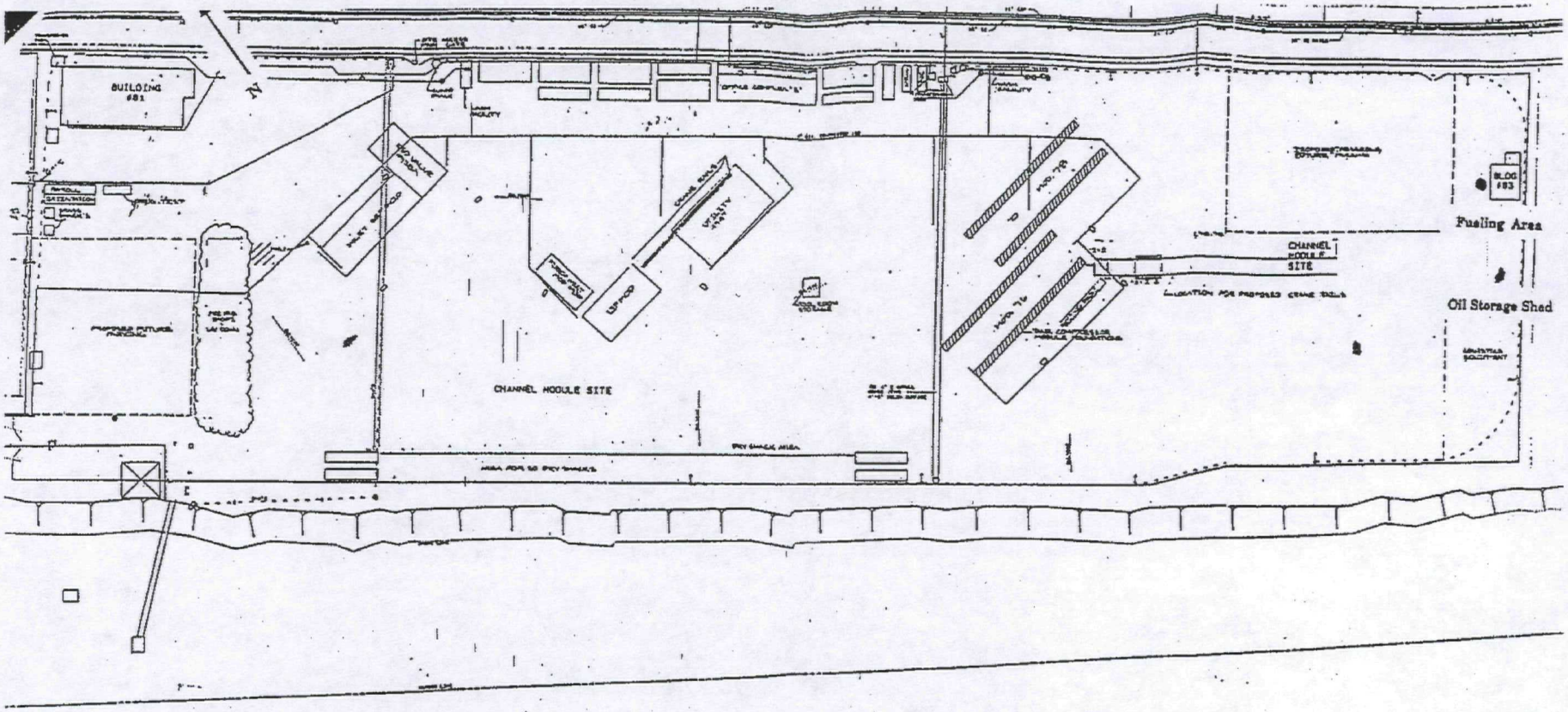
Figure 5



not to scale

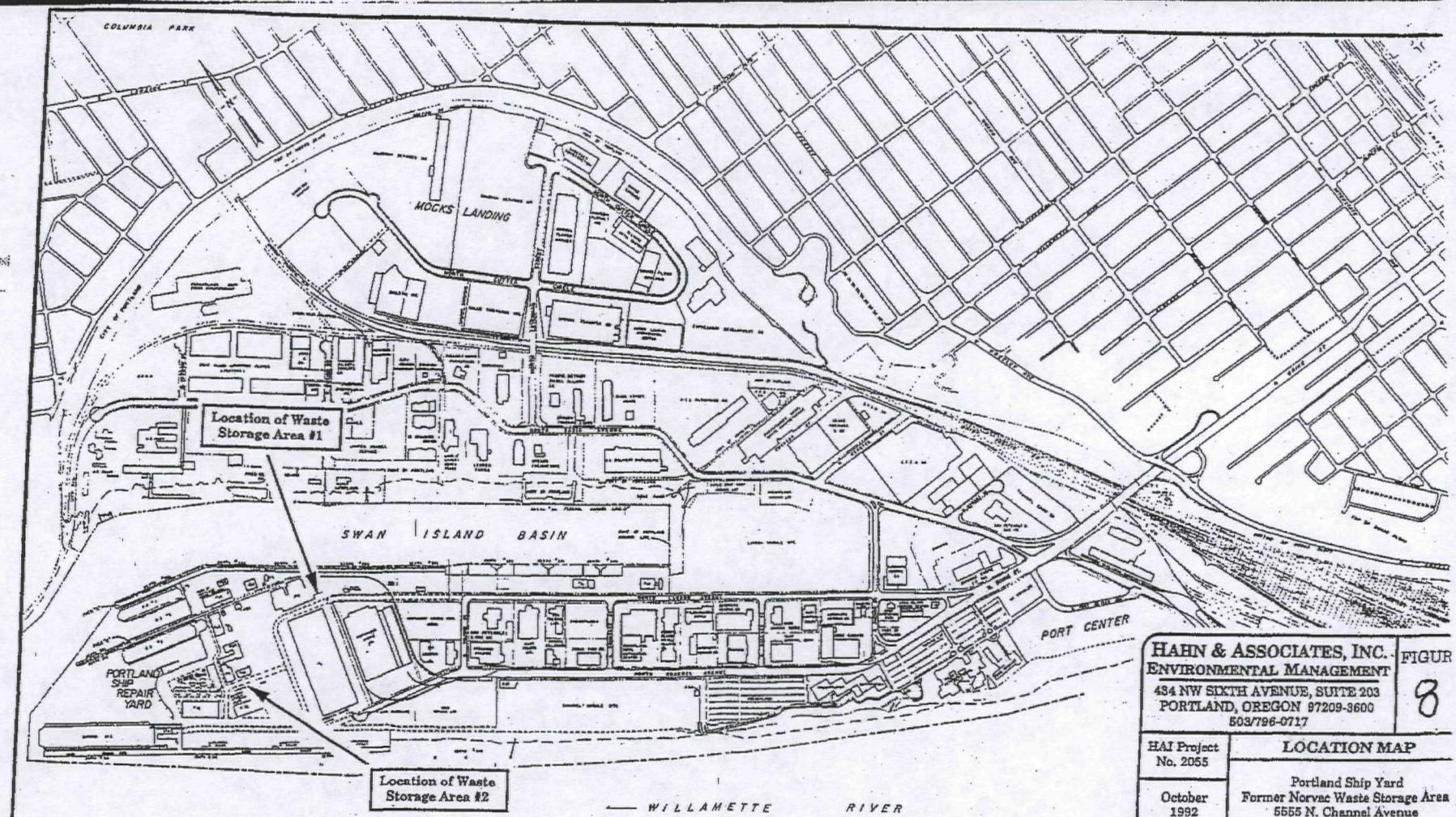
N. Channel Ave
Fabrication Site

Figure 6



N. Channel Ave
Fabrication Site-2

Figure 7

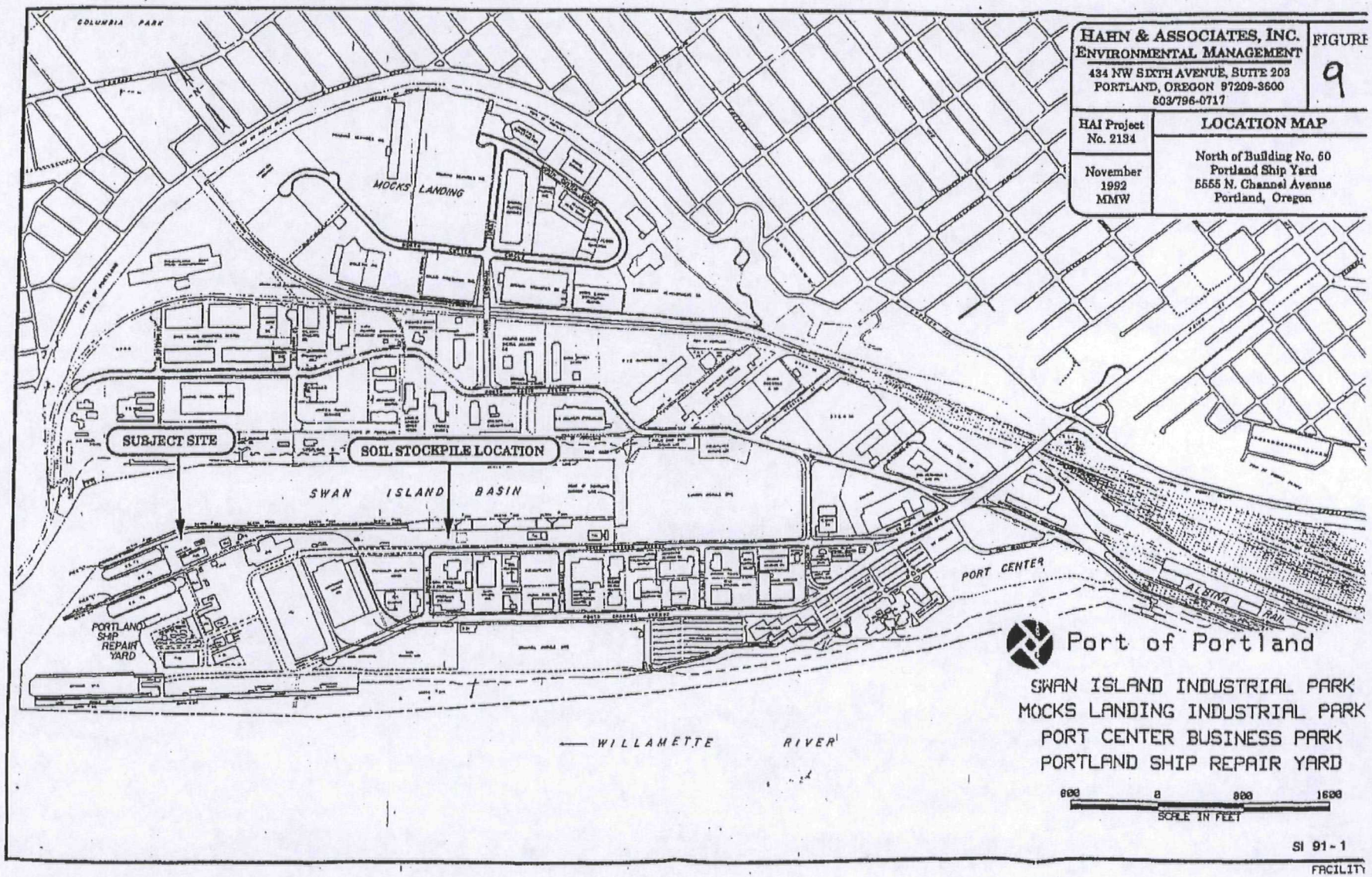


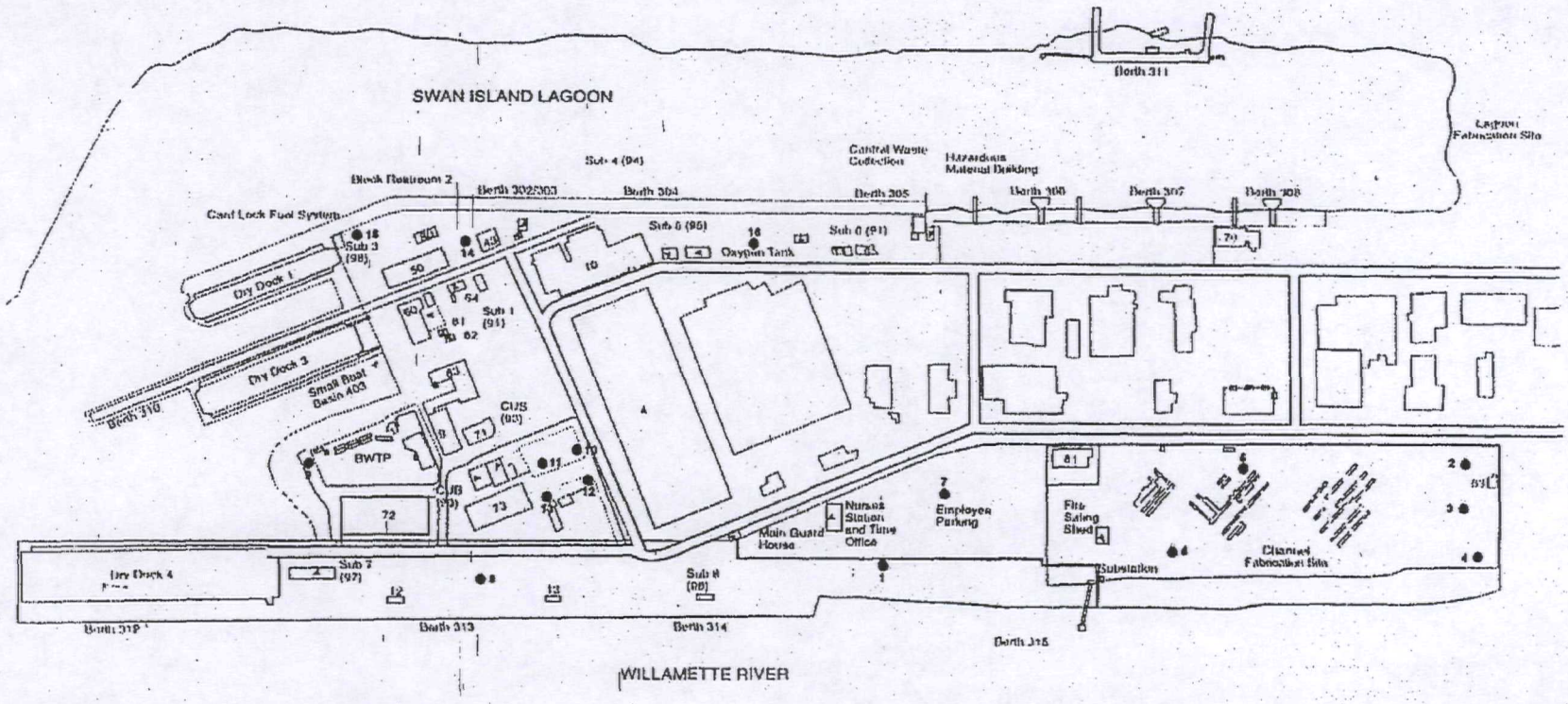
HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209-3600
503/796-0717

FIGUR 8

HAI Project No. 2055	LOCATION MAP
October 1992 JAA	Portland Ship Yard Former Norvac Waste Storage Area 5555 N. Channel Avenue Portland, Oregon

SI 91-1


COLUMBIA PARK
MOCKS LANDING
SUBJECT SITE
SOIL STOCKPILE LOCATION
SWAN ISLAND BASIN
PORT CENTER
ALBINA RAIL
PORTLAND SHIP REPAIR YARD
WILLAMETTE RIVER
HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209-3600
503/796-0717
FIGURE
9
HAI Project No. 2134
LOCATION MAP
November 1992 MMW
North of Building No. 60
Portland Ship Yard
5555 N. Channel Avenue
Portland, Oregon
Port of Portland
SWAN ISLAND INDUSTRIAL PARK
MOCKS LANDING INDUSTRIAL PARK
PORT CENTER BUSINESS PARK
PORTLAND SHIP REPAIR YARD
800 0 800 1600
SCALE IN FEET
SI 91-1
FACILITY



LEGEND
● Soil Sampling Locations

NORTH

● 7 Soil Boring Location

Figure 10
Soil Sampling Locations

CH2MHILL

Figure 11
Conceptual Site Model for Potential Human Exposures
Portland Shipyard (PSY) Site

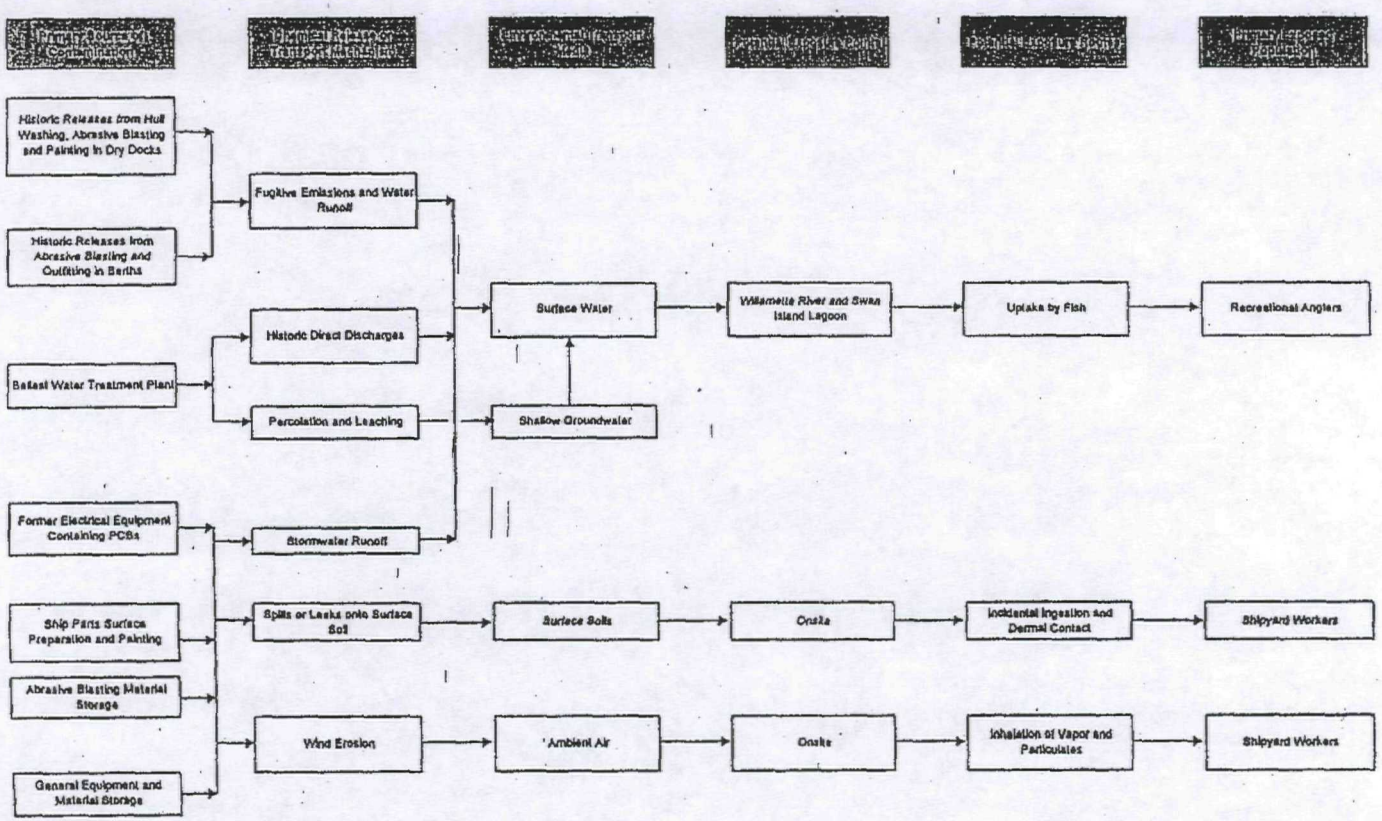


Figure 12
Conceptual Site Model for Ecological Exposures
Portland Shipyard (PSY) Site

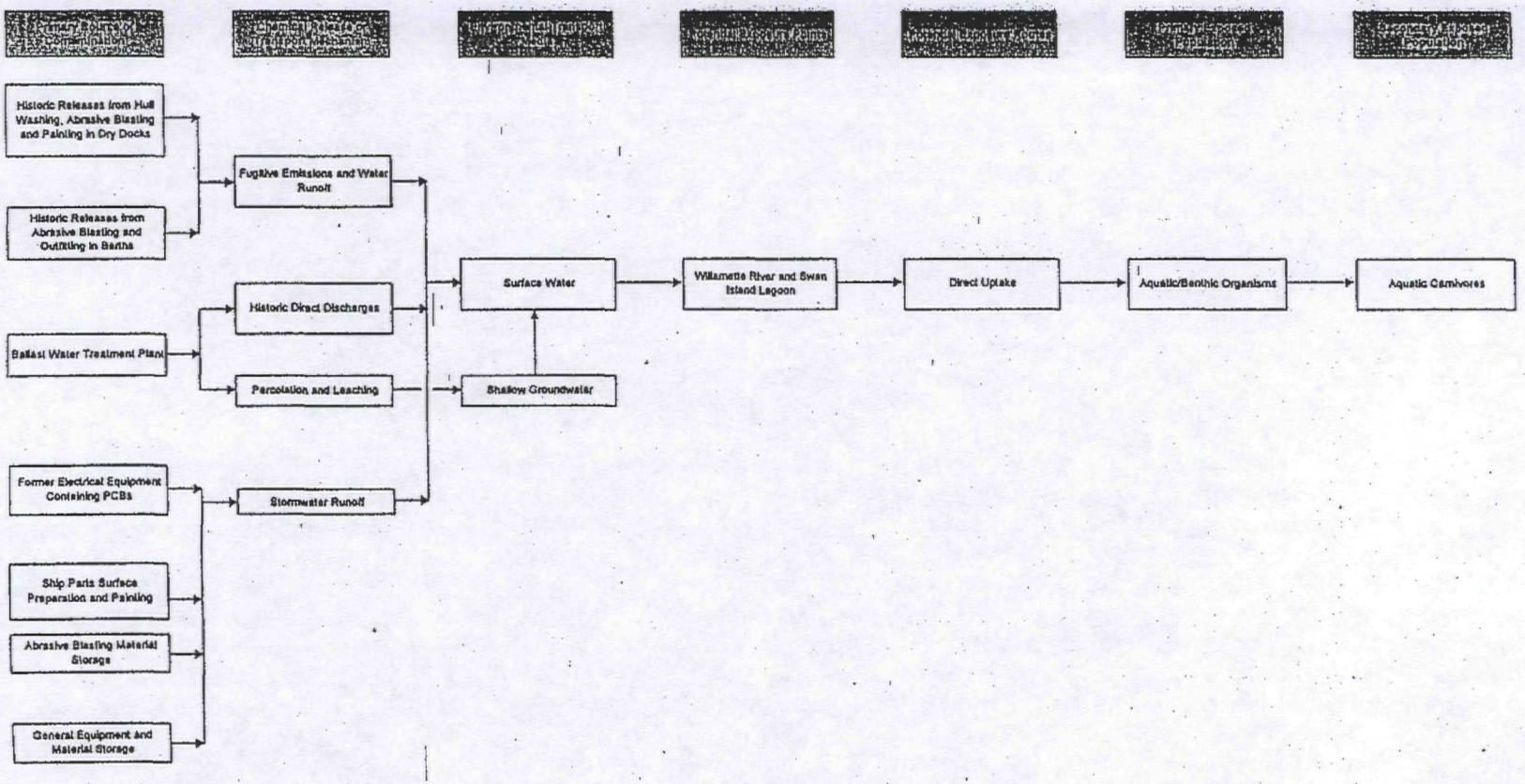


Table 2: Material Inputs and Potential Pollutant Outputs for the Shipbuilding and Repair Industry

Industrial Process	Material Inputs	Air Emissions	Wastewater	Residual Wastes
Surface Preparation	Abrasives (steel shot, lead shot, steel grit, garnet, copper slag, and coal slag), detergents, solvent paint strippers and cleaners, and caustic solutions.	Particulates (metal, paint, and abrasives) and VOCs from solvent cleaners and paint strippers.	Wastewater contaminated with paint chips, cleaning and paint stripping solvents, surface contaminants, and oil residues from bilges and cargo tanks.	Paint chips (potentially containing metals, tributyl-tin), spent abrasives, surface contaminants, and cargo tank residues.
Metal Plating and Surface Finishing	Plating metals, cyanide solutions, cleaning solvents, rinse water, acid and caustic solutions and rust inhibitors.	Metal mists and fumes, and VOCs from solvents.	Rinse and quench water contaminated with metals, cyanides, acids, alkalies, organics, and solvents.	Sludge from wastewater treatment, spent plating solutions and cyanide solutions, bath cleaning residues.
Painting	Paints, solvents, and water.	VOCs from paint solvents and equipment cleaning solvents, and overspray.	Waste equipment cleaning water and water wash spray paint booth sump water contaminated with paints and solvents.	Leftover paint and solvents, waste paint and solvent containers, spent paint booth filters, and spent equipment.
Fiberglass Reinforced Construction	Fiberglass, resin, solvents, curing catalysts, and wood and plastic reinforcing materials.	VOC emissions released during construction operations and curing (e.g., styrene) and during cleaning with solvents (e.g., acetone and methylene chloride).	Little or no wastewater generated.	Waste fiberglass, gelcoat, resin, unused resin that has exceeded its shelf life, spent solvents, and used containers.
Machining and Metal Working	Cutting oils, lube oils, and solvents.	VOC emissions from the use of cleaning and degreasing solvents.	Wastewater containing solvents, emulsified lubricating and cutting oils and coolants.	Waste cutting oils, lube oils, and metal chips and shavings.

Sources: Kura, Bhaskar, *Typical Waste Streams in a Shipbuilding Facility*, and U.S. EPA, Office of Research and Development, *Guides to Pollution Prevention, The Marine Maintenance and Repair Industry.*

Table 1

Historic Dredging Activities at the PSY

Date	Dredged Area	Volume of Dredged Material
1961	Berth A	Unknown Dredged to 52 ft below CRD
1962	Berths 303, 304, 304	Unknown
	Pier C	Unknown Dredged to 57 ft below CRD
1966	Turning (Lagoon to Berth 305)	Unknown
1978	Dry Dock 4	135,000 cy Dredged to 65 ft below CRD
1981	Dry Dock 3	Unknown Dredged to 54 ft below CRD
1985	Berths 301, 302, 303, 304, 305	Unknown Dredged to 30 ft below CRD
1992	Berth 311	Unknown
	Dry Dock 4	95,000 cy
1993	Dry Dock 1	14,000 cy
1994	Dry Dock 3	22,000 cy
1995	Berth 311, 309, 310	Unknown

CRD = Columbia River datum

from: Striplin Environmental Associates, 11/9/98, "Portland Shipyard Sediment Investigation"

Table 3—Summary of Dry Dock Discharge Water and Sandblast Analysis

Analyte	Water Concentration Range (mg/L)[a]	Sandblast Concentration Range (mg/kg)[b]
Antimony	0.11	4.9 - 60
Arsenic	ND[c]	22 - 96
Barium	0.04 - 0.48	240 - 615.8
Beryllium	ND[c]	0.46 - 7.9
Cadmium	ND[c]	1.4 - 7.2
Chromium	0.02 - 0.05	35 - 90
Copper	0.034 - 0.93	2,477 - 17,000
Iron	0.24 - 36.4	42,700 - 159,160
Lead	0.05 - 0.1	30 - 700
Mercury	ND[c]	0.28 - 3.1
Nickel	0.01-0.03	14.8 - 40
Selenium	ND[c]	1.2
Silver	0.01	2.8 - 3.1
Thallium	0.05	13 - 20
Tin	0.32	46 - 760
Zinc	0.01 - 0.58	1,120 - 8,100

[a] mg/L = milligrams per liter = parts per million
[b] mg/kg = milligrams per kilogram = parts per million
[c] ND - Not detected in any sample. The above ranges present the detected concentrations; some of the above analytes were undetected in certain years.

Note: A single value indicates that there was only one detect in the reporting period or that there were multiple detections at the same concentration.
Analyses are from years 1993, 1992, 1991, 1988, 1986, and 1985.

Source: Hunt, 1994b

From: EPA, 12/96, Site Inspection Report, Port of Portland - Swan Island

Table 4
Summary of EP Toxicity Results from Used Sandblast Samples Collected in 1985 and 1988

Metal	EP Tox Result (mg/L)	RCRA Limit (mg/L)
Antimony	<0.05	None
Arsenic	0.015	5.0
Barium	1.0 - 0.54	100.0
Beryllium	<0.05	None
Cadmium	0.1 – <0.05	1.0
Chromium	<0.1	5.0
Copper	3.3	None
Iron	0.21	None
Lead	0.2 - <0.05	5.0
Mercury	<0.05	0.2
Nickel	<0.05	None
Selenium	<0.05	1.0
Silver	<0.05	5.0
Thallium	<0.05	None
Tin	<1.0	None
Zinc	20.55	None

Table 5
Registered USTs at PSY
(Facility Number 392 and 496)

UST Identification Number [1]	Installation Date	Size (gallons) & Product	Status	Notes
1	5/66	3,000 gasoline	Removed 2/89	
11	5/66	1,000 gasoline	Removed 10/89	NFA 7/92
8	5/76	2,000 gasoline	Removed 10/89	NFA 7/92
9	5/61	10,000 fuel oil	Removed 10/89	Conditional NFA 7/92
7	5/76	1,000 diesel	Removed 10/89	NFA 7/92
14	5/78	? glycol	Removed 3/92	
6	5/78	500 diesel	Removed 10/89	NFA 7/92
15 (PSY-1A)	6/89	6,000 gasoline	Active	Card Lock
16 (PSY-2A)	6/89	6,000 diesel	Active	Card Lock
PSY 15	?	500 gasoline	Removed 8/89	
PSY-16	?	100 gasoline	Removed 8/89	
PSY-17	?	250 diesel	Removed 8/89	
2 (PSY-18)	?	12,700 diesel	Removed 8/89	NFA 7/92
5 (PSY-19)	?	500 diesel	Removed 8/89	NFA 7/92

(1) UST Identification Number refers to UST Number in Figure 5

Table 6 PSY Site Specific Apparent Effects Thresholds (AETs).

		Chironomid Bioassay	Amphipod Bioassay	Microtox Bioassay	Lowest AET (LAET)
Metals (mg/kg)	Arsenic	>17	17	13	13
	Chromium	>46	>48	>46	>46
	Copper	>655	397	397	397
	Lead	>96.6	>96.6	>96.6	>96.6
	Mercury	>0.54	>0.54	>0.54	>0.54
	Nickel	>31	31	31	31
	Silver	>3.3	>3.3	1.1	1.1
	Zinc	>683	>683	490	490
	Porewater TBT (ug/L)	>11	7.2	7.2	7.2
LPAH (ug/kg)	Naphthalene	>148	140000	180	>148
	2-methylnaphthene	>54	280	24	24
	Acenaphthene	>90	100000	120	>90
	Acenaphthylene	>25	2600	120	>25
	Anthracene	>429	41000	870	>429
	Fluorene	>285	96000	180	180
	Phenanathrene	>1720	210000	620	620
HPAH (ug/kg)	Dibenzo(a,h)anthracene	>72	870	56	56
	total benzofluoranthenes	>2270	34000	2500	>2270
	Benzo(a)anthrancene	>1480	33000	940	940
	Benzo(a)pyrene	>1630	11000	1100	1100
	Benzo(g,h,I) perylene	>854	>21000	1400	>854
	Chrysene	>2140	39000	2100	2100
	Fluoranthene	>3600	130000	2400	2400
	Indeno(1,2,3cd)pyrene	>889	2400	760	760
	Pyrene	>4280	85000	2400	2400
Phthalates (ug/kg)	Bis(2-ethylhexyl)phthalate	>7590	3510	2220	2220
	Butylbenzyl Phthalate	>280	280	280	280
	Di-n-butyl phthalate	>116	116	116	116
	Di-n-octyl phthalate	>413	115	90	90
	Dimethyl phthalate	>58	58	21	21
Other (ug/kg)	Total PCBs	>394	>394	>394	>394
	Carbazole	–	1800	140	140
	Dibenzofuran	>64	204	41	41

Table –Summary of Dry Dock Discharge Water and Sandblast Analysis

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Note: A single value indicates that there was only one detect in the reporting period or that there were multiple detections at the same concentration.
Analyses are from years 1993, 1992, 1991, 1988, 1986, and 1985.

Source: Hunt, 1994b

List of Portland Shipyard Documents Provided to DEQ
February 1, 1999

Chronological Order

OK	1/3	Final Site Visit: Environmental Review, Arco Alaska, Inc. Portland Fabrication Site, Port of Portland, Ship Repair Yard, Portland, Oregon, by Hahn and Associates, July 24, 1990.	- See JMA Summary - Site inspection (observation only). 4 areas of PCS & 1 area of sand blast grit accumulation
LUST 26-89-166 OK	2/4	Subsurface Investigation, Port of Portland, Ship Repair Yard, Between Buildings #58 and #64, Portland, Oregon, by Hahn and Associates, February 13, 1991.	- Reviewed in LUST 26-89-166 - see FRMA REG HISTORY/ISSUES- LUST 26-89-166, "UST Between Bldg 60 & Lips Propeller Facility
OK	3/12	Level II Environmental Assessment, Soils Investigation, Portland Ship Yard, 5555 North Channel Avenue, Former Norvac Waste Storage Areas, Portland, Oregon, by Hahn and Associates, October 30, 1992.	- See JMA Summary - Shallow soil investigation in 2 haz waste storage areas. HAI recommends NFI.
OK	4/7	Polychlorinated Biphenyl Inventory and Disposal Recommendations, Port of Portland, Portland Ship Yard, Building #60, Electrical Substation, Portland, Oregon, by Hahn and Associates, February 28, 1992.	- See JMA Summary - Fluid, soil, tar & wipe sampling at Substation 1. 2 hot transformers & pad (#6 & #10)
OK	5/13	Investigation and Excavation of Contaminated Soils, North of Building No. 50, Portland Ship Yard, 5555 N. Channel Avenue, Portland, Oregon, by Hahn and Associates, November 9, 1992.	- See JMA Summary - PCS next to substation. Adequate contaminant characterization + disposal, 91 tons to Hillsboro
OK	6/16	Soil Investigation, Tank 10 and Pipe Areas, Ballast Water Treatment Plant, Portland Ship Repair Yard, Port of Portland, 5555 Channel Blvd., Portland, Oregon, by Hahn and Associates, May 28, 1993.	- See JMA Summary - PCS characterized & removed from Tank 10 area & pipe area to below ALs
OK	7/11	Disposal of Oil and Stoddard Solvent Contaminted Soil, Construction Excavation, Portland Ship Yard, Port of Portland, 5555 N. Channel Drive, Oregon by Hahn and Associates, August 21, 1992.	- Letter & "Application to Dispose Special Waste" from HAI to Hillsboro LF - 30 cy of PCS discovered during construction excavation activities PCS HCID = Stoddard (C_8-C_{10}) & heavy oil (C_{28}-C_{40}) TPH-D = 46-390 ppm PCBs = 0.08-0.09 ppm TCLP Results = < AL's TPH-418.1/IR: 490-1500 ppm VOCs = E = 0.012 ppm, X = 0.015 ppm
OK	8/5	Soil Sampling at Ballast Water Treatment Facility, Ship Repair Yard by Hahn and Associates, May 31, 1991.	- During installation of new sump at BWTF, PCS was discovered. Waste characterized = TPH-D. 10 cy of diesel PCS excavated & sent to Hillsboro. Confirmation samples (HCID) = ND.
OK	9/18	Level II Environmental Assessment, Soils Investigation, Portland Ship Yard, Ballast Water Treatment Plant, Portland, Oregon by Hahn and Associates, February 28, 1992.	- See JMA Summary - soil contamination below ASTs
	10/9	An Environmental Review, Building 10, Bays 1 and 2, Portland Ship Yard, Portland, Oregon by Hahn and Associates, May 26, 1992.	- See JMA Summary - PCB/oil stn on floor & overhead crane. Most stns CUed using rinse/wash.
OK	11/2	An Environmental Review, Arco Alaska, Inc. Portland Fabrication Site, 5100 N. Channel Avenue, Portland, Oregon by Hahn and Associates, December 8, 1989.	- See JMA Summary - Site inspection (observation only) & regulatory compliance review. 3 areas of PCS near south end
	12/18	Century West Engineering Corp. Environmental Site Assessment Berths 305 and 306, Portland Shipyard, Swan Island, Confidential Report of Findings. March 14, 1994.	- See JMA Summary - ESA recommending NFI
LUST 26-93-6019 OK	13/17	Century West Engineering Corp. Central Utility Building UST Site Characterization Report, Port of Portland, Portland Ship Repair Yard. January 12, 1994.	- See LUST-26-93-6019 - 5/93 2 HA SBs at 4 near vault to TD = 8', TPH < 500ppm at 8' estimate 7 cy of PCS, No GW - 10/93 3 SBs to 27'. Soil & 2 GW samples. GW = ND. Soil below 15' was < 10ppm TPH

LUST 26-93-6019	14/15 Hahn & Associates, Inc. Final Letter Report: Investigate Underground Bunker oil Storage Tank Release, Central Utility Building, Portland Ship Repair Yard, Portland, Oregon. April 28, 1993.	- Letter describing discovery of UST release, SI, Regulatory Analysis, DEQ Notification, Remediation, Recommendations
LUST 26-89-166	15/10 Oregon Department of Environmental Quality. Underground Storage Tank Decommissioning at the Portland Ship Yard. July 24, 1992.	- DEQ's review of POP's submittal on USTs. UFA for: ① Berth 305, ② SW Corner Bldg 64, ③ Between bldg 43 & 50, ④ North side of Bldg 4, ⑤ SW corner of Bldg 10, ⑥ Between Bldg 58 + 64,
LUST 26-93-6019	16/14 Port of Portland. Correspondence Re: P.O.P Ship Repair Yard Heating Oil Tank Release. April 27, 1993.	- DEQ's UST Program notice to CU HOT release rptd 4/20/93. Standard letter
	17/6 Port of Portland. Correspondence Re: Portland Ship Repair Yard, PCB Transfer at Substation #1. October 8, 1991.	- POP Memo: 1) PCB-containing transformers in Substation 1 that was on RBS PCB log. Transformers appears to have leaked, 2) 2 abandoned oil-filled circuit breakers not on log at substation 1, 3) submit sample of tar-like material in Substation 1 that covers 8'X6'x ¼" area near old abandoned (leaking) terminator
	18/1 Port of Portland. Portland Ship Repair Yard Underground Storage Tank Inventory. September 9, 1988.	- Map + list of 16 USTs (6 offsite, 10 onsite). 2 USTs on list that don't appear on POP's 7/29/92 letter to Andrea P listing tanks
OK	19/19 Port of Portland and Cascade General. 1998 Portland Shipyard (PSY) Upland Sampling Results.	- See JMA Summary - 16 SBs w/ soil sampling at 7 locations in Upland AOCs
	20/2A Letter from Chem Pro re: "Oil Spill at Wright Schuchart Harbor Co. on May 6, 1990." dated 6/14/90	- Chem Pro Transmittal Letter covering lab rpt & misc docs. OFF-site? Surface spill of @ 200 hydraulic (?) oil, 40cy PCS to Hillsboro?
OK	21/3A "UST Decommissioning Rpt, POP - Oregon Freightways Facility" by HAI dated 8/30/90	- Facility is located directly east of Berth 311 (on mainland). 10,000-gal gasoline + 500-gal WO UST removed 7/89. Release of gas & WO, & diesel PCS next to diesel AST, 460cy of ~~soil~~ PCS excavated & disposed of at St Johns. Confirmation samples < ALs. 166cy of diesel PCS was excavated & transported to St. Johns. Confirmation samples < ALs GW = BTEX-ND, but 4ppm TPH
OK	22/18A "Soil Remediation, BWTP" by HAI dated 3/31/94	- See JMA Summary - Excavate 50cy PCS from BWTP

CH2MHILL's (?) - 1998 - Portland Shipyard (PSY) Upland Sampling Results

(19/19)

Introduction

- Purpose - assess whether past &/or current activities resulted in releases to upland soils
  - assess if correlation exists between COI in soils & sediments

Methodology 16 SBs

- Sample locations selection based on data gaps in following areas
  - Channel Ave Fab
  - Main Parking Lot
  - Tank farm, BWTP
  - Paint sheds & blast booths near Bldg 73
  - Bldg 53 (PCB release)
  - Steam Cleaning Basin near Bldg 80
  - Bldg 10 & grit silo
- SBs - 2 sets of composite samples at 16 locations, 1ST set = 0-2' bgs & 2nd set = WL - 2' above WL
- Analysis - deep samples analyzed only if shallow samples took hits

---

Channel Ave Fab Site

- 20 acres
- Historic use by ARCO. Activities = welding, hydro blasting, sand blasting, haz sub use & storage, equipment storage
- SOW - 5 locations
  - SB-2 - area of soil stn W of Bldg 83. Analytes = TPH, PCB metals, solvents
    - 0-2' = TPH 418.1 = 146 ppm
    - 20-22' =
  - SB-3 - SW of Bldg 83. Analytes = TPH, PCB, metals, solvents
    - 0-2' = TPH 418.1 = 3010 ppm
    - 16-18' =
  - SB-4 - SW of Bldg 83. Analytes = TPH, PCB, metals
    - 0-2' = PCB = 0.1 ppm, As = 99, TPH 418.1 = 2360 ppm
    - 16-18' = As = 3
  - SB-5 - Analytes = TPH, PCB, metals
    - 0-2' =
    - 16-18' =

SB-6 Analytes = TPH, PCB, metals

0-2' = TPH 418.1 = 773 ppm

16-18' =

Main Parking Lot

- 8 acres
- During WW II, boiler fabrication
- SOW - 2 SB

SB-1 Analytes = TPH, PCB, metals

0-2' =

16-18' =

SB-7 Analytes = TPH, PCB, metals

0-2' = TPH 418.1 = 451

16-18' =

Tank Farm BW.TP

- SOW - 1 SB

SB-9 Analytes = TPH, PCB, metals

0-2' = PCBs = 0.05 ppm, TPH = 569 ppm

14-16' = PCBs = 0.4 ppm, TPH = 1030 ppm

Paint Shed / Blast Booth Area / Booth 313

- Near Bldg 73
- SOW = 5 SBs

SB-8 - Analytes = TPH, PCB, metals

0-2' =

16-18' =

SB-10 - Analytes = A/A

0-2' = TPH = 644 ppm

16-18' =

SB-11 - Analytes = A/A

0-2' = TPH = 365 ppm

16-18' =

SB-12 - Analytes = A/A

0-2' = TPH = 180 ppm

16-18' =

SB-13 - Analytes = A/A

0-2' = TPH = 198 ppm

16-18' =

(19/19) (2)

Substation 3 Area

- PCB's ided in sediments near stormwater outfall draining Substation 3. 92 tons of soil contaminated w Stoddard Solvent & TPH occurred at Substation 3 in 1992

- SOW - 1 location

  SB-15 - Analytes = TPH, PCB, metals

  0-2' =

  16-18' =

Buildings 43, 50, 80 Area (Steam Cleaning Basin)

- Bldg 50 conducts metal working & operates a steam cleaning basin
- Used to be Bldg 43 (used for paint & petro storage)
- SOW - 1 location

  SB-14 - Analytes = TPH, PCB, metals

  0-2' = TPH 418.1 : 55E ppm

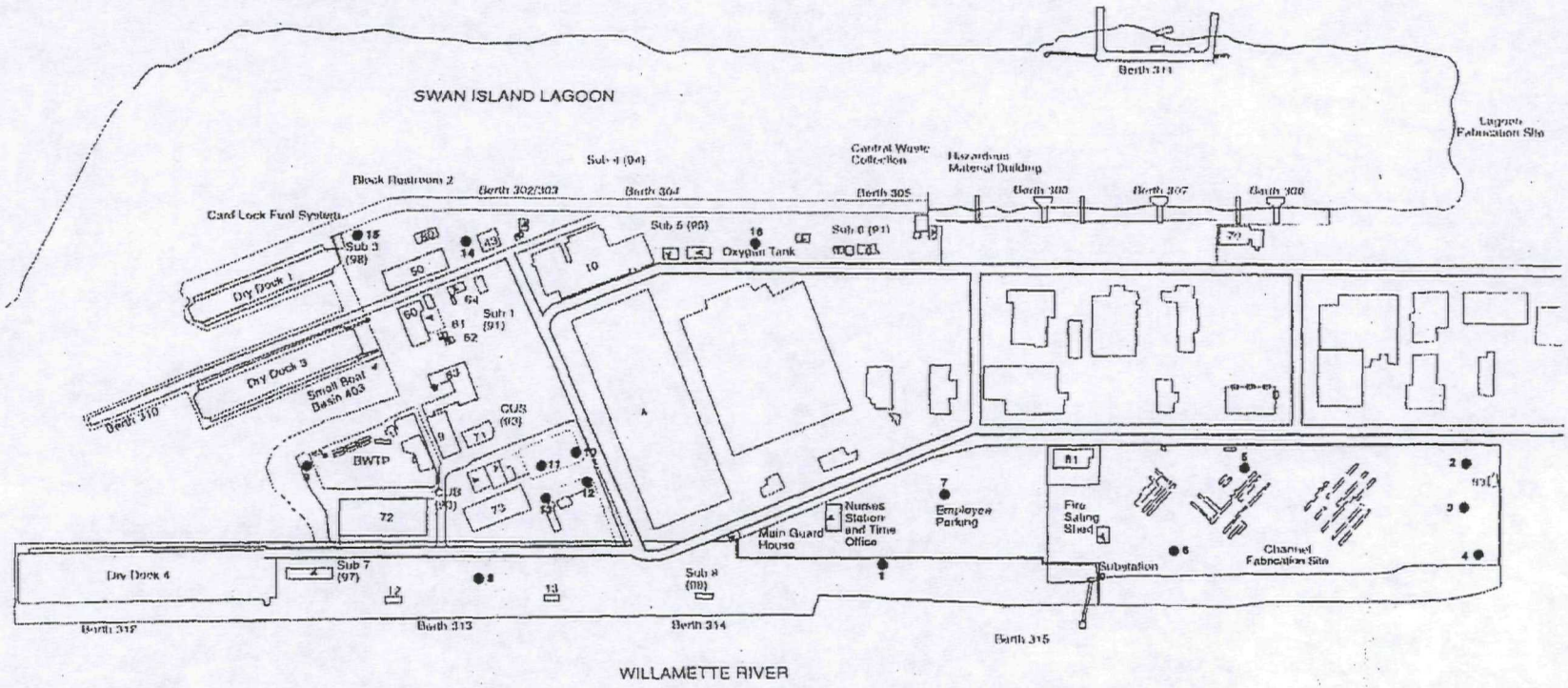
Building 10 & Grit Silo Area

- Near Berth 30?
- SOW - 1 location

  SB-16 - Analytes = TPH, PCB, metals, solvents

  0-2' =

  16-18' =



LEGEND
● Soil Sampling Locations

NORTH

Figure 1
Soil Sampling Locations

POPS - Portland Harbor Sediment Data Review

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(11)

EXECUTIVE SUMMARY

- POP reviewed DEQ/EPA PDX Harbor Sediment Study (PHSS) & several other studies. POP compared data to a range of conservative, effects-based screening levels from other regions. POP also examined relationship between SL & results of biological testing conducted in Harbor (Section 1)
- POP also reviewed information on sediment/contaminant sources & transport in PDX Harbor, including hydraulics, potential upstream sources, etc (Section 2)
- Key Conclusion - Chemicals have the greatest potential to cause adverse effects close to source. Conclusion based on:
  - contaminant distribution patterns
  - bioassay data indicate adverse effects are limited in extent & don't extend into channel & general PDX Harbor
  - water velocities are too low to resuspend & transport sediments & associated contaminants away from their sources
  - Sediment carried into PDX Harbor from upstream sources tend to deposit at specific locations & these upstream sources contribute to "lower" ambient chemical CJ.
- ★ "Contaminated sediments in PDX Harbor should be addressed as discrete sites rather than as ~~one~~ large site." Rpt supports conclusion.
- Recommendation. Additional biological testing be conducted before further decisions are made & biological testing be used to establish a uniform basis for addressing the CU of sediments in PDX Harbor. Testing is needed to confirm adverse effects & avoid false positives that may result from conservative SLs.
- "Data indicate actual adverse effects in River occur over a more limited area than would be predicted by some of the existing sediment screening criteria developed for other regions."
- POP recommends confirmatory biological testing be conducted before any decision is made to list facilities on NPL or State list.
- POP recommends DEQ take the lead in this effort & DEQ seek to integrate Sediment CU activities into a broader set of watershed restoration strategies for the River.
- Summary - DEQ take lead in addressing discrete sites based on confirmatory biological testing, rather than listing the entire Harbor as Superfund Site.

1 INTRODUCTION (p. 1-1)

- POP reviewed EPA/DEQ PHSS & offers framework establishing path forward that not only protects HH+E, but also supports economy

BACKGROUND (p. 1-1)

What is the PDX Harbor? (p. 1-1)

- lower 11.6 miles of Willamette River (Burg Bridge to mouth)

Historic Development of the PDX Harbor (p. 1-1)

Historic Development (p. 1-1)

Uses of PDX Harbor (p. 1-3)

Terminal 1 - undergoing conversion to non-maritime trade use

Terminal 2 - general cargo & container vessels

Terminal 4 - bulk cargo, cars, etc

Terminal 5 - bulk cargo, grain, etc

PSY - 3 dry docks, 15 berths

Future Development of Portland Harbor (p. 1-4)

Growth in Exports & Imports (p. 1-4)

- Federal government may deepen channel in 2003

Waterfront Redevelopment (p. 1-5)

- Brownfield & redevelopment discussion

POP SEDIMENT DATA REVIEW (p. 1-5)

Past Sediment, WQ, & Related Studies (p. 1-6)

- Table 1

Recent Sediment Studies (p. 1-6)

① COE, 1997, "Draft Sediment Quality SAP for Baseline Cost Estimate Related to Columbia River Channel Deepening Construction." - sediment characterization in Columbia & lower Willamette River channel

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OBJECTIVES of COE, 1997

- characterize sediments to confirm & establish rank in accordance w/ FRAMEWORK
- provide info to develop baseline cost estimate for proper sediment disposal
- provide info for EIS to describe material to be potentially dredged

- SOW - Samples from 40 locations (physical & chemical testing)

(2) DEQ/EPA, 1997 & 1998, "PDX Harbor Sediment Study"

- SOW - Surface samples from 150 locations
  - Subsurface (1.8-4.8') samples from 37 locations

  } all samples: Total metals, PAHs, TOC, grain size

  selected samples: PCBs, pest., TBT, Ti

- Goals - summarize & add perspective to existing sediment data
  - identify AOC & "Hot Spots"
  - identify sources of contamination

(3) POP, 1998, Sediment Study at PS4

- Objective - Determine distribution of chemicals in & around PS4 & identify areas that have the potential for adverse effects.
- SOW - Samples in 6 areas around PS4
  - Surface samples at 55 locations
  - Surface samples at 23 locations

  } tested for: metals, PCBs, ABN compounds, VOCs, TBT & conventional parameters

  - Freshwater toxicity testing on all surface samples
  - 3 toxicity tests (bioassay)

FRAMEWORK FOR INTERPRETING SEDIMENT SAMPLING RESULTS (p.17)

- No sediment quality standards at State or Federal level
- POP developed proposed FRAMEWORK for interpreting PDX Harbor sediment data (Fig 2) & is similar to COE Framework
- FRAMEWORK has 2 underlying principles:
  1) Interpretation of sediment data should be effects-based (i.e., CV based on scientifically defensive predictions of adverse effect to aquatic or HH).
  2) Biological testing results should be given greater weight than chemical data in decision process

- Elements of FRAMEWORK

- Database Assembly - assemble current, valid data
- Data Screening - compile existing sediment criteria for freshwater sediments based on review of US/Canadian data. Purpose is to identify locations in Harbor that don't need follow-up & focus further study on areas w potential for adverse effects.
  - Low-[] Areas - low or no potential for adverse effects
  - Hi-[] Areas - likely adverse ecological effects
  - Mid-[] Areas - ? adverse effects. Areas should be subject to biological testing to identify actual adverse effects
- Define Study Area - Group stations w similar []'s together for biological testing. Consider contaminant source & transport. Id data gaps
- Prioritize Study Area - Magnitude of exceedance, presence & sensitivity of ecological & Human receptors, size of area, interference w BU, time-critical transaction/development plans.
- Conduct Biological Testing -
  - Areas w high potential for adverse impacts - v. high bioaccumulation, persistent chemicals, etc
  - Conduct biological testing areas w high potential or areas with existing evidence of biological effects.
  - For most areas, it's recommended biological testing be conducted to confirm adverse effects
- Interpret Biological Results - Interpret biological results in accordance w regional guidelines. PDP recommends use of biological test QA & interpretation in COE Framework

- Use only parts of COE because:
  - COE SL's are for marine
  - CU sites ≠ dredge sites

ORGANIZATION OF REPORT (p. 1-10)

Section 2 - Review of Chemical & Biological Effects Data
Section 3 - Contaminant Sources & Transport
Section 4 - Conclusions

SECTION 2 - REVIEW OF CHEMICAL + BIOLOGICAL EFFECTS DATA (p.2-1)

- POP FRAMEWORK starts w assembly + screening data to id locations w potential fa adverse effects.

DATABASE ASSEMBLY (p.2-1)

- Information Sources:
  - PDX Harbor Sediment Investigation Report
  - Columbia River Channel Deepening Sediment Quality Evaluation
  - Mc/Bax Creosoting Co RI RpT
  - PSY Sediment Investigation
  - TPRI Baseline Sediment Assessment

DATA SCREENING (p.2-1)

- Lowest Effects Level (LEL) - level that can be tolerated by 90-95% of aquatic organisms (Ontario)
- Minimal Effect Level (MEL) - level that can be tolerated by 85% of organisms tested (EC/Quebec)
- Threshold Effects Level (TEL) - 15%tile of the effects data set + 50%tile of the no-effects data set. Level below which "adverse biological effects are rarely seen." (Env. Canada)
- Probable Apparent Effects Thresholds (PAETs) - derived on a bioassay-specific basis, multiple thresholds fa each chemical

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- When contaminant [] is below effects level in Table 2, its unlikely sediment will pose significant risk
- When contaminant [] is well above upper end of range, some degree of adverse effects is likely
- When contaminant [] is range, I adverse effect + biological testing should be conducted

STUDY AREA DEFINITION (p. 2-3)

- Sediment chemistry data fam sources were compared to effect levels (Table 2) to id chemicals t/a locations that have little or no potential fa adverse effects.
  COPC = metals, PAHs, pest, PCBs, TBT

- TRENDS
  1) Several areas in Harbor that are elevated relative to SL's + other Harbor sites:
     - Cr + Pb near RM 8.8 (Gunderson, CSO)
     - Porewater TBT on north side near RM 8.1 (PSY)
     - DDT on north side near RM 7.3 (Elf Atochem)
     - HPAH + LPAH on NW side near RM 6.4 (GASCO)
     - HPAH on north side near RM 4.9 (T-4)

2) Slightly elevated COCs seen in several locations (As, Cd, fluorene, B(k)F, & anthracene. Not likely to cause wide spread adverse effects

3) Elevated COCs (e.g., Cu, Zn, Hg, B(a)P, B(a)A, indenopyrene, dibenzanthracene & acenaphthalene) in several locations. Site specific biological testing is needed.

Review of Existing Biological Effects Data (p. 2-4)

- Some biological data exists & was used to determine whether chemicals are present at levels likely to cause adverse effects thruout the Harbor, or just in discrete areas
- Existing biological data used to determine AETs (for discussion only)

Usable Data Sets (p. 2-4) - up-to-date sampling & bioassay protocols & QA/QC

- Portland Shipyard Sediment Investigation - 1998 (55 stations) w bioassays
- McCox RI - sediment chemistry, 2 rounds of sediment bioassays, fish & crayfish analyses, & fish histopathology. (56 stations) & (17 stations)

Possibly Usable Data Sets (p. 2-5) - may be usable, not enough information to tell whether data is "valid"

- Willamette River Basin WQ Study ('92-'95) - Tetra Tech for DEQ. WQ modeling & field calibration of models, nutrient loading & algal growth, fish community studies, etc & benthic community analyses. Benthic study at RM 9 (near Swan Island)
- Willamette River Toxics Study ('88-'91) - Several studies over several years in basin which included: chemical analyses of sediments, bioassays, fish tissue analyses, fish health assessment, & fish growth assays.

Unusable Data Sets (p. 2-5)

- 1988 COE Lower Willamette Bioassays - some bioassays & chemical analyses, but no QA/QC
- Terminal 2, Berth 203 Bioassays - Pre-dredge sediments that are no longer in place

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Extent of Biological Effects in the PDX Harbor (p. 2-6)

- Screening of data above show several metals + PAHs present in many locations at ☐'s within range of effects levels in Table 2.
- To better assess extent, biological data from Mc/Bax RI + 1998 PSY sediment investigation were reviewed. Each study has >50 stations w both chemical + biological data + represent wide range of PAH + metal ☐'s.
- Mc/Bax RI
  - Hyalella azteca + Microtox bioassays at 54 stations
  - only 12 stations within 300' of shoreline near Mc/Bax showed toxicity in one or both bioassays
  - ☆ Moderate to high levels of toxicity were confined to within 200' of major source areas (seeps, etc)
  - ☆ No toxicity was observed in up- or downstream reference areas or in main shipping channel suggesting lower levels of PAHs + metals within effects range are not associated w adverse biological effects
- 1998 PSY Sediment Investigation
  - Hyalella azteca, Microtox, + chronic chironomid bioassay was also conducted at 55 stations at PSY (in + @ dry docks + berths, Swan Is lagoon, + up- + downstream of PSY).
  - No adverse effects in chironomid bioassay
  - 17 stations showed toxicity at 1 or both bioassays. All these stations were located in immediate vicinity of source areas
  - Stations up- + downstream of site + those in lagoon showed no toxicity in any bioassay
  - ☆ Findings support inference that lower chemical ☐s found broadly thruout Harbor will not cause adverse effects. Rather, adverse effects are limited to localized area or discrete sites w elevated ☐'s.

Development of Effects Levels for PDX Harbor (p. 2-6)

- There's a need for PDX Harbor-specific SLs. 1998 PSY Sediment Investigation + Mc/Bax RI can be combined as 1st cut
- Mc/Bax data is not available as electronic files, so effort was'nt made to combine them.
- POP developed AETs on metals + PAHs (Table 3). COC were those that had ≥ 30 detected values
- No AET for PCB because not enough detected values

- Comparison of Tables 2 & 3 show mean AETs for PDX Harbor are higher than other regions, indicating other data may be too conservative
- PDX Harbor AETs are also lower than COE SLs.
- POP recommends biological tests within areas of concern prior to make CU decisions
- Further biological testing should be consistent w COE Framework & Puget Sound Protocols & include
  - Microtox (pore water)
  - Hyalella azteca (10 day mortality)
  - Chironomus (mortality t/or growth bioassays)
- No benethic community studies are recommend due to difficulty in identifying reference area & habitate confounding factors

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SECTION 3 - CONTAMINANT SOURCES & TRANSPORT (p.3-1)

-POP proposed FRAMEWORK defines potential study areas based on screening of chemical & biological data (Section 2) & on contaminant source & transport considerations

PDX Harbor Hydraulics (p.3-1)

Harbor Bathymetry & Stability (p.3-1)

- late 1800 & 1900's harbor improvements & radically changed nature of reach
- Today Harbor is relatively stable channel of 1300' - 2000' wide

Willamette River Inflows into PDX Harbor (p.3-1)

- Stream flow (Q) dominated by seasonal rain fall
- Low flow = July thru Sept
- High flow = Nov to April
- 1996 flood had Q of 400,000 cfs
- Average Annual Q = 33,000 cfs

Tidal Influence of Columbia River (p 3-2)

- Water elevations fluctuate on daily basis, mainly due to tides in Columbia River
- Tides can reverse flow direction in river
- Tidal fluctuation can also result from Columbia River water mixing in to Willamette River. However, contaminated Columbia River sediments aren't expected in Willamette due to low velocity & gr. size.

Water Velocities (p. 3-2)

- Velocities slow in PDX Harbor due to channel widening & gradient flattening. Lower than upstream reaches
- Max Velocity = 0.5 ft/s
- Average Velocity = 0.33 ft/s during Q = 62,200 cfs
  = 0.2 ft/s during Q =

SEDIMENT/CONTAMINANT SOURCES & TRANSPORT (p.3-5)

- 3 Primary sources in PDX Harbor for Sediments & Contaminants:
  1) River transport into PDX Harbor
  2) Point Sources of direct discharge into harbor
  3) Non-Point Sources of direct discharge into harbor

Sediment/Contaminant Transport into the PDX Harbor by Willamette River (p. 3-5)

Sediment Transport by Willamette River (p.3-5)

- Amount of TSS varies seasonally
- Most TSS enters after major storm event or during spring snowmelt
- Amount of TSS increases w Q
- Average TSS load is 1,700,000 cy/year
  - ↳ <20% sand
    >80% silt/clay
- Bed sediments in Willamette are fgr (silt) unlike Columbia (sd)
- COE 1997 sampling program in navigation channel show sediments in nav channel are predominantly sd
- % solids in sediments - 60-93%
- TOC in seds - 0.07 - 2.26%
- COE 1979 study described 2-to4-foot layer of "fluff" in PDX Harbor (silty loam)

Contaminant Transpat by Willamette River (p. 3-9)

- Sediment & WQ data indicate at least some of the sources of sediment contamination in PDX Harbor are from upstream.
- Little data exists on suspended sediments coming into PDX Harbor.
- Harrison (1995) is 2 phase USGS. basin-wide study (Table 5) shows very few contaminants entering PDX Harbor on suspended Sediments

- "Upstream contaminant sources are, at least in part, responsible for "ambient" [metals + PAHs] found in bed sediments in PDX Harbor." Spikes in contaminants in PDX due to PDX Harbor sources.

Sediment / Contaminant Transpat in the PDX Harbor (p. 3-16)

Sediment Transpat Processes (p. 3-16)

- Sediment transpat capacity in PDX Harbor is low due to low water velocities & flow reversals.
- Sedimentation rates in PDX Harbor are low; but at flood stages sedimentation increases (2/96 flood caused up to 6" of sedimentation).
- Key sediment deposit locations:
  - Downstream of Fremont Bridge
  - N-side of nav channel across from Swan Island
  - B-N RR Bridge
  - W-side of nav channel near T-4
  - W-side of nav channel between Multi Channel + confluence w Columbia
- POP's experience shows historic sediment deposition areas:
  - RM 3.25 - RM 7.3 (shoaling in nav channel)
  - RM 7.3 - RM 11.3 (east bank upstream of Swan Island)
- Most of sediment entering PDX Harbor flows thru
- Average annual suspended load entering PDX Harbor = 1.7 million cy
- Average annual nav channel dredging & POP dredging = 0.17 million cy
- Given low transpat capacity, sediments deposited on bottom remain & will not be transported. Localized resuspension & transport may occur

Contaminant Transpat Processes (p. 3-17)

- Contaminant transpat in PDX Harbor is controlled by rate & direction of water movement if contaminant tends to dissolve. These types of contaminants will eventually leave the Harbor.
- Other contaminant adsorb to sediment particles & transport will be controlled by transport, deposition & resuspension of seds in PDX Harbor. Contaminated seds tend to settle & will not be resuspended or transpated to another location.

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- PGE Station L data showed contaminated seds moved less than 100' from original point of release in nearly 20 yrs.
- Contaminants from seperate sources are unlikely to be commingled

Sediment/Contaminant Sources within PDX Harbor (p. 3-18)

Point Sources (p. 3-18)

- Columbia Slough is only natural point source discharge in PDX Harbor
- Small delta exists at mouth of Slough meaning Slough contributes seds to PDX Harbor
- A number of outfalls discharge into PDX Harbor
  - 2 of the outfalls (Elf-Atochem & Rhone-Poulenc) only contribute a negligible amount of seds.

Non-Point Sources (p. 3-18)

- City's CSOs, etc, but little data exist
- Common contaminants in Stormwater Outfalls include As, Cr, Cu, Pb, Zn, phthalate
- Another non-point source is contaminated GW/NAPL recharging river

CONCLUSION (p. 4-1)

- POP recommends contaminated areas of Harbor be identified w confirmatory biological testing & addressed individually by DEQ at discrete sites
- Rpt makes arguement for addressing individual sites"
- POP recommends biological testing to be conducted to confirm that there are significant adverse impacts to the environment. DEQ should take lead in effort & focus on CU, rather than site listing

- Summary
  - PDX Harbor doesn't contain broad areas of high chemical contamination. Rather chemical COIs that have potential to cause adverse biological effects are located in discrete areas near their upland source. This is mainly due to low water velocities which dis-allow sediment resuspension & transport.
  - Stormwater outfall & CSO can also act as contaminant sources/in addition to industrial facilities

"ranges are proposed for use only as a guideline to screen available sediment quality data"

TABLE 2
Freshwater Criteria Summary

Chemical	Ontario LEL	EC/Quebec MEL	Env. Canada TEL	Washington Lowest PAET	Range of Effects Levels
Metals (mg/kg)					
Arsenic	6	7	5.9	19	5.9–19
Cadmium	0.6	0.9	0.6	7.6	0.6–7.6
Chromium	25	55	37	70	26–70
Copper	16	28	36	340	16–340
Lead	31	42	35	240	31–240
Mercury	0.2	0.2	0.17	0.22	0.17–0.22
Nickel	16	35	18	39	16–39
Silver	0.5	--	--	3.9	0.5–3.9
Zinc	65	150	120	500	65–500
Organometallics (µg/L)					
TBT (pore water)	--	--	--	--	0.05–0.25[a]
PCBs/Pesticides (µg/kg)					
Total PCBs	70	200	34	21	21–200
Aldrin	2	2	--	--	2
Chlordane	7	7	4.5	--	4.5–7
DDT	8	9	1.2	--	1.2–9
DDD	8	10	3.5	--	3.5–10
DDE	5	7	1.4	--	1.4–7
Dieldrin	2	2	2.9	--	2–2.9
Endrin	3	8	2.7	--	2.7–8
Heptachlor	--	0.3	--	--	0.3
Heptachlor epoxide	5	5	0.60	260	0.6–260
Lindane	3	3	0.94	--	0.94–3
Mirex	7	11	--	--	7–11
2,3,7,8-TCDD	--	--	--	0.0072	0.0072
PAHs (µg/kg)					
Naphthalene	--	400	--	37,000	400–37,000
Acenaphthylene	--	--	--	1,900	1,900
Acenaphthene	--	--	--	3,500	3,500
Fluorene	190	--	--	3,600	190–3,600
Phenanthrene	560	400	42	5,700	42–5,700
Anthracene	220	--	--	2,100	220–2,100
Fluoranthene	750	600	110	11,000	110–11,000
Pyrene	490	700	53	9,600	53–9,600
Benzo(a)anthracene	320	400	32	5,000	32–5,000
Chrysene	340	600	57	7,400	57–7,400
Benzo(k)fluoranthene	240	--	--	11,000	240–11,000
Benzo(a)pyrene	370	500	32	7,000	32–7,000
Indeno(1,2,3-c,d)pyrene	200	--	--	730	200–730
Benzo(g,h,i)perylene	170	--	--	1,200	170–1,200
Dibenz(a,h)anthracene	60	--	--	230	60–230
Miscellaneous Organics (µg/kg)					
Bis(2EH)phthalate	--	--	--	635	635
Di-n-butylphthalate	--	--	--	42	42
Phenol	--	--	--	48	48

[a] Based on recent PSDDA guidance and personal communications with WDOE.

TABLE 2
Freshwater Criteria Summary

Chemical	Ontario LEL	EC/Quebec MEL	Env. Canada TEL	Washington Lowest PAET	Range of Effects Levels
Metals (mg/kg)					
Arsenic	6	7	5.9	19	5.9–19
Cadmium	0.6	0.9	0.6	7.6	0.6–7.6
Chromium	25	55	37	70	26–70
Copper	16	28	36	340	16–340
Lead	31	42	35	240	31–240
Mercury	0.2	0.2	0.17	0.22	0.17–0.22
Nickel	16	35	18	39	16–39
Silver	0.5	--	--	3.9	0.5–3.9
Zinc	65	150	120	500	65–500
Organometallics (µg/L)					
TBT (pore water)	--	--	--	--	0.05–0.25[a]
PCBs/Pesticides (µg/kg)					
Total PCBs	70	200	34	21	21–200
Aldrin	2	2	--	--	2
Chlordane	7	7	4.5	--	4.5–7
DDT	8	9	1.2	--	1.2–9
DDD	8	10	3.5	--	3.5–10
DDE	5	7	1.4	--	1.4–7
Dieldrin	2	2	2.9	--	2–2.9
Endrin	3	8	2.7	--	2.7–8
Heptachlor	--	0.3	--	--	0.3
Heptachlor epoxide	5	5	0.60	260	0.6–260
Lindane	3	3	0.94	--	0.94–3
Mirex	7	11	--	--	7–11
2,3,7,8-TCDD	--	--	--	0.0072	0.0072
PAHs (µg/kg)					
Naphthalene	--	400	--	37,000	400–37,000
Acenaphthylene	--	--	--	1,900	1,900
Acenaphthene	--	--	--	3,500	3,500
Fluorene	190	--	--	3,600	190–3,600
Phenanthrene	560	400	42	5,700	42–5,700
Anthracene	220	--	--	2,100	220–2,100
Fluoranthene	750	600	110	11,000	110–11,000
Pyrene	490	700	53	9,600	53–9,600
Benzo(a)anthracene	320	400	32	5,000	32–5,000
Chrysene	340	600	57	7,400	57–7,400
Benzo(k)fluoranthene	240	--	--	11,000	240–11,000
Benzo(a)pyrene	370	500	32	7,000	32–7,000
Indeno(1,2,3-c,d)pyrene	200	--	--	730	200–730
Benzo(g,h,i)perylene	170	--	--	1,200	170–1,200
Dibenz(a,h)anthracene	60	--	--	230	60–230
Miscellaneous Organics (µg/kg)					
Bis(2EH)phthalate	--	--	--	635	635
Di-n-butylphthalate	--	--	--	42	42
Phenol	--	--	--	48	48

[a] Based on recent PSDDA guidance and personal communications with WDOE.

above (along with some of the possibly usable data sets) could be combined to take a first look at criteria for Portland Harbor. Combined together, the McCormick & Baxter and Portland Shipyard data would provide a fairly large data set (greater than the minimum 30 to 50 samples) needed to calculate AETs and other types of standards. Areas encompassed within these two studies include nearshore, midchannel, and upstream areas, a comprehensive list of chemical analytes, and a wide range of concentrations. These data sets would be particularly useful if supplemented with bioassay data from a Phase II Portland Harbor Study, encompassing a larger geographic range (areas far upstream and downstream from the two facilities, as well as areas across the river, are not well-represented in these data set.

Because the McCormick & Baxter data set was not available electronically, this effort was not undertaken for this report. However, a sense of where such effects levels may fall for at least some chemicals can be obtained from examining site-specific AETs developed during the course of the Portland Shipyard Sediment Investigation. Site-specific AETs were developed for chemicals with at least 30 detected values (see Table 3). AETs are reported for the Microtox and *Hyalella* bioassays, and the lowest AET is shown in the right-hand column. Because the chironomid bioassay did not show toxicity at any of the stations, AETs could not be calculated for this test.

TABLE 3
AETs Calculated Based on Bioassays Conducted at the Portland Shipyard

Chemical	*Hyalella* AET	Microtox AET	Lowest AET
Metals (mg/kg)			
Arsenic	15 (17)	13 13	13
Chromium	>46 (>48)	>46 >46	>46
Copper	397 (397)	397 398	397
Lead	>97 (>96.6)	>97 >96.6	>97
Mercury	>0.54 (>0.59)	>0.54 >0.59	>0.54
Nickel	31 (31)	31 31	31
Silver	1.1 (>3.3)	1.1 1.1	1.1
Zinc	>683 (>683)	443 490	443
Organics (µg/kg)			
Anthracene	429 41,000	429 ~~880~~ 870 ~~620~~ 620	429
Phenanthrene	566 (210,000)	469 ~~2100~~ ~~2580~~	469
Benzofluoranthenes	>2,270 (34,000)	>2,270 ~~420~~ 2580	>2,270
Benz(a)anthracene	353 (33,000)	353 ~~420~~ 940	353
Benz(a)pyrene	>1,630 (11,000)	>1,630 ~~840~~ 1100	>1,630
Benz(g,h,i)perylene	186 (>21,000)	186 ~~780~~ 1400	186
Chrysene	489 (39,000)	489 ~~680~~ 2100	489
Fluoranthene	>3,600 (130,000)	>3,600 2400	>3,600
Indeno(1,2,3-cd)pyrene	222 (2400)	222 760	222
Pyrene	770 (85,000)	770 2400	770
Bis(2-ethylhexyl)phthalate	3510 3510	2,220 2200	2220
Butylbenzyl phthalate	>280 >280	>280 >280	>280
Di-n-butyl phthalate	116 116	116 116	116
Di-n-octyl phthalate	115 115	110 110	110

> : AET can't be determined from PSY data set, but ~~EC~~ is above any measured values at PSY. Need stations w higher Σ] to determine AET.

17: PSY + Mc/Bax merged dataset

-premise = with more data AET [] should increase

TABLE 6
Water Quality of Combined Sewer Overflows

Site ID Analyte (mg/kg)	Monitored CSO*	
	Min	Max
Conventional (mg/L)		
Total Suspended Solids	0.3	74
Total Metals (mg/L)		
Arsenic	ND	1.6
Cadmium	ND	0.002
Chromium	0.047	0.093
Copper	0.026	0.033
Lead	0.024	0.036
Mercury	ND	0.0005
Nickel	ND	ND
Silver	ND	0.064
Zinc	0.14	0.17
Organics (µg/L)		
Acetone	16	65
Ethylbenzene	ND	33
4-Methyl-2-pentanone	ND	47
Tetrachloroethene	ND	5
Toluene	ND	60
Xylene	ND	200

Source: CH2M HILL, et al. 1992

*Overflows in three outfalls to the Willamette River were monitored before discharge point. Two storms were monitored.

ND = Analyte not detected

TABLE 7
Chemical Concentration Ranges in Sediments Adjacent to Storm-Water Discharges in the Willamette River Near Portland

Site ID	Site1[a]		Site 2[b]		Site 3[c]		Site 4[d]		Site 5[e]	
Descriptive Location	W. Bank between Riverplace and Hawthorne Bridge		W. Bank, Front Ave. South of Fremont Bridge		W. Bank, Front Ave. N. of Fire Bureau Dock		E. Bank, Swan Island Lagoon		E. Bank, St. Johns, T4, N. of Pier 2	
Type	Residential/ Commercial		Commercial/ Industrial		Commercial/ Industrial		Commercial/ Industrial		Industrial	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Analyte										
Total Metals (mg/kg)										
Arsenic	2	2	2	4	ND	4	2	3	3	5
Cadmium	ND	2	ND	ND	ND	ND	ND	ND	ND	4
Chromium	20	48	28	43	12	30	24	36	16	142
Nickel	13	17	13	26	ND	23	22	26	15	41
Copper	70	145	42	1610	20	75	25	40	10	150
Lead	150	420	90	350	20	100	20	38	10	160
Zinc	710	1540	210	420	620	1750	60	90	80	680
PAHs (µg/kg)										
Benzo(a)anthracene	ND	ND	ND	ND	ND	ND	ND	ND	0.25	17
Benzo(a)pyrene	ND	ND	ND	ND	ND	ND	ND	ND	0.5	19
Benzo(b)fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	0.5	21
Benzo(g,h,i)perylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	9.5
Benzo(k)fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	0.25	12
Bis(2-ethylhexyl) phthalate	3	8	4	38	0.5	6	ND	1	ND	38
Butylbenzyl phthalate	ND	6	ND	ND	ND	2	ND	ND	ND	3
Chrysene	ND	ND	ND	ND	ND	ND	ND	ND	0.5	19
Fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	0.5	28
Indeno(1,2,3-cd)pyrene	ND	ND	ND	ND	ND	ND	ND	ND	0.5	17
Phenanthrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	12
Pyrene	ND	ND	ND	ND	ND	ND	ND	0.5	0.5	23
VOCs (µg/kg)										
1,4-Dichlorobenzene	ND	ND	ND	20	ND	155	ND	ND	ND	ND
Acetone	ND	ND	ND	ND	ND	170	ND	340	ND	ND
Chlorobenzene	ND	ND	ND	ND	ND	30	ND	ND	ND	ND
Methylene Chloride	3	4	ND	ND	ND	ND	ND	18	ND	10
Tetrachloroethene (PCE)	ND	ND	ND	ND	ND	59	ND	ND	ND	ND
Toluene	ND	3	ND	ND	ND	2300	ND	ND	ND	600
Total Xylenes	ND	ND	ND	ND	ND	ND	ND	ND	ND	185

Source: Port of Portland. Chemical Characterization of Sediments Adjacent to Storm-Water Discharges in the Willamette River Near Portland. 1995.
Note: Concentrations are estimated based on available graphs
[a] Based on 4 samples collected at 12 ft. intervals downstream of discharge point.
[b] Based on 6 samples collected at 12 ft. intervals downstream of discharge point.
[c] Based on 7 samples collected at 12 ft. intervals downstream of discharge point.
[d] Based on 7 samples collected at 12 ft. intervals downstream of discharge point.
[e] Based on 5 samples collected at 12 ft. intervals downstream of discharge point.
ND = Analyte not detected

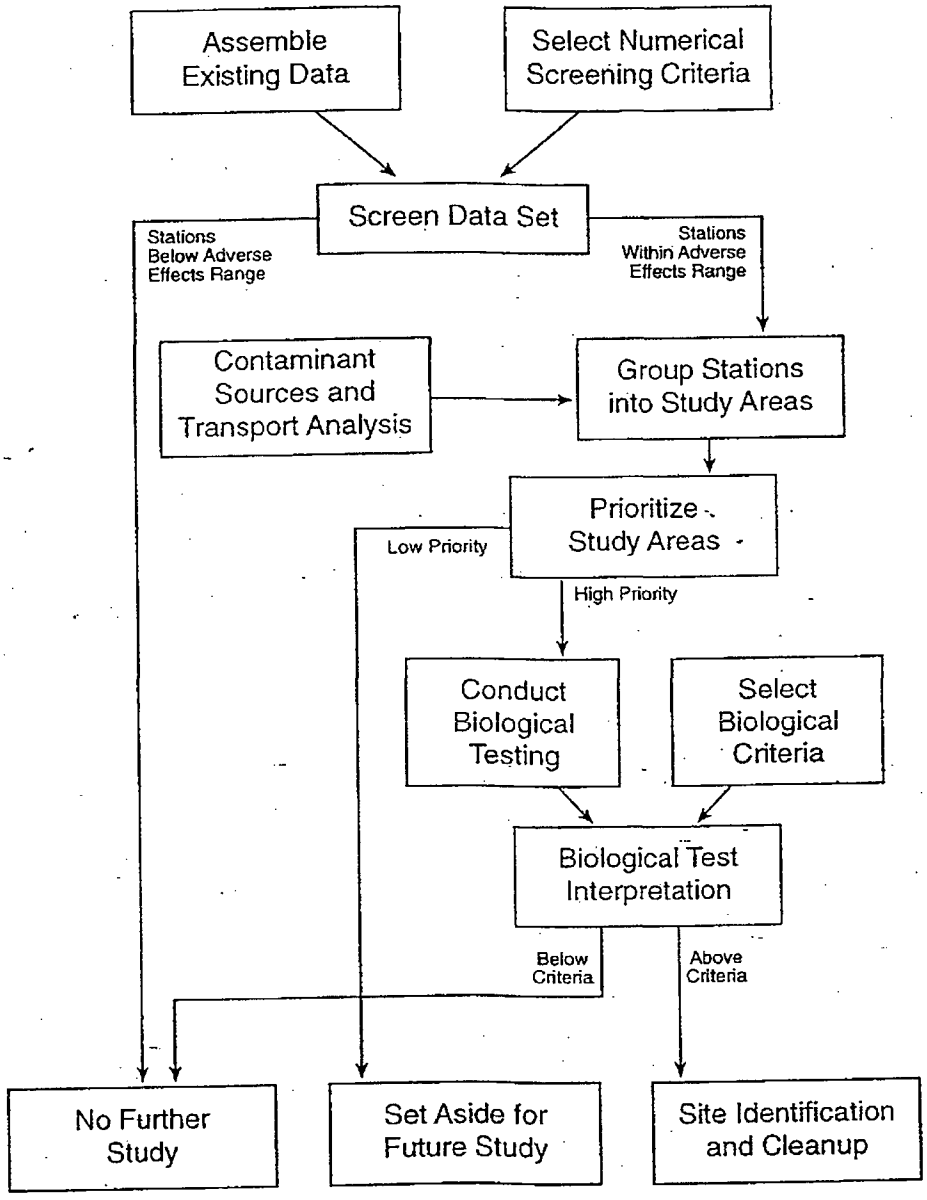


Figure 2
Recommended Decision Framework for the Portland Harbor
Portland Harbor Sediment Data Review
Port of Portland

Reference	Year(s) of Study	Water Quality	Sediment Quality	Biological Study
McKenzie, 1977	1977		X	
Corps of Engineers, 1979	1977-1978	X	X	X
Fuhrer, 1989	1980-1983	X	X	
Brannon, et al., 1991	1990-1991		X	X
Tetra Tech, 1992 a and c	1987-1992	X	X	
Tetra Tech, 1992b	1991	X		
Anderson et al., 1996	1992-1994	X	X	
United States Geological Survey, 1995	1994		X	
Department of Environmental Quality, 1994	1988-1991		X	X
United States Geological Survey, 1995	1992-1994	X	X	
Corps of Engineers, 1997b	1986, 1988-1989, 1992, 1994-1996		X	
PTI , 1992	1990-1992	X	X	X
Port of Portland, 1995	1995		X	

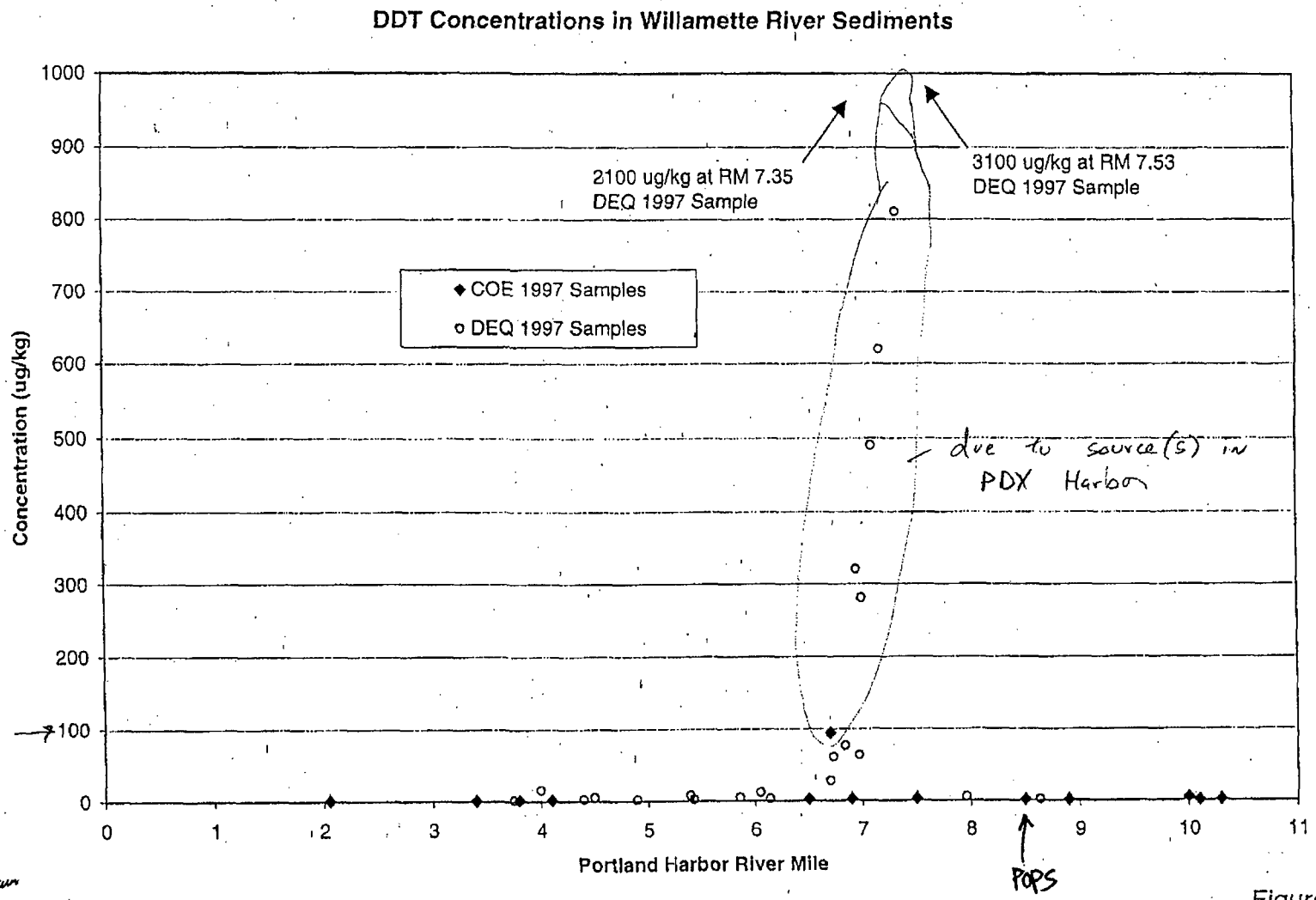


Figure 7
Comparison of DDT Concentrations in Mid-Channel versus Near-Shore Sediments
Portland Harbor Sediment Data Review
Port of Portland

(Source: COE, 1998 and Weston, 1998)

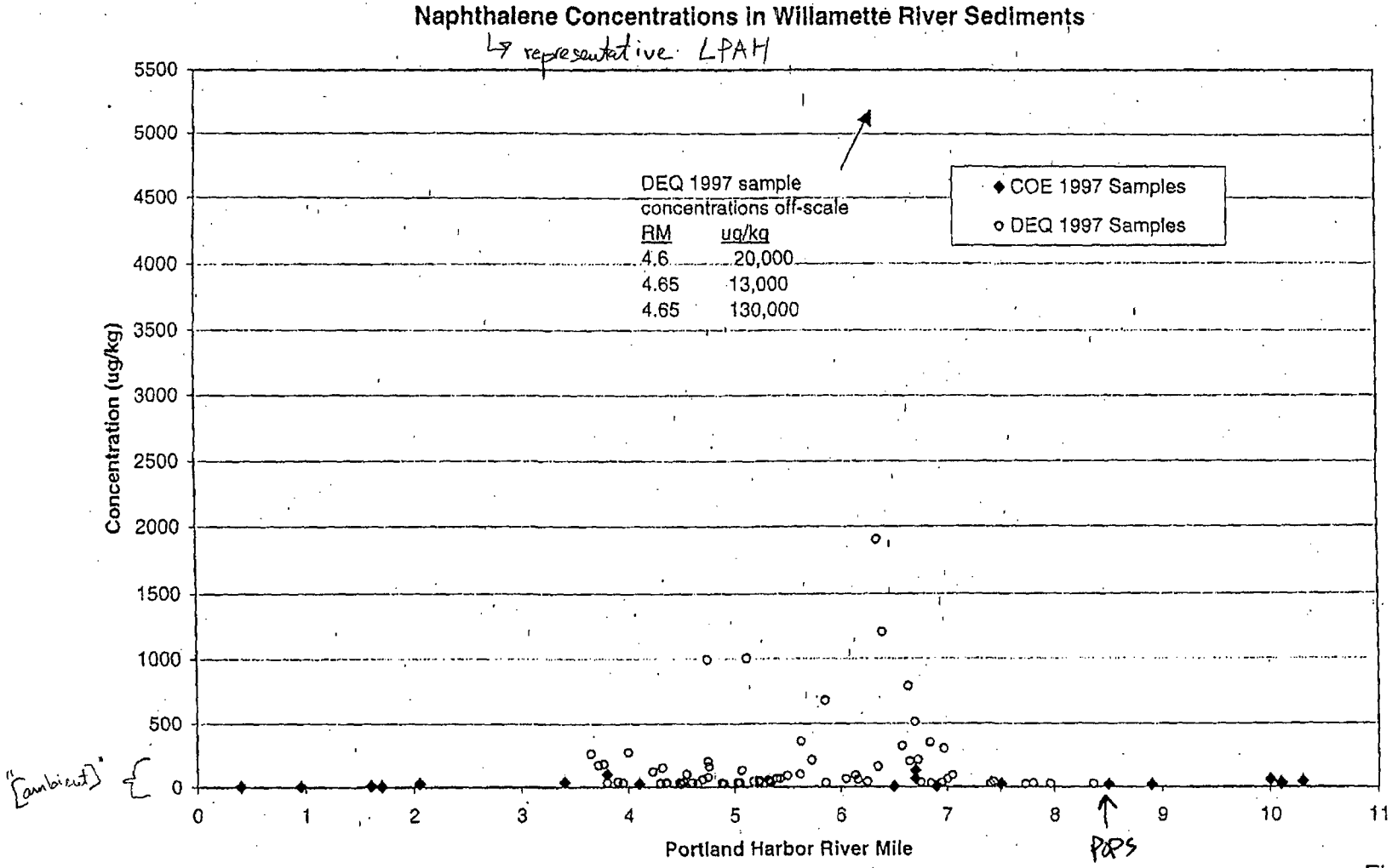


Figure 8
Comparison of Naphthalene Concentrations in Mid-Channel versus Near-Shore Sediments
Portland Harbor Sediment Data Review
Port of Portland

(Source: COE, 1998 and Weston, 1998)

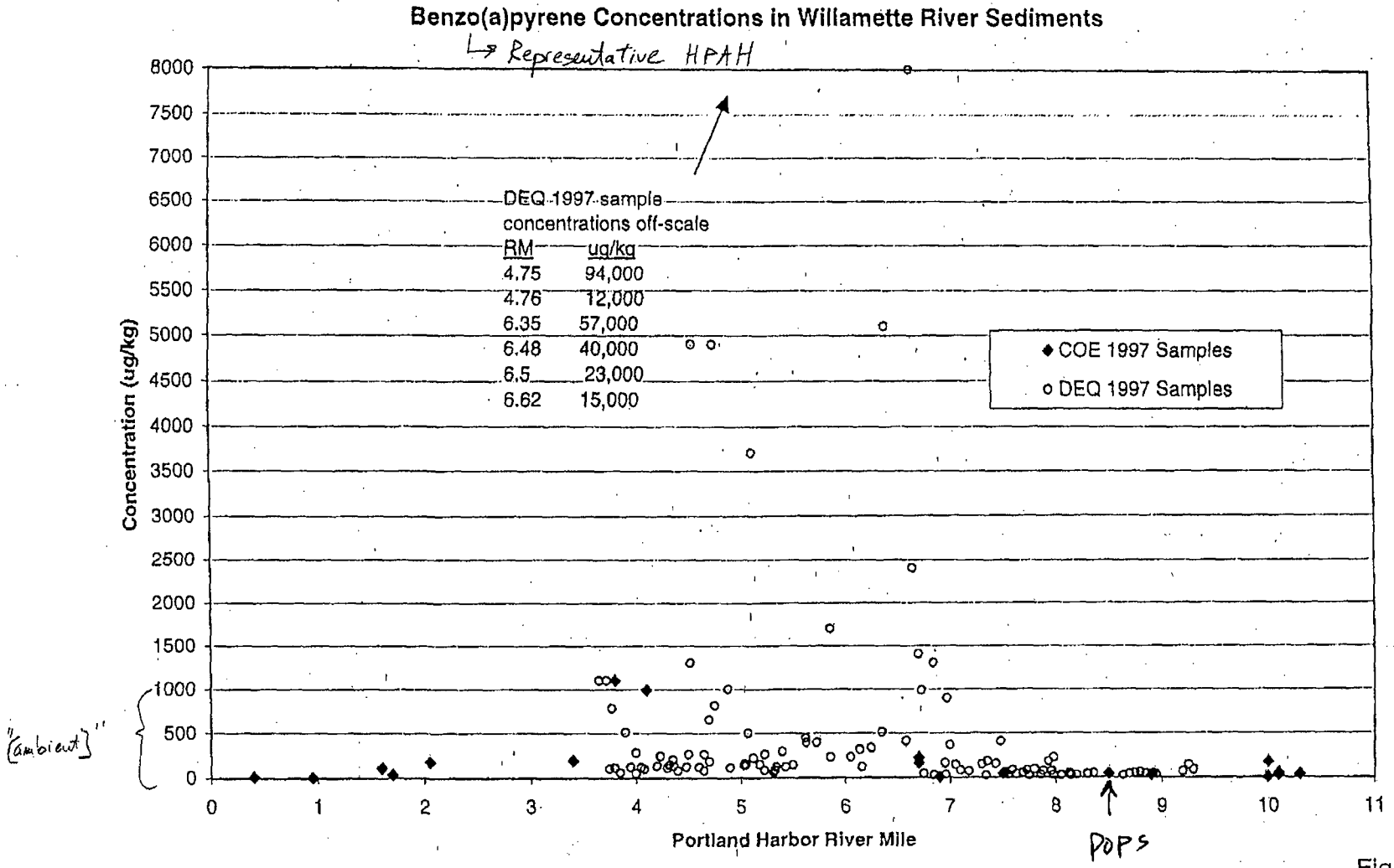


Figure 9
Comparison of Benzo(a)pyrene Concentrations in Mid-Channel versus Near-Shore Sediments
Portland Harbor Sediment Data Review
Port of Portland

(Source: COE, 1998 and Weston, 1998)

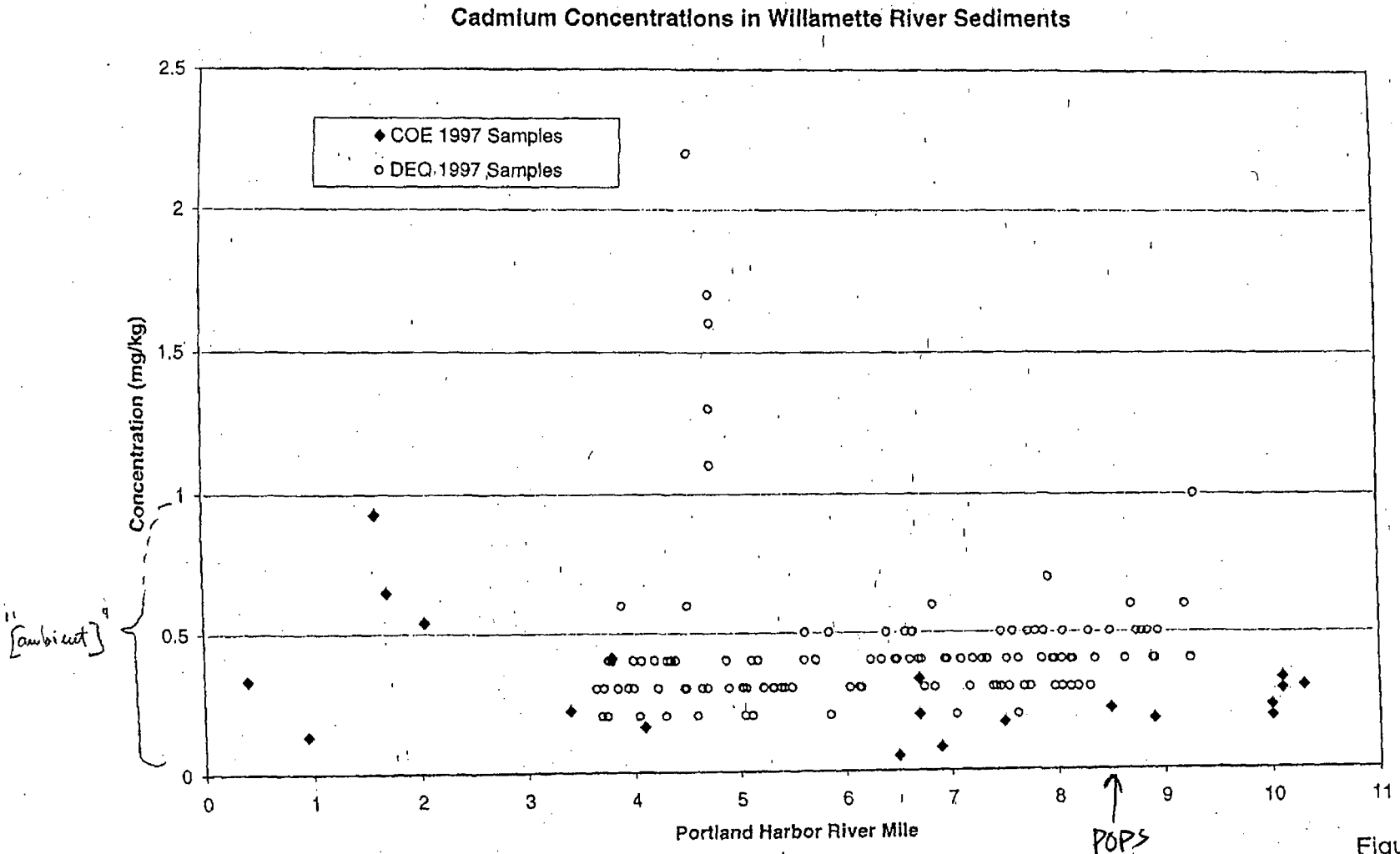


Figure 10
Cadmium Concentrations in Comparison of Mid-Channel versus Near-Shore Sediments
Portland Harbor Sediment Data Review
Port of Portland

(Source: COE, 1998 and Weston, 1998)

WQ File Summary 1 of 2

POPS 9/98

(1)

- Tax Lot Information
- Maps & aerial photos
- POP - Public Brouchure
- 1976 POP Sumanary "Transition of an Island"
- Tenant Listings

WQ File Summary 2 of 2

- 6/90 PA by DEQ for EPA

CWE - 3/14/94 - Environmental Site Assessment - Berths 305 + 306

12/18

Executive Summary

- 2.5 acres
- 190 cy of PCS removed from UST release + disposed of at St Johns LF. DEQ closed site in 7/92

Introduction

- Purpose - assess environmental conditions

Information Review

- DEQ File Review
  - UST file # 496
  - LUST = 26-89-0166 - 12,700 gal diesel fuel fr boiler in Bldg 35 (demoed before 1969). 190 cy of PCS to LF, 3 confirmation samples were ND. Excavation backfilled w clean soil + asphalted
  - HW - no file
  - ECD/ECSI
- CERCLIS Review - not on CERCLIS
- FINDS LIST - not on FINDS
- Fire Marshal File - asbestos release due to improper handling
- Aerial Photos
- Local Geology
- POP Files
  - D&M's 2/89 PEA - drum storage / catch basins
  - D&M's 6/91 Environ Assess Rpt - drum storage

Site Examination

- Site History - Bldg 77 & Bldg 35 (boiler) constructed in @ 1940 + demoed in late - 1960's

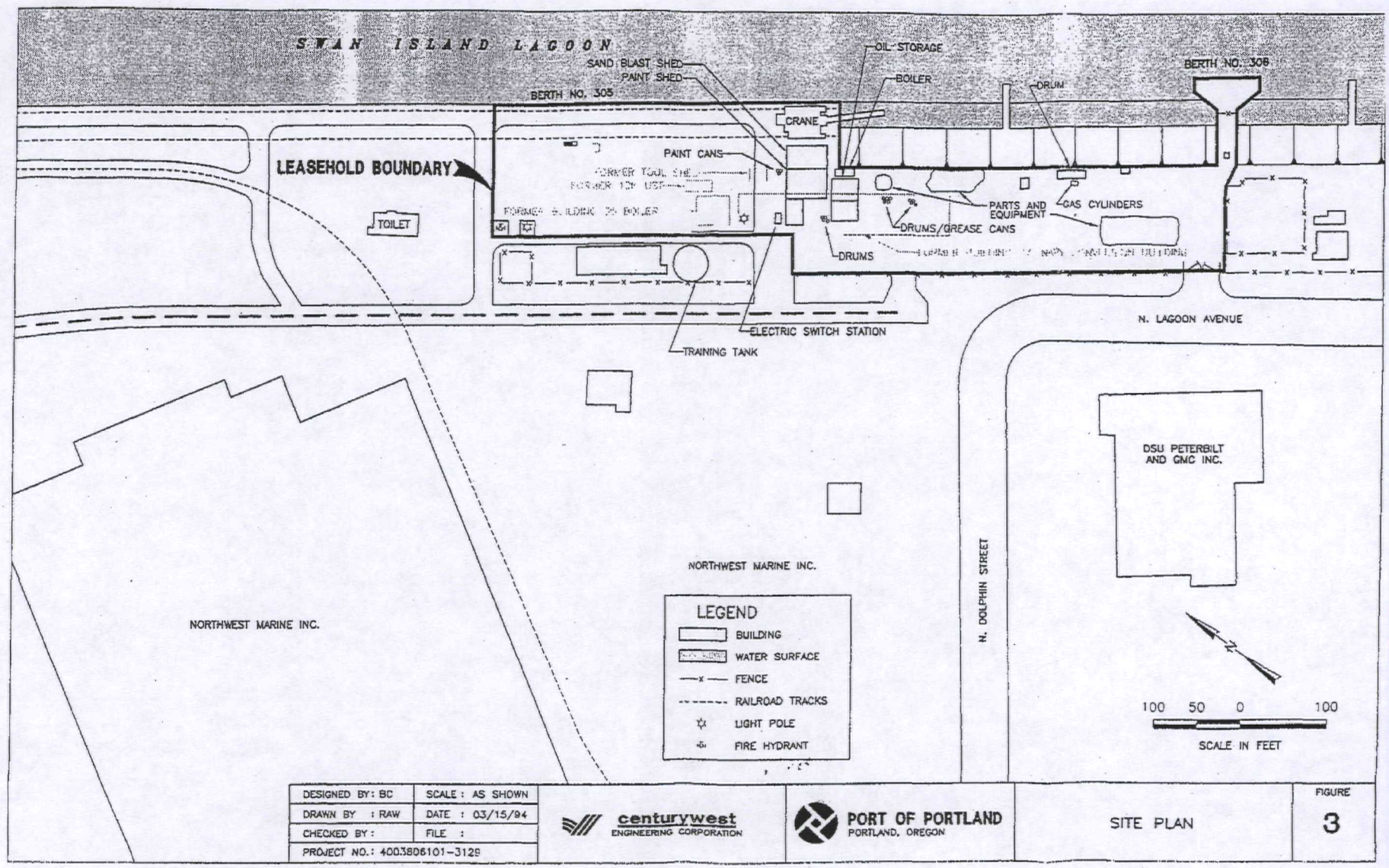
- Impacts from Adjacent Properties

Conclusions

- Sheds at Berth 305 have been used for painting & sand blasting. Wastes would likely enter CB & discharge to Lagoon

Recommendations

- Lack of evidence showing current or past haz mat impacts, CWE recommends NFI



DESIGNED BY: BC	SCALE : AS SHOWN
DRAWN BY : RAW	DATE : 03/15/94
CHECKED BY :	FILE :
PROJECT NO.: 400380610I-3129	

centurywest ENGINEERING CORPORATION

PORT OF PORTLAND PORTLAND, OREGON

SITE PLAN

FIGURE 3

HAI's - 5/28/93 - Soil Investigation, Tank 10 & Pipe Areas

6/16

Purpose - Assist in CU of 2 areas of PCS at BWTP
- ↳ soil surrounding Tank 10
- ↳ soil beneath Pipe Area N of Tank 10

SOW - soil sampling, lab analysis, determine CU levels, document excavation of contaminated soil & collect confirmation samples

Sample Collection

Tank 10 - 20 soil samples (12 characterization & 8 verification)
- collected from 3 areas around Tank 10

Pipe Area - 14 soil samples (8 characterization & 6 verification)

Results

Tank 10 - Table 1

- Characterization Samples (1-17)
  - TPH = 1120 - 59,000 ppm
  - PCB = 0.7 - 1.2 ppm
  - VOCs = NA
  - 8 TCLP metals = < ALs
- Post-CU Samples (19-28)
  - TPH = ND - 1000 ppm
  - PCB = ND

Pipe Area - Table 2

- Characterization Samples (1-8)
  - TPH = 84 - 27,000 ppm (59,000 ppm in soil pile)
- Post CU Samples (9-14)
  - TPH = ND - 8,100 ppm

- assumed PCB/VOC/TCLP metals at Tank 10 could be applied at Pipe Area

Regulatory Analysis

TPH CU level = 500 ppm
PCB CU level = ND

Remedial Activities

- Excavate, stockpile, land fill
- Verification samples analyzed for TPH & when TPH AL was achieved, analyze for PCB

Tank 10

- Concrete layer existed under part of the site at 6" bgs
- 20 tons of PCS removed & shipped to Hillsboro
- All confirmation samples below ALs

Pipe Area

- 46 tons of PCS removed & shipped to Hillsboro
- All confirmation samples below ALs

CONCLUSIONS

- PCS removed from Tank 10 area to below ALs. Excavations backfilled & capped w concrete
- PCS removed from Pipe Area to below ALs. A/A

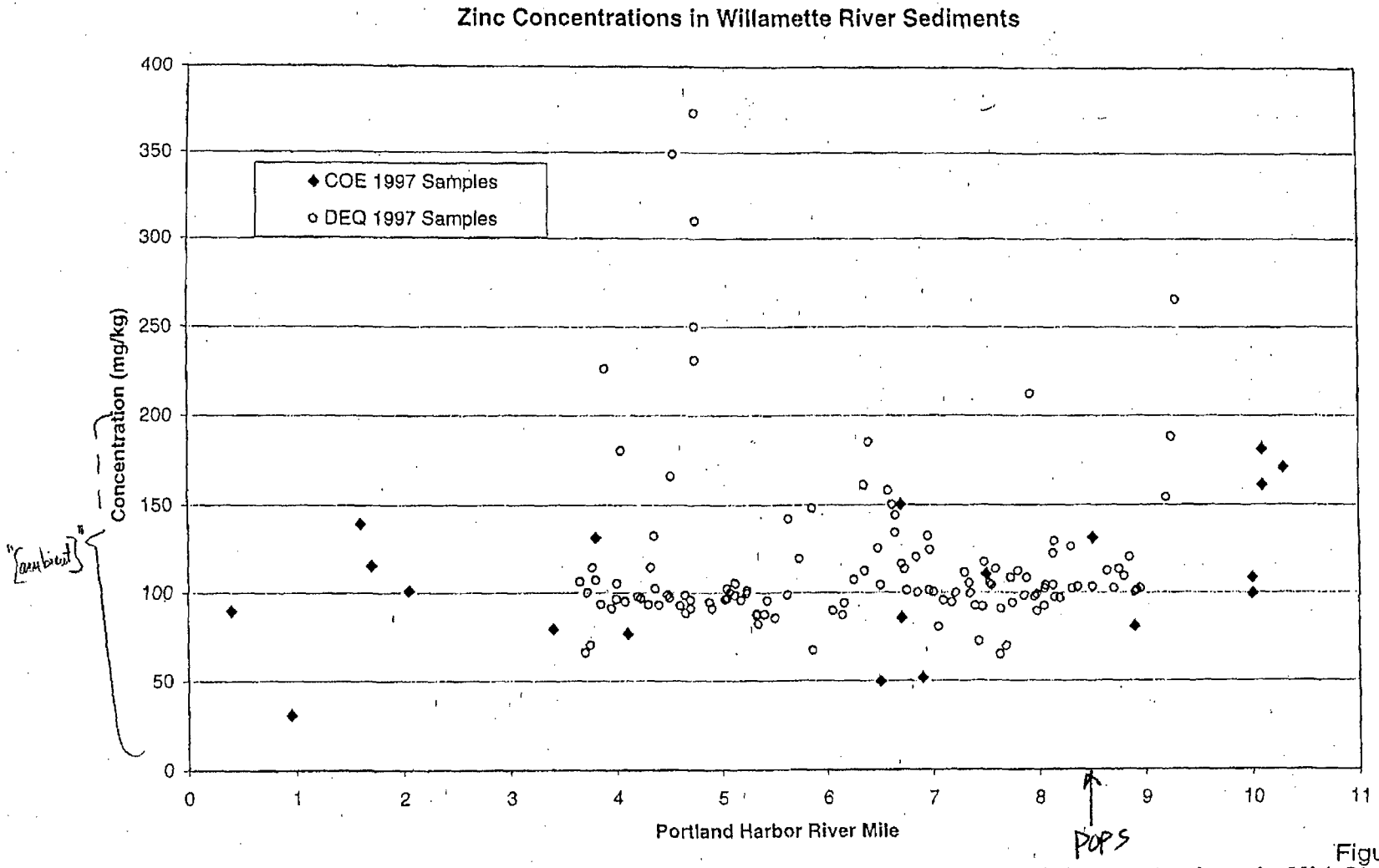
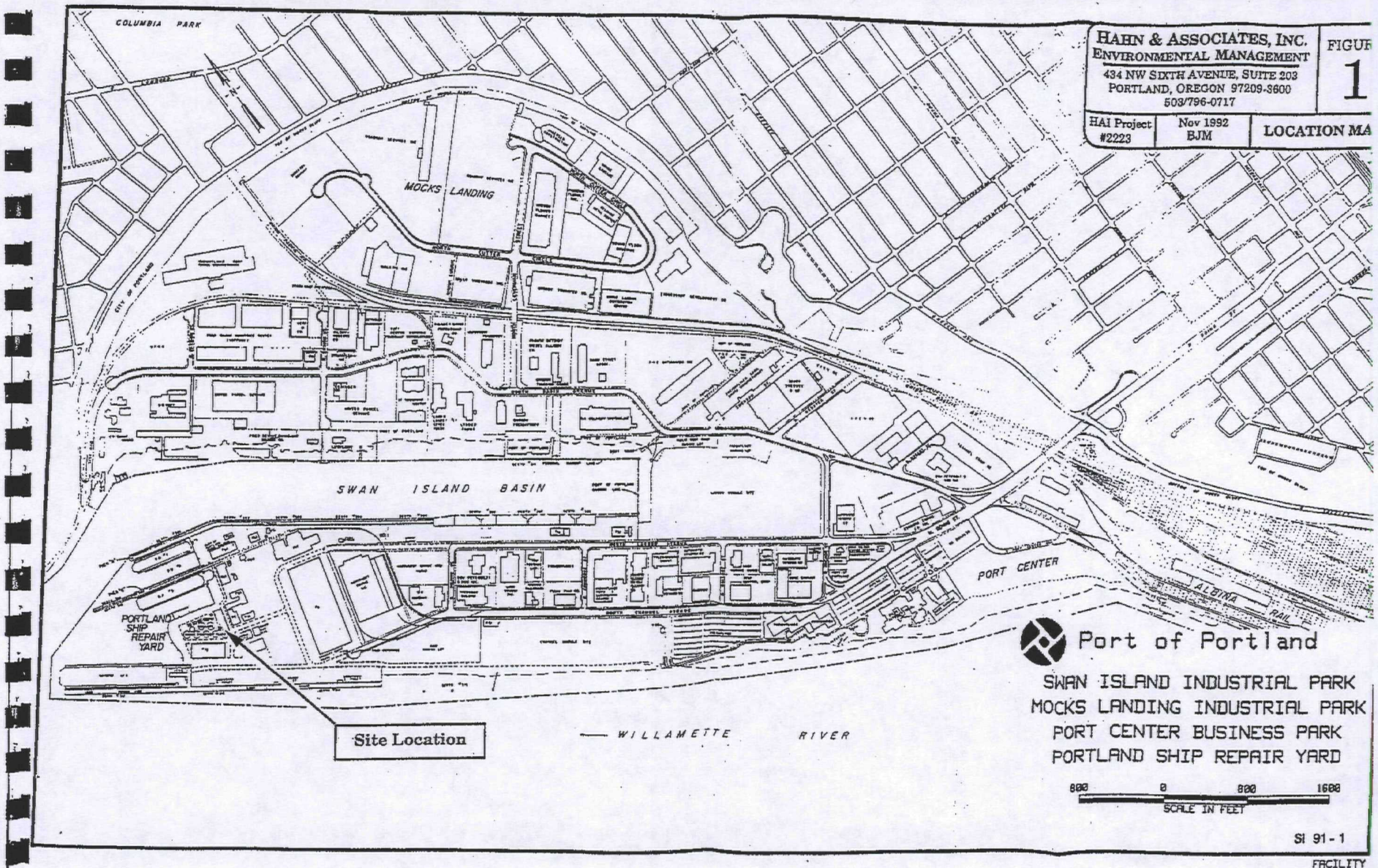
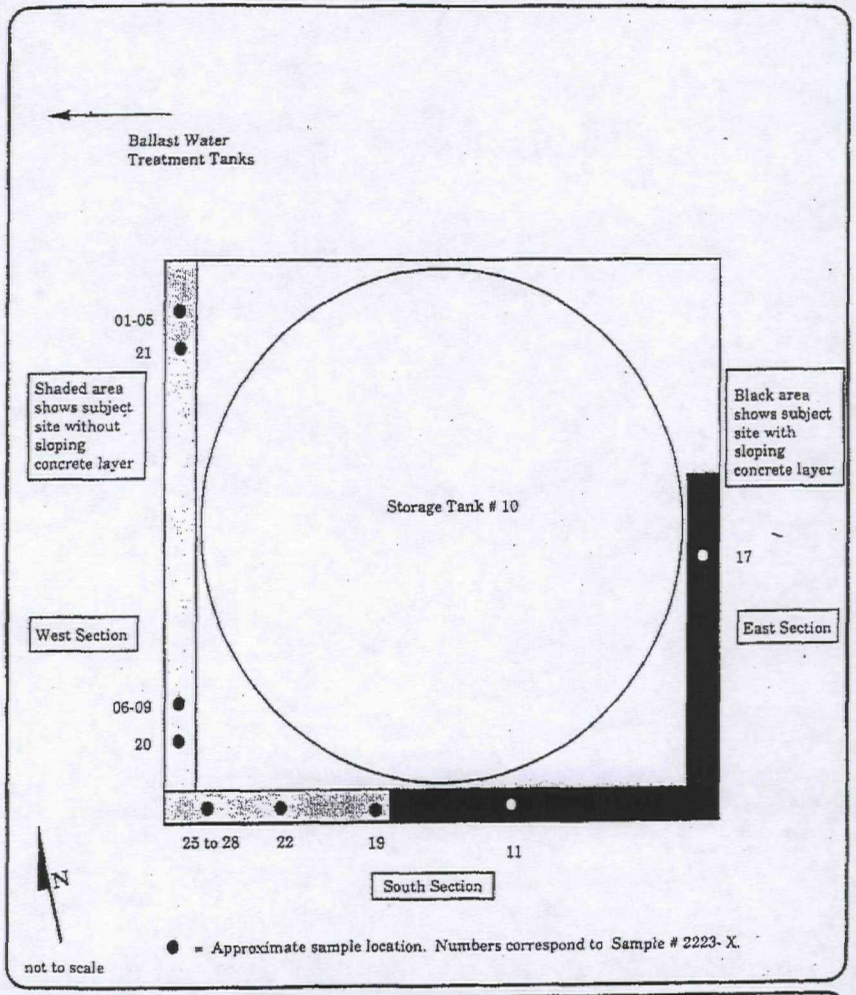


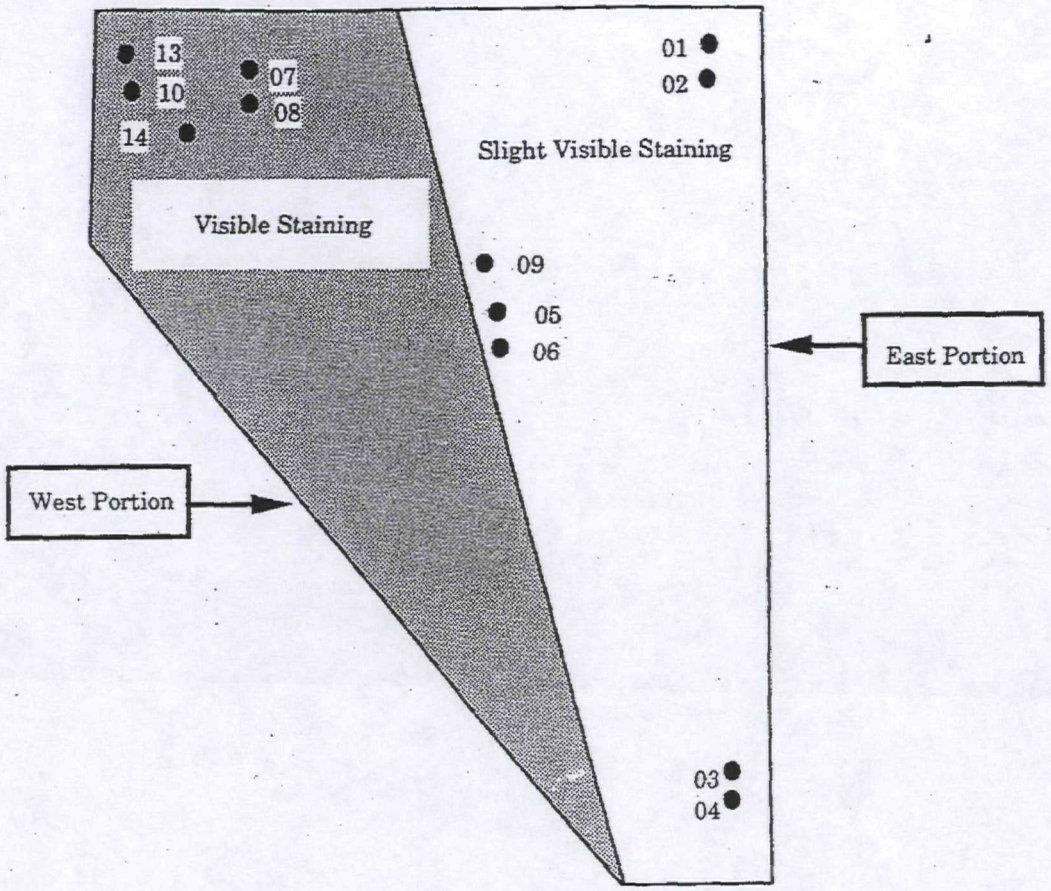
Figure 11
Comparison of Zinc Concentrations in Mid-Channel versus Near-Shore Sediments
Portland Harbor Sediment Data Review
Port of Portland

(Source: COE, 1998 and Weston, 1998)


COLUMBIA PARK
MOCKS LANDING
SWAN ISLAND BASIN
PORTLAND SHIP REPAIR YARD
PORT CENTER
ALBINA RAIL
Site Location
WILLAMETTE RIVER
HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209-3600
503/796-0717
FIGUR
1
HAI Project #2223
Nov 1992
BJM
LOCATION MA
Port of Portland
SWAN ISLAND INDUSTRIAL PARK
MOCKS LANDING INDUSTRIAL PARK
PORT CENTER BUSINESS PARK
PORTLAND SHIP REPAIR YARD
800 0 800 1600
SCALE IN FEET
SI 91-1
FACILITY



HAI Project #2223 May 1993 BJM	HAHN & ASSOCIATES, INC. ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209-3600 503/796-0717	SITE MAP - Tank 10 Portland Ship Yard Port of Portland Portland, Oregon	FIGURE 2



HAI Project #2223 May 1993 BJM	**HAHN & ASSOCIATES, INC.** ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209-3600 503/796-0717	**SITE MAP - Pipe Area** Portland Ship Yard Port of Portland Portland, Oregon	FIGURE 3

TABLE 2

Soil Sample Analytical Results - Pipe Area Samples

(Samples obtained by Hahn and Associates, Inc., between Oct. 1992 and Feb. 1993)

5555 Channel Blvd.

Portland, Oregon

COC Sample ID Number	Report Sample ID Number*	Date sampled	Depth-bgs (section)	concentrations in parts per million (ppm) TPH (EPA 418.1)	PCBs (EPA 8080)
1-1-10/92	2192-01	10/6/92	1 (east)	280	-
1-2-10/92	2192-02	10/6/92	2 (east)	-	-
2-1-10/92	2192-03	10/6/92	1 (east)	84	-
2-2-10/92	2192-04	10/6/92	2 (east)	-	-
3-1-10/92	2192-05	10/6/92	1 (east)	27,000	-
3-2-10/92	2192-06	10/6/92	2 (east)	870	-
4-1-10/92	2192-07	10/6/92	1 (west)	4,100	-
4-2-10/92	2192-08	10/6/92	2 (west)	2,400	-
1-2192-92123	2192-09	12/3/92	2 (east)	ND	-
2-2192-92123	2192-10	12/3/92	2 (west)	6,100	-
3-2192-92123	2192-11	12/3/92	Soil pile	59,000	0.38
4-2192-92123	2192-12	12/3/92	Soil pile	24,000	ND
2223-932202-23	2192-13	2/22/93	4 (west)	98	-
2223-932202-24	2192-14	2/22/93	2 (west)	53	-
Regulatory standard				500 **	ND

PRE-CU ↑

Notes:

COC = Chain of custody
bgs = Below Ground Surface (in feet)
TPH = Total Petroleum Hydrocarbons
EPA = Environmental Protection Agency
PCBs = polychlorinated biphenyls
- = not analyzed
ND = Not Detected above analytical detection limit
Constituents that were not detected are not shown in this table.
Analytical methods and chain-of-custody referenced in the Pacific Enviromental Laboratory, Inc. laboratory report.
* = Report Sample ID number is used to standardize the COC Sample ID numbers for the repor
Different COC Sample ID Numbers wer used because some samples were initially obtained under another project number.
** = TPH cleanup standard based on Level 2 Underground Stroage Tank Soil Matrix Clean-up Standard (Oregon Administrative Rules 340-122-305 to 360)

HAI Project # 2223

28-May-93

TABLE 1
Soil Sample Analytical Results - Tank 10 samples
(Samples obtained by Hahn and Associates, Inc., between Nov. 1992 and March 1993)

5555 Channel Blvd.
Portland, Oregon

Sample Number (**)	Date sampled	Depth-bgs (section)	concentrations in parts per million (ppm)			
			TPH (EPA 418.1)	Volatile Organic Compounds (EPA 8240)	PCBs (EPA 8080)	TCLP Metals (EPA 1311)
2223-110592-01	11/5/92	0 (west)	10,000	-	0.78	-
2223-110592-02	11/5/92	1 (west)	210	-	-	-
2223-110592-03	11/5/92	2 (west)	2,400	-	-	-
2223-110592-04	11/5/92	3 (west)	-	-	-	-
2223-110592-05	11/5/92	3.5 (west)	-	-	-	-
2223-110592-06	11/5/92	0 (west)	14,000	-	0.69	-
2223-110592-07	11/5/92	1 (west)	120	-	-	-
2223-110592-08	11/5/92	2 (west)	200	-	-	-
2223-110592-09	11/5/92	2.5 (west)	-	-	-	-
2223-110592-11	11/5/92	0 (south)	40,000	ND	1.2	NDR
2223-110592-16	11/5/92	0 (east)	59,000	-	-	-
2223-110592-17	11/5/92	0.5 (east)	24,000	-	-	-
2223-921202-19	12/3/92	1 (south)	3,200	-	-	-
2223-921202-20	12/3/92	2 (west)	480	-	-	-
2223-921202-21	12/3/92	3 (west)	300	-	-	-
2223-932202-22	2/22/93	2.5 (south)	1,000	-	-	-
2223-930305-25	3/5/93	3.5 (south)	650	-	-	-
2223-930305-26	3/5/93	4.5 (south)	ND	-	ND	-
2223-930305-27	3/5/93	5.5 (south)	ND	-	-	-
2223-930317-28	3/17/93	5.5 (south)	ND	-	-	-
Regulatory standard			500 *	Compound Dependent ***	ND	Compound Dependent †

Pre-CU

Post CU

HAI Project No. 2223
28-May-93

HAI's - 11/9/92 - Investigation & Excavation of Contaminated Soils

(5/13)

Purpose - Characterize, supervise excavation & assist in disposal of PCS discovered during parking lot resurfacing N of Bldg 50 next to electrical substation

SOW

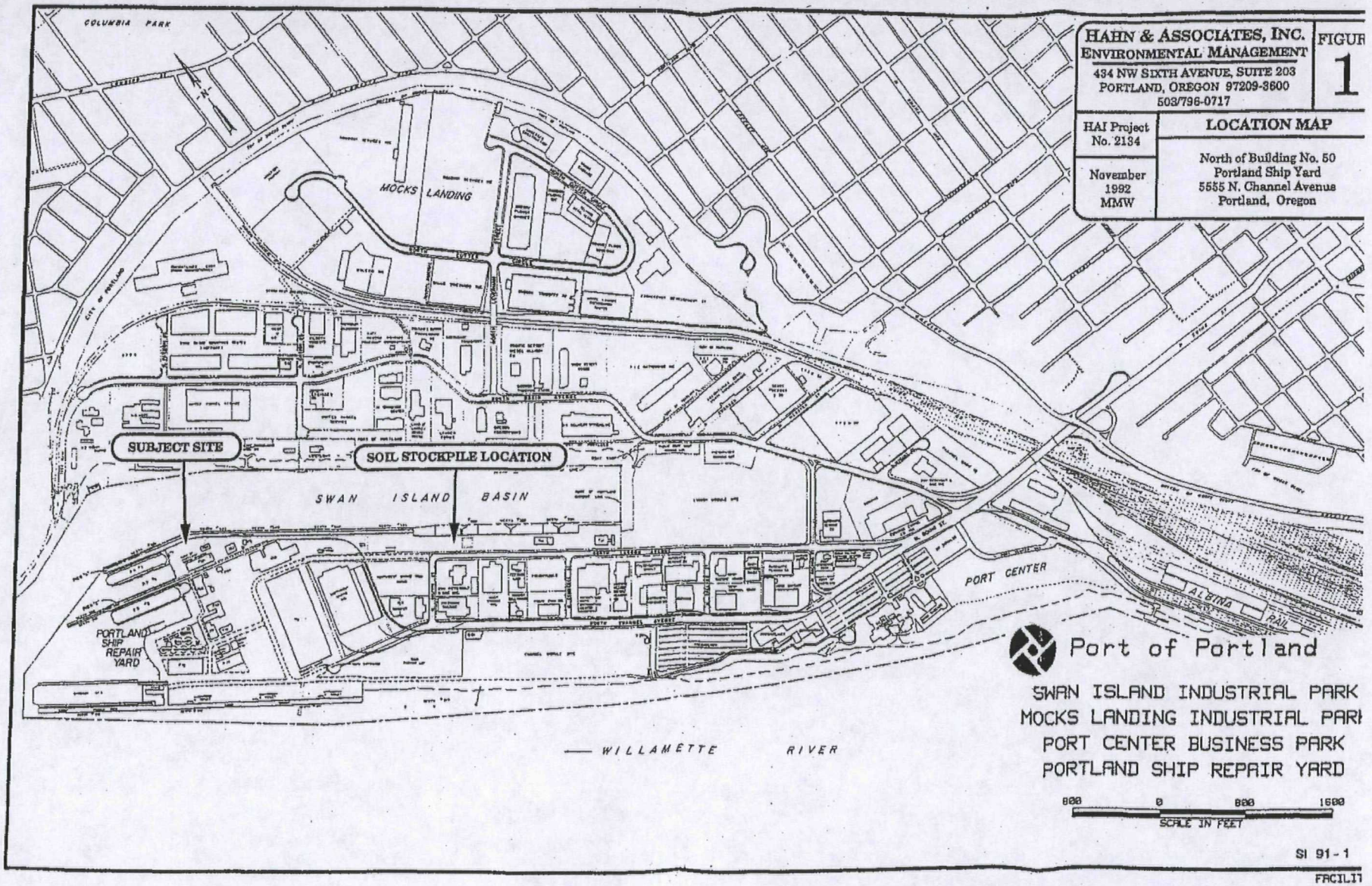
- collect & analyze 2 soil characterization samples

Results

- Soil Characterization samples
  - TPH-HCID - stoddard solvent & heavy oil
  - PCB - 0.08 - 0.09 ppm
  - & TCLP Metals - Pb = 0.68 & 7.26 ppm
  - VOCs E = 0.012 ppm X = 0.015 ppm
  - TPH-Stoddard - up to 390 ppm
  - TPH 418.1/MM - up to 1500 ppm
- CU Standards
  - using most conservative CU standards, some characterization samples exceeded CU levels for Stoddard solvent, TPH-418.1, & PCB. Therefore, verification samples analyzed for stoddard solvent & TPH 418.1 only (cuz PCBs were barely over CU levels)

Excavation & Post-Excavation Sampling

- Nearly 91 tons (70 cy) of stn PCS were excavated & moved to stockpile near Berth 306 & covered
- Excavation = 25' x 15' x 4-5' deep ; No GW encountered
- 3 Confirmation samples analyzed for TPH-stoddard & TPH-418.1 = ND
- PCS to Hillsboro



HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209-3600
503/796-0717

FIGUR
1

HAI Project No. 2134

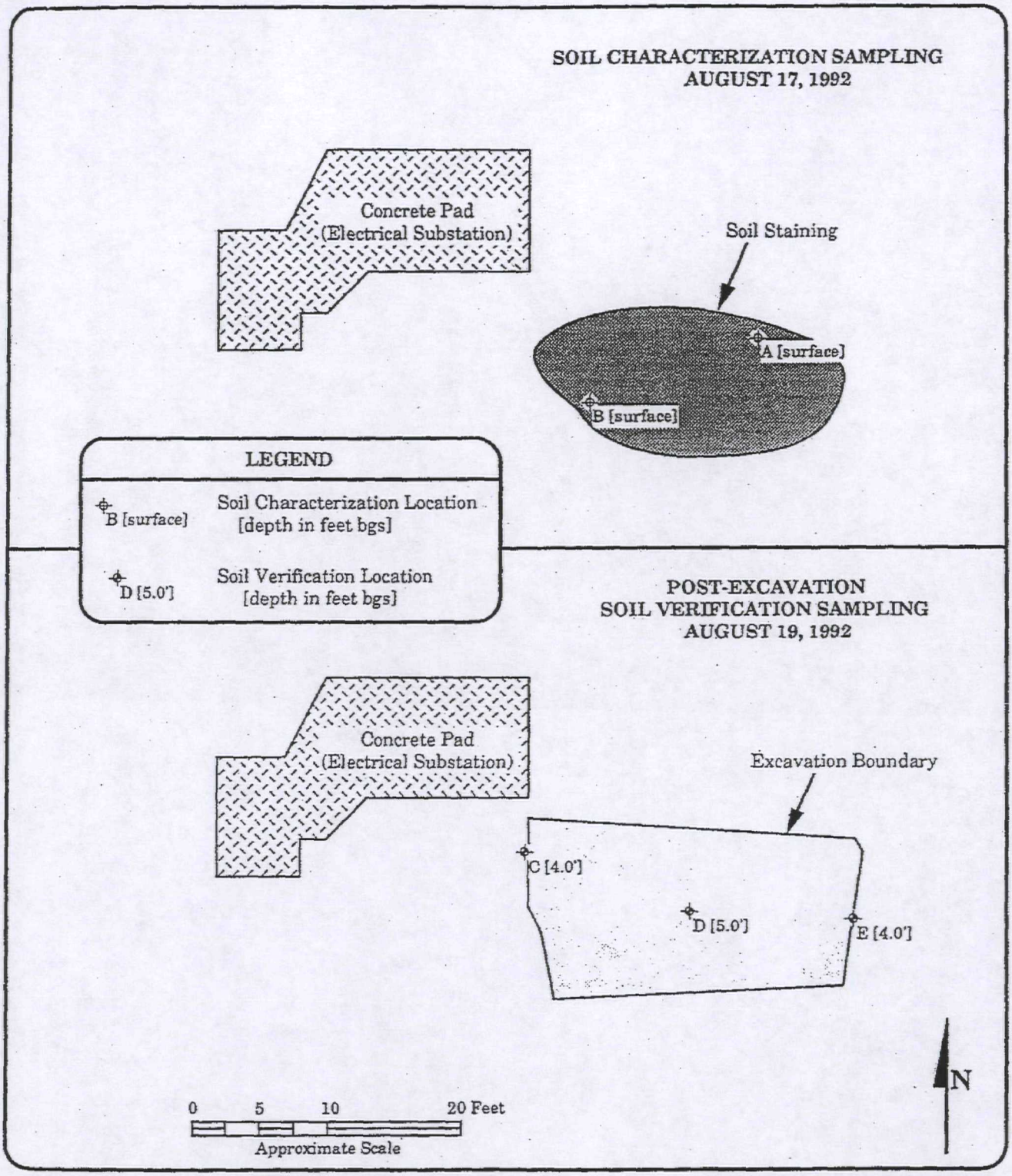
November 1992 MMW

LOCATION MAP

North of Building No. 50
Portland Ship Yard
5555 N. Channel Avenue
Portland, Oregon

SI 91-1

FACILI



HAI Project No. 2134 November 1992 MMW	**HAHN & ASSOCIATES, INC.** ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209-3600 503/796-0717	**SAMPLE LOCATIONS** North of Building No. 50 Portland Ship Yard 5555 N. Channel Avenue Portland, Oregon	FIGURE 2

HAI - 10/30/92 - Level II Environmental Assessment, Soils Investigation

(1)

3/12

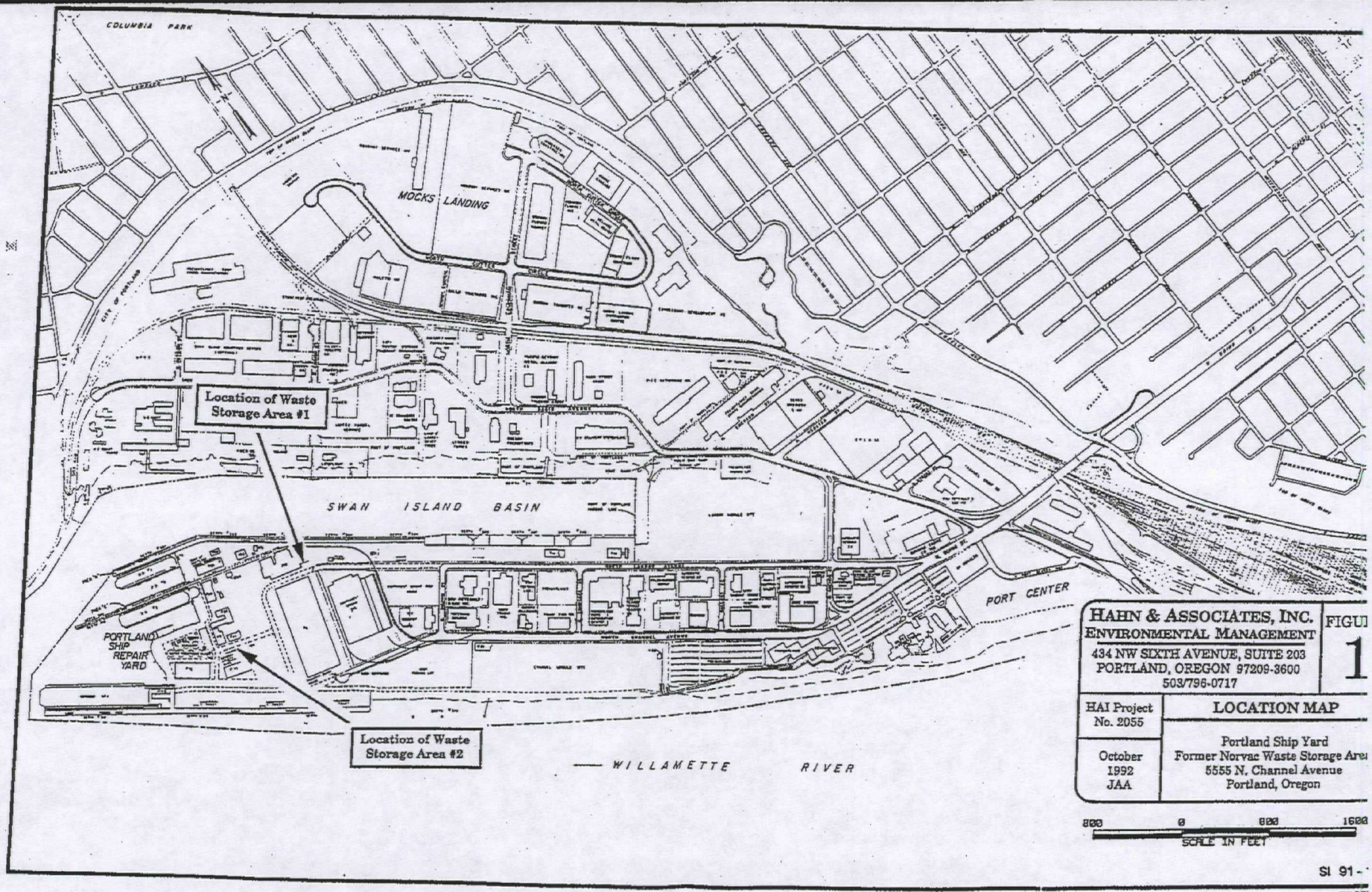
- Purpose - Assess soils in vicinity of 2 haz waste storage areas & after POP detected 2 storage areas w PCS

- SOW - 6 SB w TD = 4' bgs & 4 samples/SB

- Background - During 1/92 investigation, 2 soil samples were collected from each of the 2 waste storage areas (TPH ranged from 530 - 4,100 ppm)

- Findings
  - The shallowest sample at each SB (1' bgs) was analyzed for TPH-418.1 & all 6 SBs <20 ppm. Therefore, no deeper samples were analyzed.
  - PCS limited to surface - v. shallow soil. PCS may be due to disseminated asphalt
  - Soil Matrix Level 2

- Conclusions
  - PCS exists in surface & near surface soils directly beneath asphalt at 2 waste storage areas. Contamination may be due to asphalt
  - No Further investigation or site remediation required


COLUMBIA PARK
MOCKS LANDING
Location of Waste Storage Area #1
SWAN ISLAND BASIN
PORT CENTER
PORTLAND SHIP REPAIR YARD
Location of Waste Storage Area #2
WILLAMETTE RIVER
HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209-3600
503/796-0717
FIGU
1
HAI Project No. 2055
LOCATION MAP
October 1992 JAA
Portland Ship Yard
Former Norvac Waste Storage Are
5555 N. Channel Avenue
Portland, Oregon
800 0 800 1600
SCALE IN FEET

SI 91-

FACI

HAI's -5/26/92- Environmental Review

Bldg 10 & Bay 1 & 2

(10/9)

Purpose - Environmental review of current status of Bldg 10 & its 2 bays & associated office space

SOW - Facility Inspection
- PCB Spill Investigation - wipe samples of floor (STN) & overhead crane (Bay 2)
- PCB CU - STN areas on floor

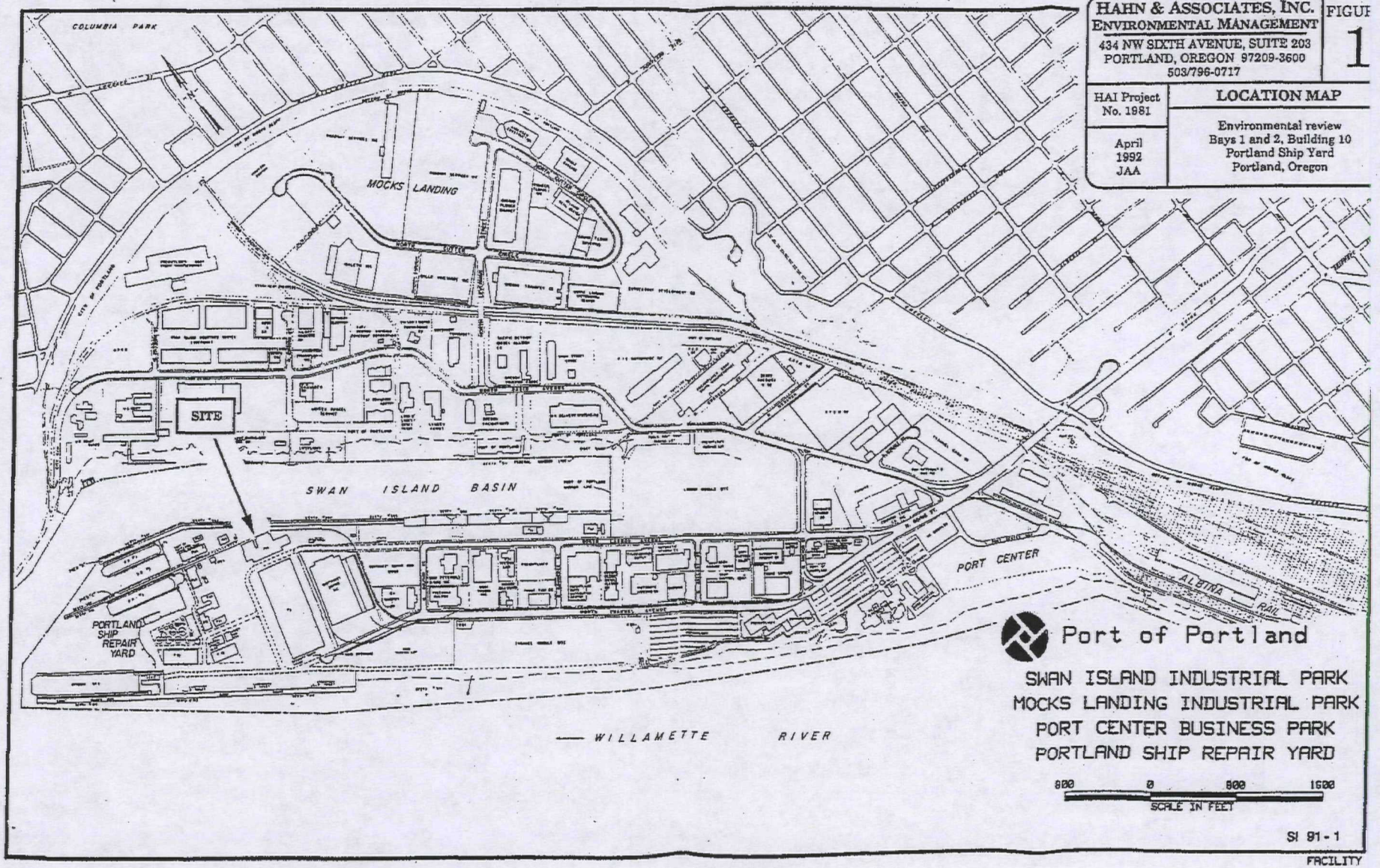
Facility Inspection
- Bldg 10 = 25,000 ft² operating space
- Bay 1 = offices, common rooms, & open bay. 2 groups of non-PCB transformers. NO CONCERNS
- Bay 2 = offices, work shops, storage areas, & open bays. Several non-PCB transformers in bay. Boom crane on tracks. PHC STN on floor
- No USTs/ASTs

PCB Investigation & CU
- 13 floor stained identified & previously sampled by GE. Suspected source = overhead crane, 13 wipe samples by HAI
- 5 wipe samples on overhead crane & oil samples from crane motors
- 9 of 13 floor STN & 3 of 5 crane areas exceed EPA PCB CU level of 10 ug/100cm²
- Crane motor = ND
- CU
  - 7 floor STNs CU by rinse/scrub/wash/rinse
  - Crane was no CU due to safety
- Verification samples
  - wipe samples of 7 floor STNs CU (5 samples/STN)
  - Results = < 1 ug/100 cm²

CONCLUSIONS + RECOMMENDATIONS

- Further investigation needed

1) Asbestos
2) Finish CU of PCB-stn on floor & crane
3) Dispose drum of PCB-contaminated waste



HAHN & ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209-3600
503/796-0717

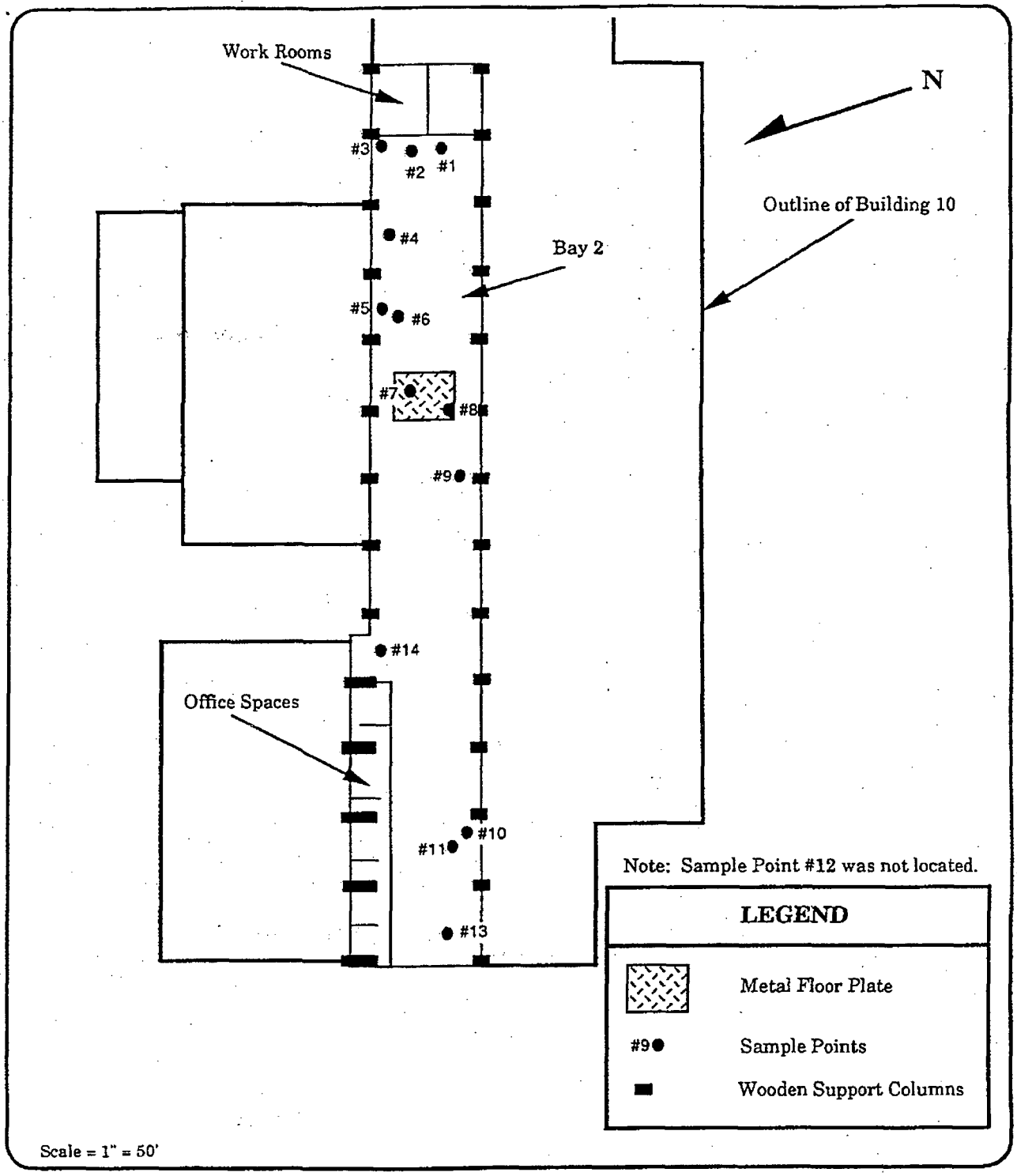
FIGURE 1

HAI Project No. 1981

April 1992 JAA

LOCATION MAP

Environmental review
Bays 1 and 2, Building 10
Portland Ship Yard
Portland, Oregon



HAI Project # 1981 May 1992 JAA	**HAHN & ASSOCIATES** **INCORPORATED** ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 503/796-0717	**Bay 2 Floor Sampling Map** **Environmental Review** **Bays 1 and 2, Building 10** **Portland Ship Yard** **Portland, Oregon**	FIGURE 3

HAI's - 2/28/92 - Level II EA Soils Investigation - BWTP

9/8

Purpose - Assess soils in vicinity of 4 84,000-gal ASTs used to store diesel/oil to determine if previous activities have impacted soils

SOW

- Soil samples collected at 6" & 3' bgs at each of 4 locations under tanks

Results

Sample 1 (Between AST 12 & 13)
- water seeping at 1½' bgs
- stn surface soil

Depth	TPH 418.1
0.5'	450
2.5'	170

Sample 2 (NW of AST 15)
- green flecks (?)

0.5'	400
3.0'	1100

Sample 3 (Between AST 14 & 15)
- obvious soil stn

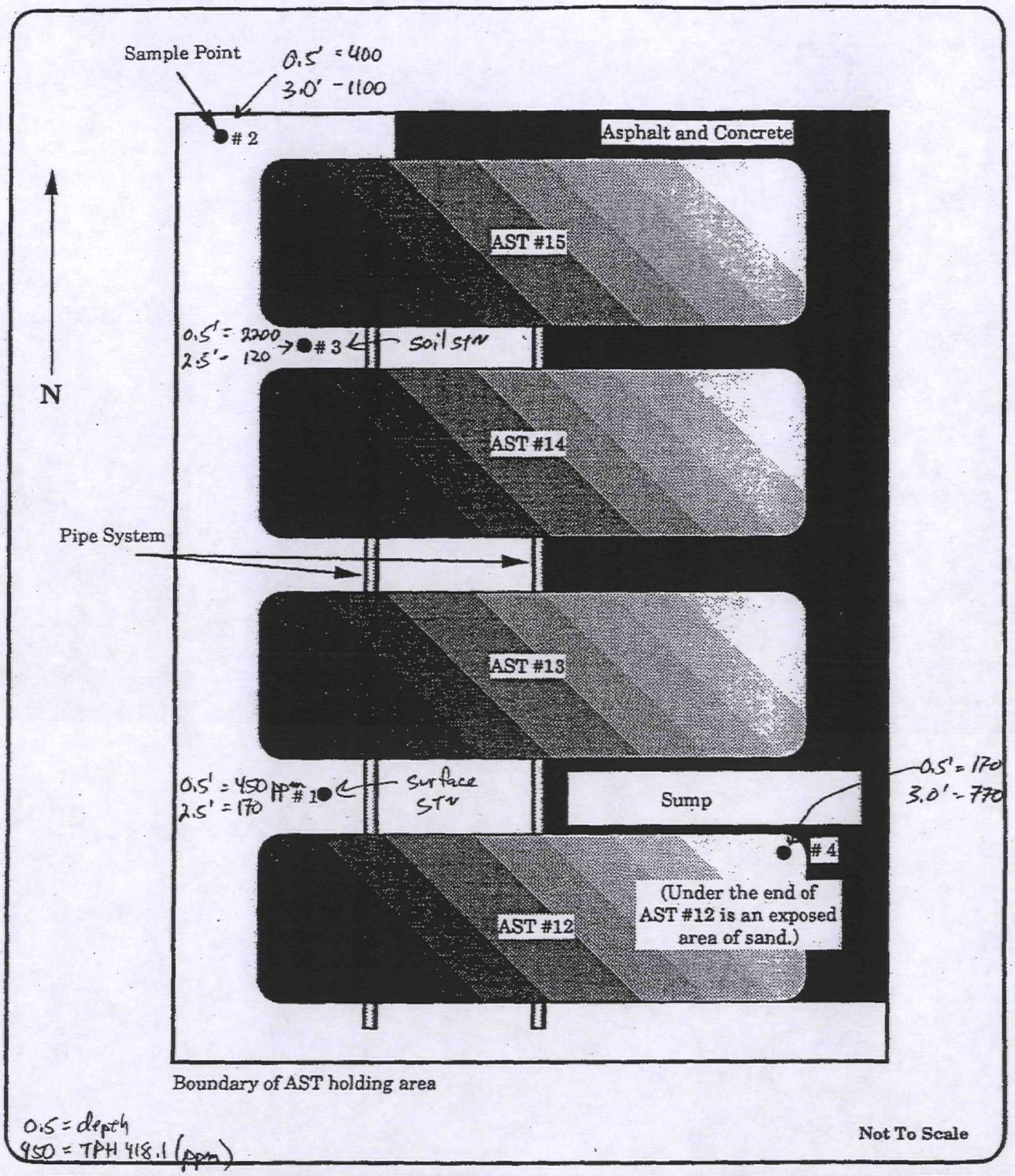
0.5'	2200
2.5'	120

Sample 4 (Under AST 12)
- no discoloration

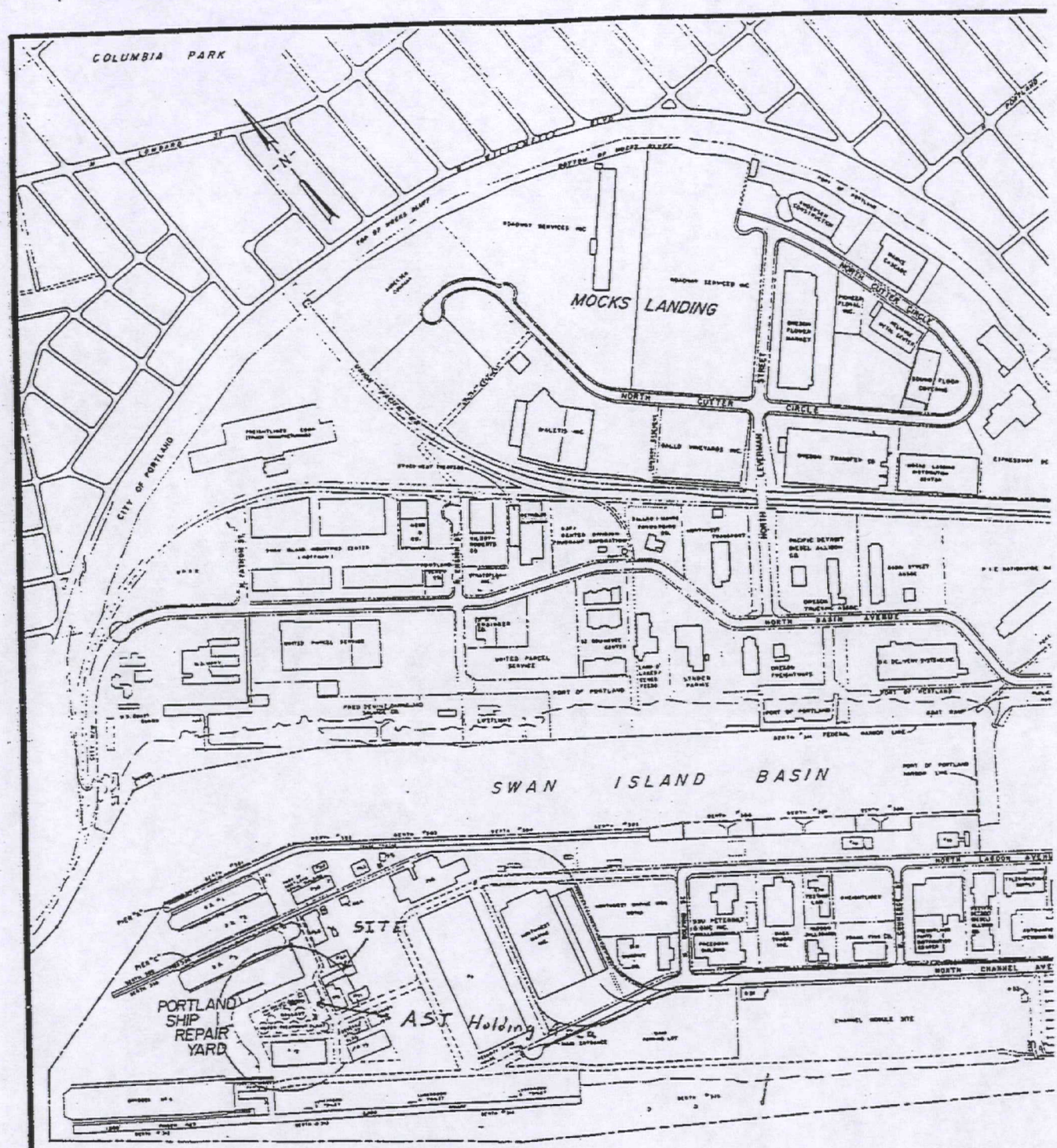
0.5'	170
3.0'	770

- Level 2 Soil Matrix site

- **CONCLUSIONS**
  - PCS, but no discernable plume direction



HAI Project # 1416 February 1992	**HAHN & ASSOCIATES** **INCORPORATED** ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 503/796-0717	**SAMPLE LOCATION MAP** Portland Ship Yard Ballast Water Treatment Plant Portland, Oregon	FIGURE **2**



HAI Project # 1416 February 1992	**HAHN & ASSOCIATES** **INCORPORATED** ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 503/796-0717	**SITE MAP** Portland Ship Yard Ballast Water Treatment Plant Portland, Oregon	FIGURE 1

HAI's - 2/28/92 - PCB Inventory & Disposal Recommendations

4/7

Purpose
- Inventory & disposal options for 25 electrical equipment pieces at Substation 1 (near Bldg 60).
- POP data base contains information on PCB content for equipment, but data gaps exist

SOW
- Collect samples of dielectric fluid / tar (11 samples / 5 samples) on untested equip
- Collect wipe samples from pads & 2 PCB transformers
- Collect bulk soil samples in suspect areas (44 samples / 7 samples)

Results
- Oil Samples - Transformer #6 & #10 had @ 50% PCB in oil
  - All other equipment was < 44 ppm PCB
- Tar Samples - only 1 hit at 1 ppm PCB
- Soil Samples - 0.14 - 5.4 ppm
- Wipe Samples - 8 - 3,700 ug/100 cm² near Transformer #6 & #10
  - ND at other areas

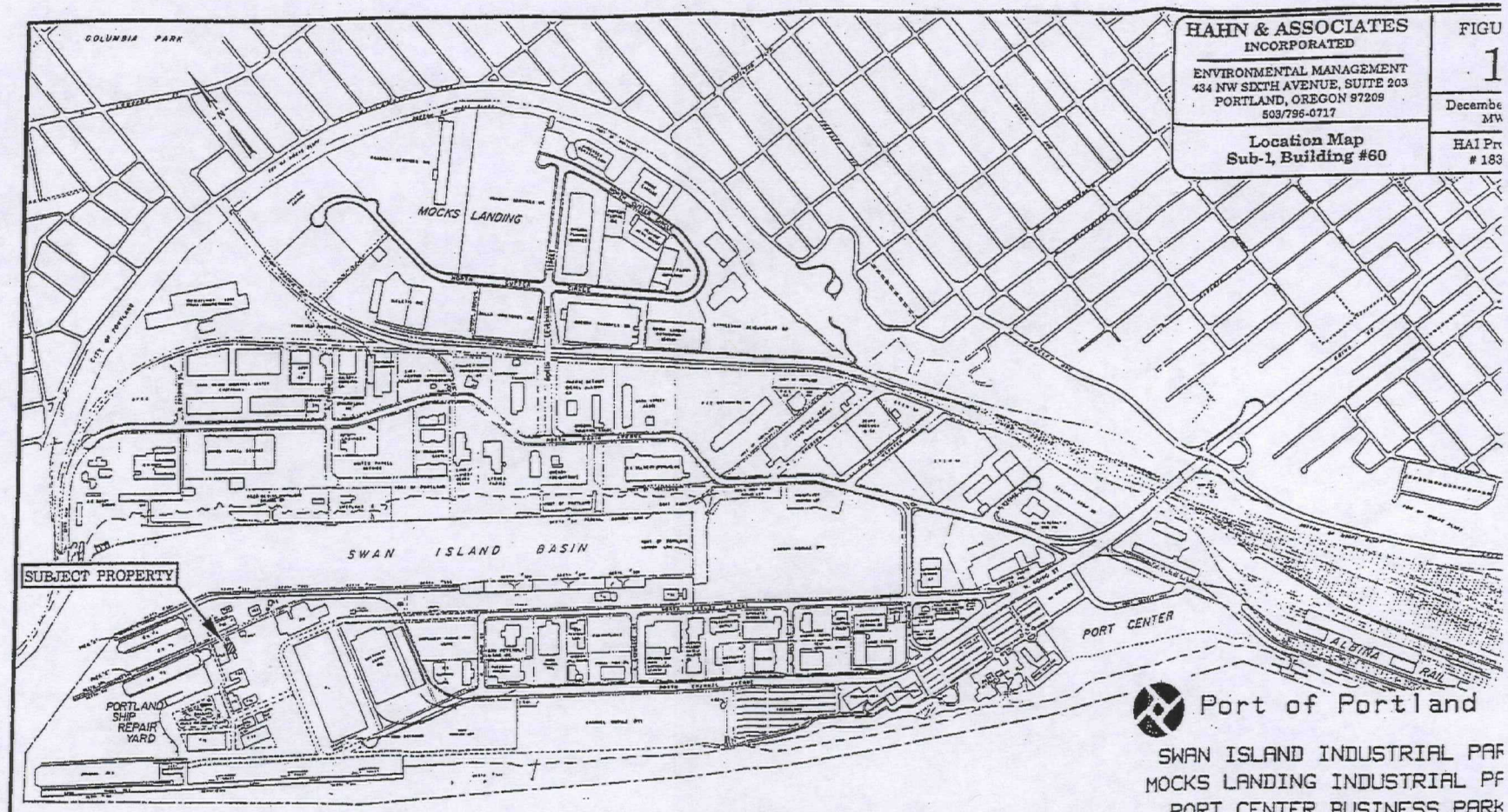
Interpretation
1) 176 gallons of fluid & 3 cy of concrete pad are PCB-containing (i.e., >500 ppm). No samples were PCB-contaminated (>50; <500 ppm)
2) > 3000 gal of fluid are Non-PCB (<1 - 44 ppm). 4 cy soil are Non-PCB (2.8-5.4 ppm) & 5 cy is (0.14 - 0.42 ppm)
3) 1 tar sample is 1 ppm are rest are ND
4) 60 gallons of fluid are ND

Disposal Options
- Burn or recycle = (PCB = ND)
- Municipal LF = Hillsboro will take solid up to 10 ppm. That is everything but concrete pads at Transformers # 6 & #10
- Chemical Waste LF = Non-liquids & liquids <500 ppm
- High Efficiency Burner & Incineration

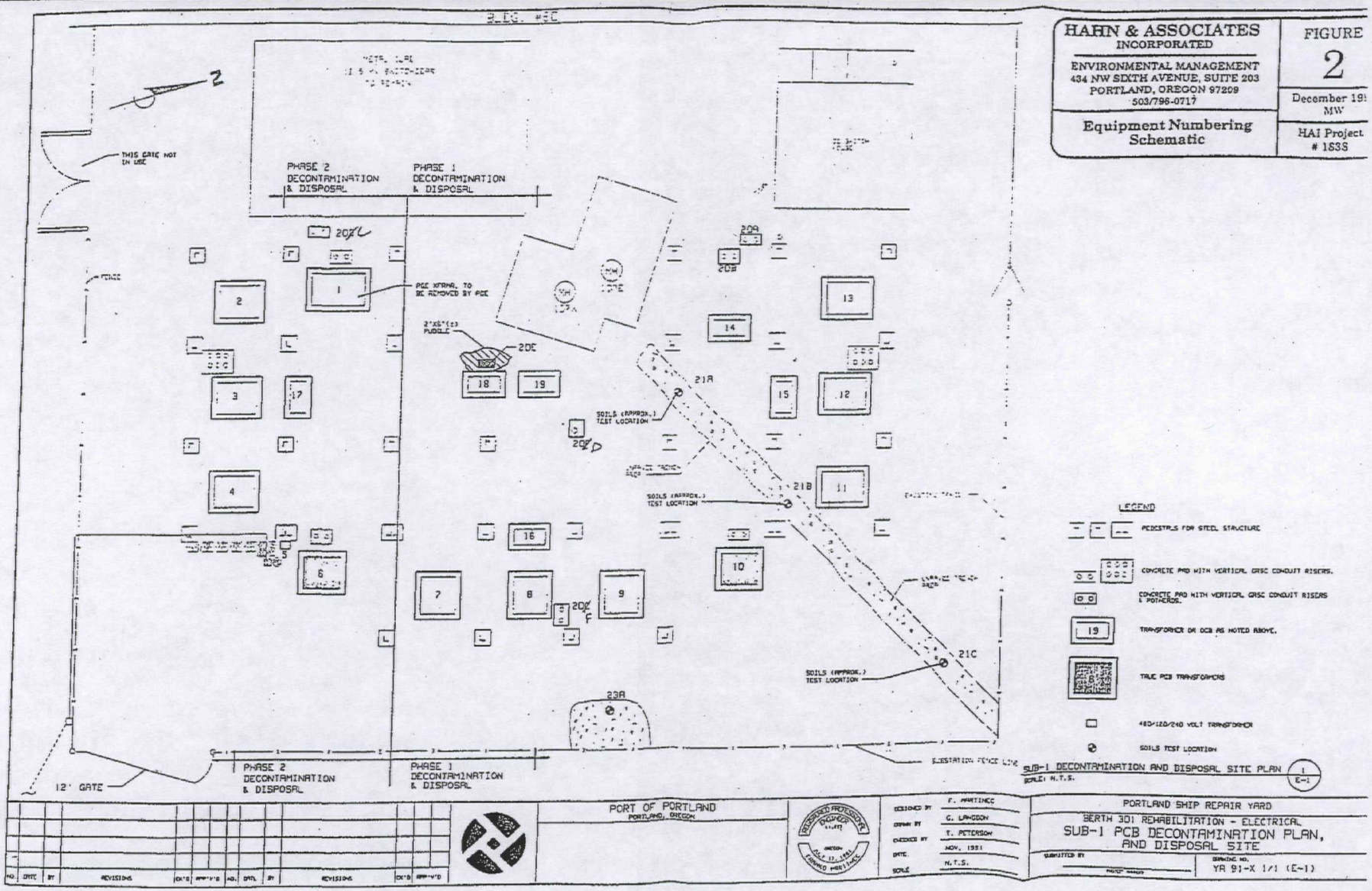
RECOMMENDATIONS

1) Monitor DEQ's new Rules for soil < 50 ppm

2) Follow EPA PCB Spill CO Policy


COLUMBIA PARK
MOCKS LANDING
SWAN ISLAND BASIN
SUBJECT PROPERTY
PORTLAND SHIP REPAIR YARD
PORT CENTER
ALBINA RAIL
WILLAMETTE RIVER
HAHN & ASSOCIATES
INCORPORATED
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717
Location Map
Sub-1, Building #60
FIGU
1
Decembe
MW
HAI Pr
183
Port of Portland
SWAN ISLAND INDUSTRIAL PAR
MOCKS LANDING INDUSTRIAL PF
PORT CENTER BUSINESS PARK
PORTLAND SHIP REPAIR YARI
800
0
800
160
SCALE IN FEET
SI 91-
FACI

[redacted]



SUB-1 DECONTAMINATION AND DISPOSAL SITE PLAN (1 / E-1)
SCALE: N.T.S.

HAHN & ASSOCIATES INCORPORATED	FIGURE 2
ENVIRONMENTAL MANAGEMENT 434 NW SIXTH AVENUE, SUITE 203 PORTLAND, OREGON 97209 503/796-0717	December 19 MW
Equipment Numbering Schematic	HAI Project # 1533

NO.	DATE	BY	REVISIONS	CK'D	APP'V'D	NO.	DATE	BY	REVISIONS	CK'D	APP'V'D

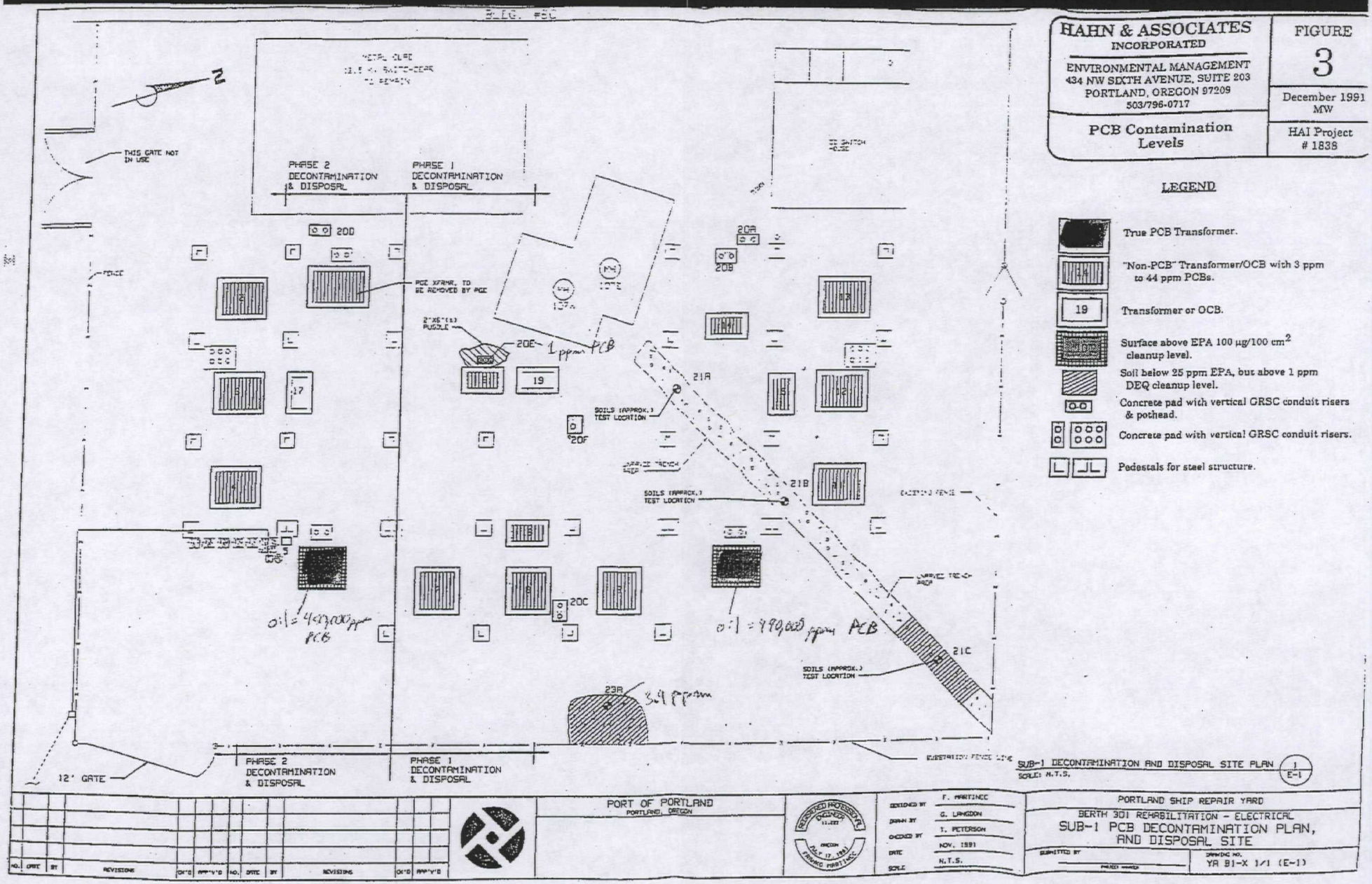
PORT OF PORTLAND
PORTLAND, OREGON

DESIGNED BY	F. MARTINEZ
DRAWN BY	G. LANGDON
CHECKED BY	T. PETERSON
DATE	NOV. 1991
SCALE	N.T.S.

PORTLAND SHIP REPAIR YARD
BERTH 301 REHABILITATION - ELECTRICAL
SUB-1 PCB DECONTAMINATION PLAN, AND DISPOSAL SITE

SUBMITTED BY _____ PROJECT MANAGER

DRAWING NO. YR 91-X 1/1 (E-1)



SUB-1 DECONTAMINATION AND DISPOSAL SITE PLAN (1/E-1)
SCALE: N.T.S.

HAHN & ASSOCIATES INCORPORATED
ENVIRONMENTAL MANAGEMENT
434 NW SIXTH AVENUE, SUITE 203
PORTLAND, OREGON 97209
503/796-0717

PCB Contamination Levels

FIGURE 3

December 1991
MW

HAI Project # 1838

LEGEND

- True PCB Transformer.
- "Non-PCB" Transformer/OCB with 3 ppm to 44 ppm PCBs.
- 19 — Transformer or OCB.
- Surface above EPA 100 µg/100 cm² cleanup level).
- Soil below 25 ppm EPA, but above 1 ppm DEQ cleanup level.
- Concrete pad with vertical GRSC conduit risers & pothead.
- Concrete pad with vertical GRSC conduit risers.
- L JL — Pedestals for steel structure.

NO.	DATE	BY	REVISIONS	CK'D	APP'V'D	NO.	DATE	BY	REVISIONS	CK'D	APP'V'D

PORT OF PORTLAND
PORTLAND, OREGON

REGISTERED PROFESSIONAL ENGINEER — OREGON — JULY 17, 1990 — FRANKLIN MARTINEZ

DESIGNED BY	F. MARTINEZ
DRAWN BY	G. LANGDON
CHECKED BY	T. PETERSON
DATE	NOV. 1991
SCALE	N.T.S.

PORTLAND SHIP REPAIR YARD
BERTH 301 REHABILITATION - ELECTRICAL
SUB-1 PCB DECONTAMINATION PLAN, AND DISPOSAL SITE

SUBMITTED BY
PROJECT MANAGER

DRAWING NO. YR 91-X 1/1 (E-1)

HA Is 7/24/90 — Final Site Visit

(1)

"N. Channel Ave Fab Site"

1/3

Purpose - Site tour to observe current conditions

Current Conditions

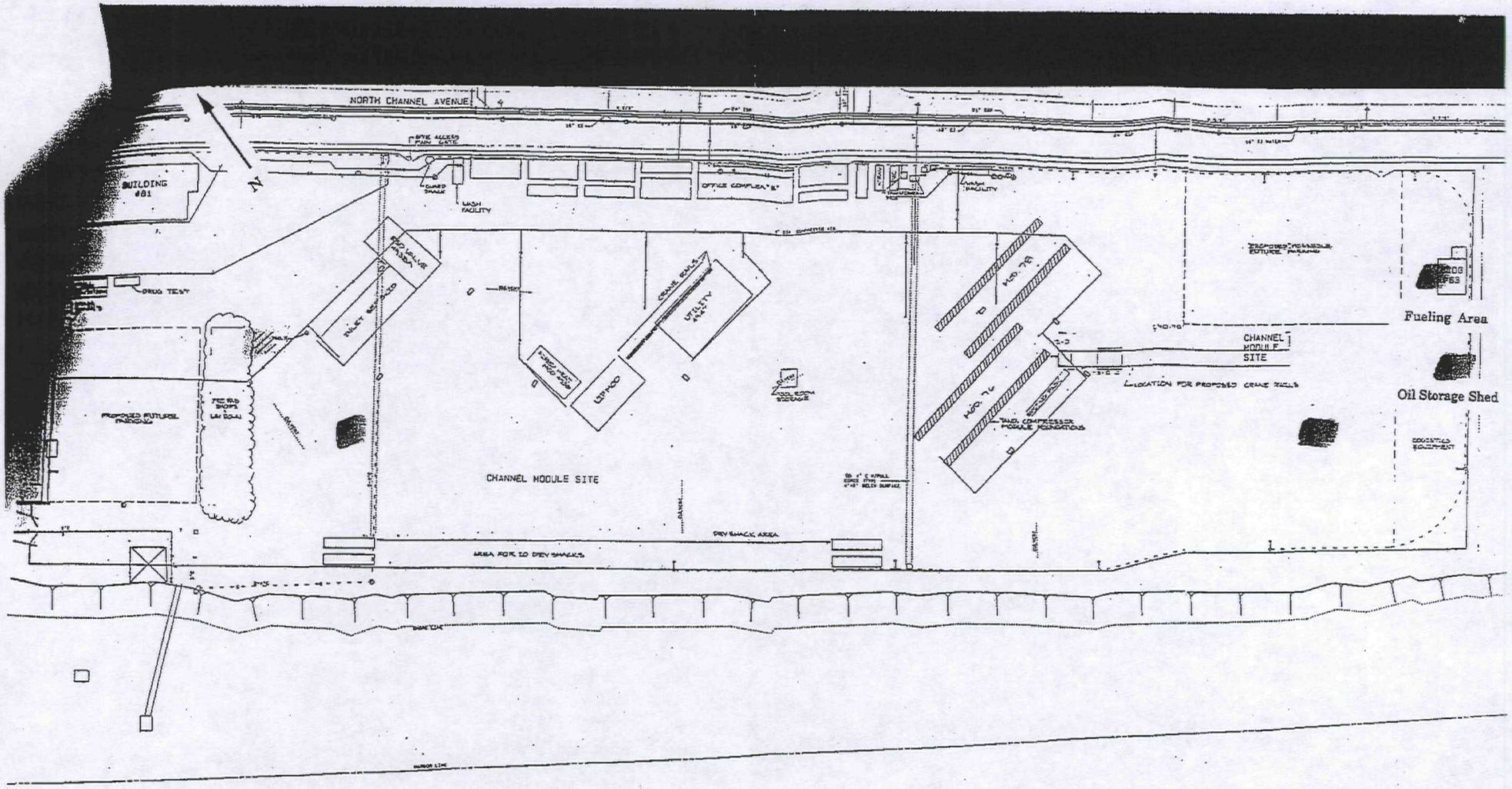
- Fab activities ceased. Site tear-down/CU proceeding.
- Site is largely vacant, but some drums & trailers & equipment still onsite, No ASTs
- Some sand blast grit observed (< 1 cy)

Actions

- POP will CU STN soil
- ARCO will gather sand blast grit & POP will dispose
- ARCO will dispose of drums/chemical storage

Conclusions

- Fab had limited impact on site (PHC STN, sand blast grit

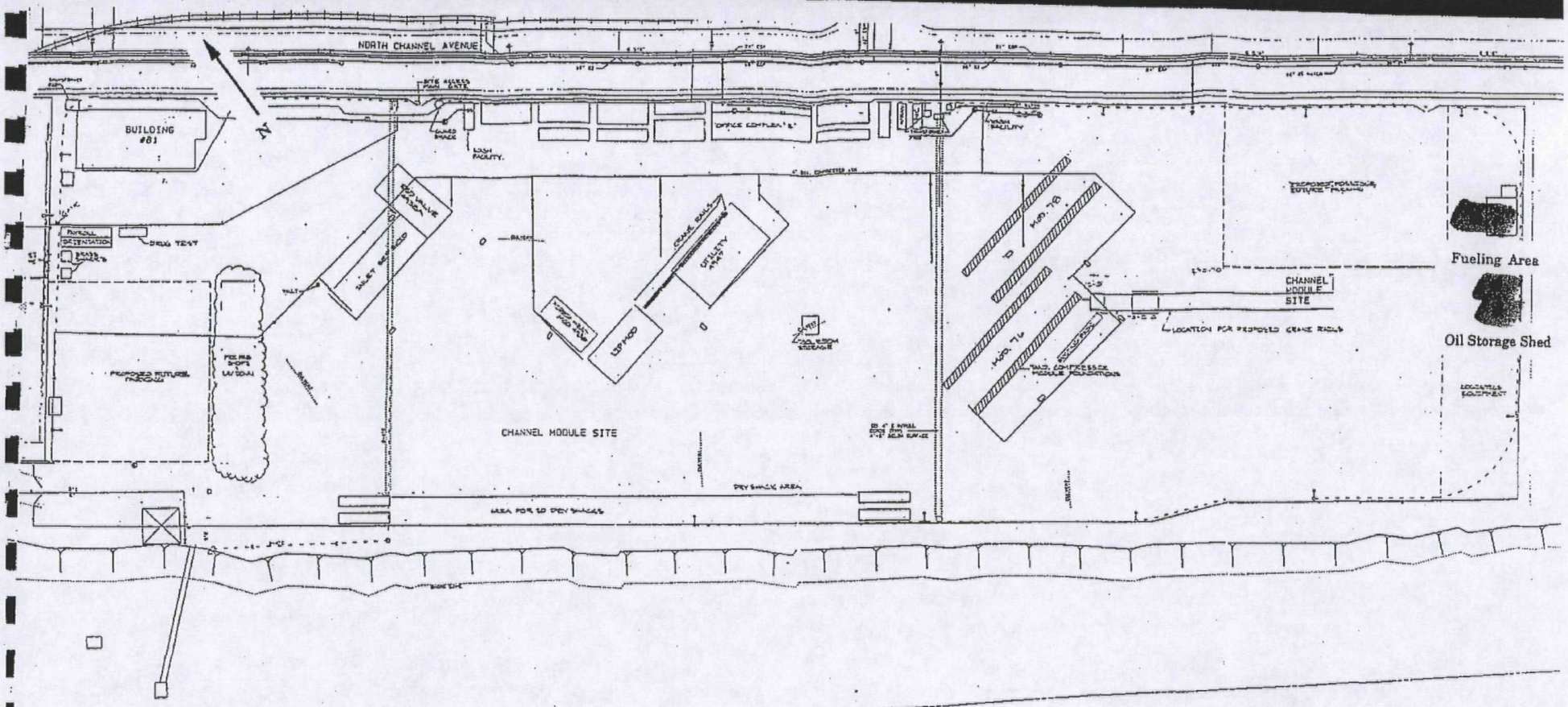


Area of Petroleum Staining

Sandblast Sand On Ground

not to scale

Figure 1. Site Map
Arco Alaska, Inc.
Portland Fabrication Site
5100 N Channel Avenue
Portland, Oregon



Area of Petroleum Staining

not to scale

Figure 2 Site Map
Arco Alaska, Inc.
Portland Fabrication Site
5100 N Channel Avenue
Portland, Oregon

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	**Date:**	9/25/01
Address:	5555 N Channel Blvd. PDX	**Report by**	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	**Class:**	
Substation/Site:	Dry Dock 3	**MVA:**	1
Transformer No.:	16121-1	**Gallons:**	415
Manufacturer:	Sierra	**PCB's**	cert.non
Voltage:	12470/480	**% Imp.**	

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/00	8/25/99
Acetylene	0	0	0
Hydrogen	6	8	2
Ethylene	3	9	1
Methane	2	5	1
Ethane	1	2	0
Carbon Monoxide	271	463	167
Carbon Dioxide	3000	2522	1597
Oxygen	14222	10690	18258
Nitrogen	63382	46353	64501
Total Combustibles	283	487	170
Total Gas	80888	60062	84526
OIL QUALITY			
Dielectric Break (kV)	43.8	41	51
Water in Fluid (ppm)	10.3	4	5
Acid Number (mg KOH/g)	0.006	0.008	0.002
Interfacial Tens.(dynes/cm)	42.3	36	38
ASTM Color	1	L1.5	L1.0
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.876	0.882	0.887
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	36C	30c	35
Pressure	0	-1	-0.5
Liquid Level	ok	ok	
GAS DIAGNOSTICS			
Rogers Ratio			
Cellulose Ratio (CO2/CO)			
IEEE/ANSI (C57.104-1991)			

COMMENTS

apply nitrogen

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Dry Dock 3	MVA:	1.5
Transformer No.:	16745-1	Gallons:	327
Manufacturer:	Sierra	PCB's	cert.non
Voltage:	12470/480	% Imp.	

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/00	8/25/00
Acetylene	0	0	0
Hydrogen	11	14	4
Ethylene	59	44	10
Methane	5	12	1
Ethane	1	2	0
Carbon Monoxide	606	817	435
Carbon Dioxide	5669	4774	3862
Oxygen	3488	6444	8625
Nitrogen	58303	45159	58658
Total Combustibles	682	889	450
Total Gas	68142	57266	71595
OIL QUALITY			
Dielectric Break (kV)	44.5	48	39
Water in Fluid (ppm)	15.3	16	4
Acid Number (mg KOH/g)	0.008	0.011	0.005
Interfacial Tens.(dynes/cm)	37.6	35	33
ASTM Color	1	L1.5	L1.0
Visual Inspection	pass	pass	pass
Specific Gravity	0.8755	0.883	0.882
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	54C	45c	50c
Pressure	-1	-1.5	-1
Liquid Level	ok	ok	

GAS DIAGNOSTICS

Rogers Ratio

Cellulose Ratio (CO2/CO)

IEEE/ANSI (C57.104-1991) retest quarterly

COMMENTS

apply nitrogen

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Dry Dock 3	MVA:	1
Transformer No.:	16121-3	Gallons:	415
Manufacturer:	Sierra	PCB's	cert.non
Voltage:	12470/480	% Imp.	

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/00	8/25/99
Acetylene	16	23	0
Hydrogen	53	60	10
Ethylene	472	463	80
Methane	177	161	34
Ethane	53	103	6
Carbon Monoxide	282	489	220
Carbon Dioxide	2846	2660	1525
Oxygen	11160	10060	16273
Nitrogen	57721	46183	64986
Total Combustibles	1053	1319	350
Total Gas	72780	60122	83135
OIL QUALITY			
Dielectric Break (kV)	40	32	48
Water in Fluid (ppm)	22.2	22	16
Acid Number (mg KOH/g)	0.008	0.005	0.003
Interfacial Tens.(dynes/cm)	39.1	36	35
ASTM Color	1	L1.5	L1.0
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.8754	0.884	0.877
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	35C	30c	35c
Pressure	0	-1	0
Liquid Level	ok	ok	

GAS DIAGNOSTICS

Rogers Ratio

Cellulose Ratio (CO2/CO)

IEEE/ANSI (C57.104-1991) retest quarterly

COMMENTS

This unit is a concern. Apply nitrogen. Consider inspection and servicing.

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	32-1	MVA:	2.5
Transformer No.:	79F835	Gallons:	488
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	11400/480	% Imp.	6.4

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/00	8/25/99
Acetylene	1	2	0
Hydrogen	4	3	3
Ethylene	34	72	42
Methane	11	8	1
Ethane	5	17	3
Carbon Monoxide	84	180	76
Carbon Dioxide	1044	1348	1132
Oxygen	79	11213	14614
Nitrogen	42924	41374	48525
Total Combustibles	139	282	125
Total Gas	44186	54217	64396
OIL QUALITY			
Dielectric Break (kV)	37.8	39	44
Water in Fluid (ppm)	26.5	19	19
Acid Number (mg KOH/g)	0.042	0.047	0.038
Interfacial Tens.(dynes/cm)	34	27	28
ASTM Color	5.5	G8.0	L5.0
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.8775	0.894	0.888
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	50C	50c	45c
Pressure	0	1.5	2
Liquid Level	HIGH	ok	
GAS DIAGNOSTICS			
Rogers Ratio			
Cellulose Ratio (CO2/CO)			
IEEE/ANSI (C57.104-1991)			

COMMENTS

LEAK @ H3 GASKET
UNITS NEEDS PRESSURE

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 4-5	MVA:	0.33
Transformer No.:	79F6705	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

	Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM		9/11/01	8/24/00	8/25/99
	Acetylene	0	0	0
	Hydrogen	4	12	4
	Ethylene	2	9	1
	Methane	9	17	5
	Ethane	11	19	4
	Carbon Monoxide	66	243	117
	Carbon Dioxide	1217	2594	2384
	Oxygen	62	4640	2316
	Nitrogen	32068	4640	53131
	Total Combustibles	92	300	131
	Total Gas	33439	50838	57961
OIL QUALITY				
	Dielectric Break (kV)	38.7	39	46
	Water in Fluid (ppm)	21.3	12	27
	Acid Number (mg KOH/g)	0.025	0.029	0.029
	Interfacial Tens.(dynes/cm)	37	29	28
	ASTM Color	6	G8.0	L5.0
	Visual Inspection	Pass	Pass	Pass
	Specific Gravity	0.883	0.899	0.899
OPERATING CONDITIONS				
	AmbientTemp.	70F	80F	
	Winding Temp.			
	Liquid Temp.	38C	35c	35c
	Pressure	0	0	0.5
	Liquid Level	ok	ok	ok
GAS DIAGNOSTICS				
	Rogers Ratio			
	Cellulose Ratio (CO2/CO)			
	IEEE/ANSI (C57.104-1991)			

COMMENTS

apply nitrogen

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 4-2	MVA:	0.33
Transformer No.:	7916702	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/00	8/25/99
Acetylene	0	0	0
Hydrogen	2	0	1
Ethylene	1	2	0
Methane	7	2	0
Ethane	9	3	0
Carbon Monoxide	42	92	38
Carbon Dioxide	577	1005	922
Oxygen	77	10084	4099
Nitrogen	32264	41027	42245
Total Combustibles	61	96	39
Total Gas	32969	52215	47306
OIL QUALITY			
Dielectric Break (kV)	44.9	32	50
Water in Fluid (ppm)	17.8	14	21
Acid Number (mg KOH/g)	0.025	0.02	0.02
Interfacial Tens.(dynes/cm)	32.6	26	39
ASTM Color	5.5	L5.0	L5.0
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.8835	0.892	0.896
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	18C	35c	35c
Pressure	0	0	0.5
Liquid Level	ok	ok	ok
GAS DIAGNOSTICS			
Rogers Ratio			
Cellulose Ratio (CO2/CO)			
IEEE/ANSI (C57.104-1991)			

COMMENTS

apply nitrogen

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 4-4	MVA:	0.33
Transformer No.:	79F6704	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

	Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM		9/11/01	8/24/00	8/25/99
	Acetylene	0	3	0
	Hydrogen	0	7	4
	Ethylene	2	96	26
	Methane	1	17	7
	Ethane	1	21	6
	Carbon Monoxide	5	326	251
	Carbon Dioxide	113	2730	2011
	Oxygen	2	4460	3101
	Nitrogen	1423	43393	64046
	Total Combustibles	9	470	294
	Total Gas	1542	51053	69452
OIL QUALITY				
	Dielectric Break (kV)	37.8	38	41
	Water in Fluid (ppm)	19	9	23
	Acid Number (mg KOH/g)	0.028	0.022	0.018
	Interfacial Tens.(dynes/cm)	38	29	31
	ASTM Color	5.5	L5.0	L5.0
	Visual Inspection	Pass	Pass	Pass
	Specific Gravity	0.8825	0.895	0.889
OPERATING CONDITIONS				
	AmbientTemp.	70F	80F	
	Winding Temp.			
	Liquid Temp.	38C	35c	35c
	Pressure	0	0	0.5
	Liquid Level	ok	ok	ok
GAS DIAGNOSTICS				
	Rogers Ratio			
	Cellulose Ratio (CO2/CO)			
	IEEE/ANSI (C57.104-1991)			

COMMENTS

apply nitrogen

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 4-11	MVA:	0.33
Transformer No.:	79F6701	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

	Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM		9/11/01	8/24/00	8/25/99
	Acetylene	0	0	0
	Hydrogen	15	22	10
	Ethylene	5	19	3
	Methane	16	28	5
	Ethane	14	21	2
	Carbon Monoxide	113	262	145
	Carbon Dioxide	2727	3118	2688
	Oxygen	70	4220	1774
	Nitrogen	47808	43362	47864
	Total Combustibles	163	372	165
	Total Gas	50768	52072	52491
OIL QUALITY				
	Dielectric Break (kV)	30	34	39
	Water in Fluid (ppm)	22.4	8	14
	Acid Number (mg KOH/g)	0.02	0.02	0.021
	Interfacial Tens.(dynes/cm)	33.9	28	31
	ASTM Color	5.5	G8.0	L6.0
	Visual Inspection	Pass	Pass	Pass
	Specific Gravity	0.886	0.897	0.892
OPERATING CONDITIONS				
	AmbientTemp.	70F	80F	
	Winding Temp.			
	Liquid Temp.	40C	35c	35c
	Pressure	0	0	0.6
	Liquid Level	ok	ok	ok
GAS DIAGNOSTICS				
	Rogers Ratio			
	Cellulose Ratio (CO2/CO)			
	IEEE/ANSI (C57.104-1991)			

COMMENTS

apply nitrogen

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 12-2	MVA:	1
Transformer No.:	79F67112	Gallons:	316
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.5

Lab Used	ACTI	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/00	8/25/99
Acetylene	0	0	0
Hydrogen	4	6	9
Ethylene	4	10	1
Methane	5	4	0
Ethane	4	1	0
Carbon Monoxide	93	194	49
Carbon Dioxide	604	710	666
Oxygen	67	5171	6757
Nitrogen	38646	50162	47613
Total Combustibles	110	215	59
Total Gas	39427	56258	55096
OIL QUALITY			
Dielectric Break (kV)	42.9	35	37
Water in Fluid (ppm)	27	8	20
Acid Number (mg KOH/g)	0.042	0.023	0.034
Interfacial Tens.(dynes/cm)	32.7	26	29
ASTM Color	6	G8.0	L6.0
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.882	0.899	0.888
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	45C	40c	40c
Pressure	0	0	0.5
Liquid Level	ok	ok	ok
GAS DIAGNOSTICS			
Rogers Ratio			
Cellulose Ratio (CO2/CO)			
IEEE/ANSI (C57.104-1991)			

COMMENTS

apply nitrogen

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 4-3	MVA:	0.33
Transformer No.:	79F9703	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/00	8/25/99
Acetylene	15	54	0
Hydrogen	24	19	4
Ethylene	40	131	0
Methane	16	35	1
Ethane	7	10	0
Carbon Monoxide	139	216	118
Carbon Dioxide	1982	1642	2229
Oxygen	71	7397	3642
Nitrogen	48411	41905	60095
Total Combustibles	241	465	123
Total Gas	50705	51409	66089
OIL QUALITY			
Dielectric Break (kV)	42.7	35	43
Water in Fluid (ppm)	20.1	6	25
Acid Number (mg KOH/g)	0.022	0.03	0.023
Interfacial Tens.(dynes/cm)	32.9	27	28
ASTM Color	5	L5.0	L5.0
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.881	0.894	0.89
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	42C	30c	40c
Pressure	1.5	0	1
Liquid Level	ok	ok	ok

GAS DIAGNOSTICS

Rogers Ratio 1-0-2-0 circulating currents and overheated joints

Cellulose Ratio (CO2/CO)

IEEE/ANSI (C57.104-1991)

COMMENTS

EVIDENCE OF ACETYLENE - MONITOR - WHAT IS PREVIOUS HISTORY OF OCCURANCES?

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 4-1	MVA:	0.33
Transformer No.:	79F9701	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

	Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM		9/11/01	8/24/00	8/25/99
	Acetylene	0	0	0
	Hydrogen	33	15	1
	Ethylene	3	9	1
	Methane	3	7	0
	Ethane	2	4	0
	Carbon Monoxide	75	173	50
	Carbon Dioxide	733	716	519
	Oxygen	105	711	6527
	Nitrogen	41678	26269	53768
	Total Combustibles	116	208	52
	Total Gas	42632	27904	60866
OIL QUALITY				
	Dielectric Break (kV)	42.5	44	43
	Water in Fluid (ppm)	25.9	26	16
	Acid Number (mg KOH/g)	0.028	0.031	0.024
	Interfacial Tens.(dynes/cm)	33.4	25	28
	ASTM Color	6	G8.0	L5.5
	Visual Inspection	Pass	Pass	Pass
	Specific Gravity	0.8808	0.893	0.896
OPERATING CONDITIONS				
	AmbientTemp.	70F	80F	
	Winding Temp.			
	Liquid Temp.	40c	40c	35c
	Pressure	0	0	0
	Liquid Level	ok	ok	ok
GAS DIAGNOSTICS				
	Rogers Ratio			
	Cellulose Ratio (CO2/CO)			
	IEEE/ANSI (C57.104-1991)			

COMMENTS

Apply nitrogen.

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 4-12	MVA:	0.33
Transformer No.:	79F97012	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/00	8/25/99
Acetylene	0	0	0
Hydrogen	12	4	2
Ethylene	4	3	0
Methane	9	4	0
Ethane	10	2	0
Carbon Monoxide	85	137	42
Carbon Dioxide	987	518	1128
Oxygen	94	5742	2699
Nitrogen	43319	42332	52838
Total Combustibles	120	150	44
Total Gas	41520	48742	56710
OIL QUALITY			
Dielectric Break (kV)	38.3	40	42
Water in Fluid (ppm)	40.8	34	27
Acid Number (mg KOH/g)	0.025	0.027	0.024
Interfacial Tens.(dynes/cm)	32.2	24	35
ASTM Color	5.5	L5.0	L5.0
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.883	0.892	0.892
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	38C	30c	35c
Pressure	0	-3	0
Liquid Level	low	low	
GAS DIAGNOSTICS			
Rogers Ratio			
Cellulose Ratio (CO2/CO)			
IEEE/ANSI (C57.104-1991)			

COMMENTS

Apply nitrogen.
Moisture increasing.

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 12-4	MVA:	1
Transformer No.:	79F8714	Gallons:	316
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/460	%Imp.	5.5

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/00	8/25/99
Acetylene	1	4	0
Hydrogen	6	7	4
Ethylene	39	145	38
Methane	28	82	25
Ethane	31	154	34
Carbon Monoxide	373	667	381
Carbon Dioxide	3506	4173	3077
Oxygen	61	4695	2461
Nitrogen	42245	45116	59156
Total Combustibles	477	1059	482
Total Gas	46289	54942	65175
OIL QUALITY			
Dielectric Break (kV)	38.8	37	46
Water in Fluid (ppm)	23.1	21	26
Acid Number (mg KOH/g)	0.022	0.025	0.019
Interfacial Tens.(dynes/cm)	37.6	31	42
ASTM Color	5.5	G8.0	L5.5
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.8805	0.897	0.89
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	42C	40c	35c
Pressure	1	0	0
Liquid Level	ok	ok	

GAS DIAGNOSTICS

Rogers Ratio 2-1-0-0 slight overheating

Cellulose Ratio (CO2/CO)

IEEE/ANSI (C57.104-1991) retest quarterly

COMMENTS

SUSPECT HISTORY

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5556 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 4-6	MVA:	0.33
Transformer No.:	79F6706	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/460	%Imp.	5.1

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/00	8/25/99
Acetylene	0	0	0
Hydrogen	6	17	4
Ethylene	2	4	0
Methane	10	4	0
Ethane	11	6	0
Carbon Monoxide	79	145	64
Carbon Dioxide	1555	1841	1654
Oxygen	115	8873	2452
Nitrogen	65591	42355	46951
Total Combustibles	108	176	68
Total Gas	58369	53245	51125
OIL QUALITY			
Dielectric Break (kV)	35.5	40	46
Water in Fluid (ppm)	26.4	22	19
Acid Number (mg KOH/g)	0.028	0.027	0.029
Interfacial Tens.(dynes/cm)	34.5	27	28
ASTM Color	5.5	G8.0	L5.5
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.8815	0.896	0.896
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	40c	40c	35c
Pressure	0.5	0.5	0.5
Liquid Level	low	low	
GAS DIAGNOSTICS			
Rogers Ratio			
Cellulose Ratio (CO2/CO)			
IEEE/ANSI (C57.104-1991)			

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 4-9	MVA:	0.33
Transformer No.:	79F6709	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/460	% Imp.	5.1

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/00	8/25/99
Acetylene	0	0	0
Hydrogen	21	52	27
Ethylene	3	14	2
Methane	14	40	7
Ethane	7	23	1
Carbon Monoxide	193	581	297
Carbon Dioxide	3430	4425	2964
Oxygen	80	4863	3123
Nitrogen	50300	49077	65723
Total Combustibles	238	710	334
Total Gas	54048	59075	72144
OIL QUALITY			
Dielectric Break (kV)	40.4	39	39
Water in Fluid (ppm)	17.2	9	6
Acid Number (mg KOH/g)	0.02	0.022	0.017
Interfacial Tens.(dynes/cm)	37.1	31	32
ASTM Color	5.5	L5.0	L5.5
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.881	0.895	0.894
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	40C	35c	35c
Pressure	0.5	0	0.25
Liquid Level	ok	ok	
GAS DIAGNOSTICS			
Rogers Ratio			
Cellulose Ratio (CO2/CO)			
IEEE/ANSI (C57.104-1991)			

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5565 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 4-10	MVA:	0.33
Transformer No.:	79F67010	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/460	% Imp.	5.1

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/99	8/25/99
Acetylene	0	0	0
Hydrogen	20	24	6
Ethylene	2	10	1
Methane	8	23	5
Ethane	4	20	4
Carbon Monoxide	108	280	135
Carbon Dioxide	999	1260	1049
Oxygen	73	5009	1404
Nitrogen	44424	41857	50845
Total Combustibles	142	357	151
Total Gas	45638	48483	53449
OIL QUALITY			
Dielectric Break (kV)	34.4	41	46
Water in Fluid (ppm)	25	3	23
Acid Number (mg KOH/g)	0.02	0.02	0.01
Interfacial Tens.(dynes/cm)	36.1	31	31
ASTM Color	L5.0	L5.0	L5.0
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.883	0.898	0.89
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	40C	35c	38
Pressure	0.5	0	0
Liquid Level	low	low	
GAS DIAGNOSTICS			
Rogers Ratio			
Cellulose Ratio (CO2/CO)			
IEEE/ANSI (C57.104-1991)			

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 4-8	MVA:	0.33
Transformer No.:	79F6708	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/460	% Imp.	5.1

Lab Used	JACO	ACTI	ATCI
DISSOLVED GASES PPM	9/11/01	8/24/00	8/25/99
Acetylene	13	43	14
Hydrogen	44	56	7
Ethylene	435	793	318
Methane	75	176	58
Ethane	49	168	40
Carbon Monoxide	207	478	195
Carbon Dioxide	1995	2010	1375
Oxygen	81	4656	1634
Nitrogen	60842	44549	52821
Total Combustibles	823	1716	632
Total Gas	63741	52831	56461
OIL QUALITY			
Dielectric Break (kV)	35.5	33	40
Water in Fluid (ppm)	15.5	14	11
Acid Number (mg KOH/g)	0.036	0.031	0.031
Interfacial Tens.(dynes/cm)	35.7	28	42
ASTM Color	2.5	L2.0	L2.0
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.8815	0.894	0.886
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	40c	40c	33c
Pressure	1.5	-1	-1.5
Liquid Level	ok	ok	

GAS DIAGNOSTICS

Rogers Ratio

Cellulose Ratio (CO2/CO)

IEEE/ANSI (C57.104-1991) retest quarterly retest quarterly

COMMENTS

SUSPECT HISTORY

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 12-1	MVA:	1
Transformer No.:	79F6711	Gallons:	316
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/460	% Imp.	5.5

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/00	8/25/99
Acetylene	0	0	0
Hydrogen	6	6	0
Ethylene	1	0	0
Methane	6	2	0
Ethane	6	0	0
Carbon Monoxide	63	77	458
Carbon Dioxide	577	669	42
Oxygen	68	12705	3557
Nitrogen	40156	44877	39437
Total Combustibles	82	85	42
Total Gas	40883	58336	43495
OIL QUALITY			
Dielectric Break (kV)	33.6	35	42
Water in Fluid (ppm)	41.1	21	20
Acid Number (mg KOH/g)	0.025	0.027	0.02
Interfacial Tens.(dynes/cm)	41.5	31	37
ASTM Color	L3.0	L2.5	L2.5
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.8735	0.883	0.879
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	37C	40c	
Pressure	0	0	0
Liquid Level	LOW	ok	
GAS DIAGNOSTICS			
Rogers Ratio			
Cellulose Ratio (CO2/CO)			
IEEE/ANSI (C57.104-1991)			

COMMENTS

Apply pressure.
MOISTURE HIGH

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Dry Dock	MVA:	1
Transformer No.:	771382	Gallons:	310
Manufacturer:		PCB's	cert-non
Voltage:		% Imp.	

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/00	8/25/99
Acetylene	25	96	23
Hydrogen	34	45	9
Ethylene	7	23	2
Methane	20	29	8
Ethane	4	14	0
Carbon Monoxide	437	604	240
Carbon Dioxide	4637	3964	2148
Oxygen	8500	9375	10799
Nitrogen	60561	48206	61624
Total Combustibles	527	811	282
Total Gas	74225	62356	74852
OIL QUALITY			
Dielectric Break (kV)	45.4	44	50
Water in Fluid (ppm)	12.5	5	13
Acid Number (mg KOH/g)	0.011	0.002	0.002
Interfacial Tens.(dynes/cm)	48.6	41	38
ASTM Color	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.8785	0.886	0.883
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	47C	40c	50c
Pressure	0	0	0.25
Liquid Level	ok	ok	

GAS DIAGNOSTICS

Rogers Ratio 0-0-1-2 Arc, with power follow-through

Cellulose Ratio (CO2/CO)

IEEE/ANSI (C57.104-1991) restest quarterly

COMMENTS

Consider additional testing/inspection.

Apply pressure.

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	**Date:**	9/25/01
Address:	5555 N Channel Blvd. PDX	**Report by**	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	**Class:**	
Substation/Site:	C.U.S.	**MVA:**	1.5
Transformer No.:	SBV567601	**Gallons:**	259
Manufacturer:	West.	**PCB's**	cert-non
Voltage:	12470/240	**% Imp.**	5.5

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/00	8/25/99
Acetylene	0	0	0
Hydrogen	11	15	5
Ethylene	19	67	20
Methane	11	25	4
Ethane	2	6	0
Carbon Monoxide	492	765	375
Carbon Dioxide	3569	3399	2534
Oxygen	517	4625	3174
Nitrogen	88262	52421	61525
Total Combustibles	535	876	404
Total Gas	92883	67637	67637
OIL QUALITY			
Dielectric Break (kV)	45.1	42	49
Water in Fluid (ppm)	4	2	8
Acid Number (mg KOH/g)	0.025	0.028	0.02
Interfacial Tens.(dynes/cm)	37.1	31	32
ASTM Color	L2.0	L2.0	L1.5
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.8715	0.881	0.883
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	35C	40c	40C
Pressure	4.5	0	0.25
Liquid Level	ok	ok	
GAS DIAGNOSTICS			
Rogers Ratio			
Cellulose Ratio (CO2/CO)			
IEEE/ANSI (C57.104-1991)			

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	C.U.S.	MVA:	1.5
Transformer No.:	SBV567602	Gallons:	259
Manufacturer:	West.	PCB's	cert-non
Voltage:	12470/240	% Imp.	5.47

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/00	8/25/99
Acetylene	0	0	0
Hydrogen	11	25	7
Ethylene	33	113	24
Methane	11	30	3
Ethane	2	6	24
Carbon Monoxide	750	1204	719
Carbon Dioxide	8100	8179	6154
Oxygen	4819	7605	8665
Nitrogen	67128	50096	67269
Total Combustibles	807	1378	753
Total Gas	80854	67258	82842
OIL QUALITY			
Dielectric Break (kV)	45.6	39	49
Water in Fluid (ppm)	2.3	5	10
Acid Number (mg KOH/g)	0.008	0.023	0.018
Interfacial Tens.(dynes/cm)	34.3	30	30
ASTM Color	L1.5	L1.5	L1.5
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.8715	0.875	0.887
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	40C	40c	40C
Pressure	0.5	0	0.5
Liquid Level	ok	ok	
GAS DIAGNOSTICS			
Rogers Ratio			
Cellulose Ratio (CO2/CO)			
IEEE/ANSI (C57.104-1991)			

COMMENTS

Apply pressure.

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	C.U.S.	MVA:	1.5
Transformer No.:	SBV567604	Gallons:	259
Manufacturer:	West.	PCB's	cert-non
Voltage:	12470/240	% Imp.	5.47

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/00	8/25/99
Acetylene	0	0	0
Hydrogen	13	38	6
Ethylene	27	124	23
Methane	12	43	4
Ethane	2	9	0
Carbon Monoxide	659	1273	479
Carbon Dioxide	4586	6061	3031
Oxygen	758	4599	4430
Nitrogen	84601	64589	60212
Total Combustibles	713	1487	512
Total Gas	90658	76736	68186
OIL QUALITY			
Dielectric Break (kV)	43.5	45	50
Water in Fluid (ppm)	4.5	2	7
Acid Number (mg KOH/g)	0.025	0.021	0.021
Interfacial Tens.(dynes/cm)	35.4	31	30
ASTM Color	L2.0	L2.0	L1.5
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.872	0.882	0.876
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	37C	35c	40C
Pressure	4	-0.5	0
Liquid Level	ok	ok	
GAS DIAGNOSTICS			
Rogers Ratio			
Cellulose Ratio (CO2/CO)			
IEEE/ANSI (C57.104-1991)			

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	C.U.S.	MVA:	1.5
Transformer No.:	SBV567603	Gallons:	259
Manufacturer:	West.	PCB's	cert-non
Voltage:	12470/240	% Imp.	5.51

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/00	8/25/99
Acetylene	0	0	0
Hydrogen	13	12	8
Ethylene	22	62	20
Methane	11	24	7
Ethane	2	5	0
Carbon Monoxide	673	846	624
Carbon Dioxide	4435	3542	3828
Oxygen	853	5320	2350
Nitrogen	87451	44842	62237
Total Combustibles	721	949	659
Total Gas	93460	54653	69074
OIL QUALITY			
Dielectric Break (kV)	40.4	40	47
Water in Fluid (ppm)	8	6	9
Acid Number (mg KOH/g)	0.022	0.03	0.019
Interfacial Tens.(dynes/cm)	36.9	31	37
ASTM Color	L2.0	L2.0	L1.5
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.8725	0.88	0.877
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	33C	30c	35c
Pressure	5	-1	-0.75
Liquid Level	ok	ok	
GAS DIAGNOSTICS			
Rogers Ratio			
Cellulose Ratio (CO2/CO)			
IEEE/ANSI (C57.104-1991)			
COMMENTS			

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	C.U.S.	MVA:	1
Transformer No.:	PAT716001	Gallons:	224
Manufacturer:	West.	PCB's	cert-non
Voltage:	12470/480	% Imp.	5.81

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/00	8/25/99
Acetylene	0	0	0
Hydrogen	12	19	8
Ethylene	17	48	14
Methane	11	26	6
Ethane	2	5	0
Carbon Monoxide	536	827	595
Carbon Dioxide	3834	3024	3116
Oxygen	230	5555	2541
Nitrogen	75203	47669	68869
Total Combustibles	578	925	623
Total Gas	79845	57173	75150
OIL QUALITY			
Dielectric Break (kV)	39.4	48	49
Water in Fluid (ppm)	3.4	4	10
Acid Number (mg KOH/g)	0.034	0.028	0.022
Interfacial Tens.(dynes/cm)	35.4	31	29
ASTM Color	2	L1.5	L1.5
Visual Inspection	2	Pass	Pass
Specific Gravity	0.873	0.878	0.876
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	21C	30c	20c
Pressure	3	-1	-0.5
Liquid Level	ok	ok	
GAS DIAGNOSTICS			
Rogers Ratio			
Cellulose Ratio (CO2/CO)			
IEEE/ANSI (C57.104-1991)			

COMMENTS

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/15/99
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 4-7	MVA:	0.33
Transformer No.:	79F67097	Gallons:	176
Manufacturer:	Elect. Tech.	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	ACTI
DISSOLVED GASES PPM	9/11/01	8/25/00
Acetylene	0	0
Hydrogen	6	3
Ethylene	1	0
Methane	11	14
Ethane	13	13
Carbon Dioxide	513	1129
Carbon Monoxide	56	88
Oxygen	113	2829
Nitrogen	40010	55237
Total Combustibles	87	118
Total Gas	40723	59313
OIL QUALITY TESTS		
Dielectric Break	41.6	46
Water in Fluid	29.9	26
Acid Number	0.036	0.024
Interfacial Tens.	34.6	28
ASTM Color	5.5	L5.0
Visual Inspection	Pass	Pass
Specific Gravity	0.883	0.891
OPERATING CONDITIONS		
AmbientTemp.	70F	
Winding Temp.		
Liquid Temp.	35C	
Pressure	0	
Liquid Level	OK	
GAS DIAGNOSTICS		
Rogers Ratio		
Cellulose Ratio (CO2/CO)		
IEEE/ANSI (C57.104-1991)		

COMMENTS

Apply pressure.

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 4	MVA:	1.5
Transformer No.:	PG08188	Gallons:	295
Manufacturer:	GE	PCB's	silicone
Voltage:	12470/480	% Imp.	

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/00	8/25/99
Acetylene	0	0	0
Hydrogen	65	70	35
Ethylene	1	4	0
Methane	32	57	25
Ethane	2	6	0
Carbon Monoxide	980	963	887
Carbon Dioxide	4672	2850	4012
Oxygen	4772	5509	6046
Nitrogen	117878	55553	110799
Total Combustibles	1080	1100	947
Total Gas	128402	65012	121804
OIL QUALITY			
Dielectric Break (kV)	44.2	33	38
Water in Fluid (ppm)	10.9	12	16
Acid Number (mg KOH/g)	0.008	0.01	0.003
Interfacial Tens.(dynes/cm)	43.7		
ASTM Color	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.9615	0.977	0.975
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	42C	40c	35c
Pressure	npg	npg	npg
Liquid Level	high	high	
GAS DIAGNOSTICS			
Rogers Ratio			
Cellulose Ratio (CO2/CO)			
IEEE/ANSI (C57.104-1991)			

COMMENTS

No pressure guage.

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/15/99
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 6	MVA:	1
Transformer No.:	836002311	Gallons:	392
Manufacturer:	RTE	PCB's	rtemp
Voltage:	12470/460	% Imp.	5.6

Lab Used	JACO	ACTI
DISSOLVED GASES PPM	9/11/01	8/25/99
Acetylene	0	0
Hydrogen	7	4
Ethylene	3	1
Methane	12	2
Ethane	6	1
Carbon Monoxide	421	1657
Carbon Dioxide	2676	299
Oxygen	71	8657
Nitrogen	51466	67461
Total Combustibles	449	307
Total Gas	54662	78081
OIL QUALITY		
Dielectric Break (kV)	41	47
Water in Fluid (ppm)	21.3	9
Acid Number (mg KOH/g)	0.018	0.011
Interfacial Tens.(dynes/cm)	37.2	34
ASTM Color	3	L3.5
Visual Inspection	Pass	Pass
Specific Gravity	0.873	0.879
OPERATING CONDITIONS		
AmbientTemp.	70F	
Winding Temp.		
Liquid Temp.	52C	
Pressure	NG	
Liquid Level		
GAS DIAGNOSTICS		
Rogers Ratio		
Cellulose Ratio (CO2/CO)		
IEEE/ANSI (C57.104-1991)		

COMMENTS

RUNNING WARM

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 6	MVA:	1.5
Transformer No.:	836002464	Gallons:	540
Manufacturer:	RTE	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.6

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/00	8/25/00
Acetylene	0	0	0
Hydrogen	5	8	4
Ethylene	4	13	2
Methane	15	34	10
Ethane	4	16	0
Carbon Monoxide	377	620	363
Carbon Dioxide	1703	1809	1652
Oxygen	60	4814	2059
Nitrogen	48969	42454	54285
Total Combustibles	405	691	379
Total Gas	51137	49768	58373
OIL QUALITY			
Dielectric Break (kV)	45.2	33	42
Water in Fluid (ppm)	21.3	18	7
Acid Number (mg KOH/g)	0.02	0.017	0.012
Interfacial Tens.(dynes/cm)	36.5	35	35
ASTM Color	3	L3.5	L3.5
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.872	0.882	0.88
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	37C	40c	40c
Pressure	npg	npg	npg
Liquid Level	ok	ok	
GAS DIAGNOSTICS			
Rogers Ratio			
Cellulose Ratio (CO2/CO)			
IEEE/ANSI (C57.104-1991)			

COMMENTS

No pressure gauge.

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Berth 307	MVA:	0.3
Transformer No.:	H425084M68	Gallons:	122
Manufacturer:	GE	PCB's	no data
Voltage:	13200/480	% Imp.	1.71

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/00	8/25/99
Acetylene	0	0	0
Hydrogen	11	26	5
Ethylene	7	27	4
Methane	28	84	23
Ethane	6	27	1
Carbon Monoxide	812	1307	666
Carbon Dioxide	4614	4962	3833
Oxygen	106	5119	2245
Nitrogen	66237	61602	62613
Total Combustibles	863	1466	699
Total Gas	71820	73149	69390
OIL QUALITY			
Dielectric Break (kV)	44.7	43	53
Water in Fluid (ppm)	3.4	11	10
Acid Number (mg KOH/g)	0.014	0.011	0.009
Interfacial Tens.(dynes/cm)	37.2	31	32
ASTM Color	L1.5	L1.5	L1.5
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.88	0.885	0.885
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	36C	40c	35c
Pressure	npg	npg	npg
Liquid Level	ok	ok	
GAS DIAGNOSTICS			
Rogers Ratio			
Cellulose Ratio (CO2/CO)			
IEEE/ANSI (C57.104-1991)			
COMMENTS			

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Berth 308	MVA:	0.3
Transformer No.:	H425082M68	Gallons:	122
Manufacturer:	GE	PCB's	no data
Voltage:	13200/480	% Imp.	1.71

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/00	8/25/99
Acetylene	0	0	0
Hydrogen	1	0	0
Ethylene	2	4	0
Methane	1	3	0
Ethane	0	0	0
Carbon Monoxide	33	133	46
Carbon Dioxide	884	1018	688
Oxygen	22095	18404	20235
Nitrogen	51645	53758	52512
Total Combustibles	37	140	46
Total Gas	74661	73320	73481
OIL QUALITY			
Dielectric Break (kV)	43.7	34	38
Water in Fluid (ppm)	25	26	29
Acid Number (mg KOH/g)	0.014	0.012	0.018
Interfacial Tens.(dynes/cm)	38.2	24	33
ASTM Color	L1.5	L1.0	L1.5
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.874	0.878	0.877
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	40C	45c	36c
Pressure	npg	npg	npg
Liquid Level	high	high	
GAS DIAGNOSTICS			
Rogers Ratio			
Cellulose Ratio (CO2/CO)			
IEEE/ANSI (C57.104-1991)			
COMMENTS			

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 7A	MVA:	2
Transformer No.:	PQH0715	Gallons:	415
Manufacturer:		PCB's	rtemp
Voltage:	12470/460	% Imp.	5.4

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/00	8/25/99
Acetylene	0	0	0
Hydrogen	6	14	5
Ethylene	7	32	6
Methane	15	43	7
Ethane	5	27	2
Carbon Monoxide	856	1346	811
Carbon Dioxide	5619	7301	4227
Oxygen	81	4656	2748
Nitrogen	52630	51068	58570
Total Combustibles	889	1462	831
Total Gas	59219	64487	66375
OIL QUALITY			
Dielectric Break (kV)	39.2	32	43
Water in Fluid (ppm)	14.4	24	8
Acid Number (mg KOH/g)	0.014	0.033	0.022
Interfacial Tens.(dynes/cm)	37.6	38	36
ASTM Color	L3.0	L3.0	L3.0
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.8725	0.881	0.884
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	44C	45c	42c
Pressure	npg	npg	npg
Liquid Level		high	
GAS DIAGNOSTICS			
Rogers Ratio			
Cellulose Ratio (CO2/CO)			
IEEE/ANSI (C57.104-1991)			

COMMENTS

No pressure guage.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Crane #14	MVA:	0.75
Transformer No.:	L243297	Gallons:	142
Manufacturer:		PCB's	silicone
Voltage:	2400/480	% Imp.	5.7

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/00	8/25/99
Acetylene	0	0	0
Hydrogen	174	208	501
Ethylene	1	4	0
Methane	56	122	41
Ethane	6	20	1
Carbon Monoxide	1054	1224	853
Carbon Dioxide	4861	3758	3068
Oxygen	1881	4803	4504
Nitrogen	110743	68964	106965
Total Combustibles	1291	1578	1396
Total Gas	118776	79103	115933
OIL QUALITY			
Dielectric Break (kV)	46.7	33	34
Water in Fluid (ppm)	11	11	26
Acid Number (mg KOH/g)	0.008	0.006	0.001
Interfacial Tens.(dynes/cm)	44.1		
ASTM Color	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.963	0.967	0.969
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	40C	35c	35c
Pressure	-0.5	0	-0.5
Liquid Level	ok	ok	

GAS DIAGNOSTICS

Rogers Ratio

Cellulose Ratio (CO2/CO)

IEEE/ANSI (C57.104-1991) retest quarterly

COMMENTS

Apply pressure.

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Crane #17	MVA:	0.5
Transformer No.:	L243297	Gallons:	125
Manufacturer:		PCB's	silicone
Voltage:	2400/480	% Imp.	

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/00	8/25/99
Acetylene	0	0	0
Hydrogen	170	203	198
Ethylene	0	3	1
Methane	78	166	51
Ethane	7	31	0
Carbon Monoxide	1200	1473	889
Carbon Dioxide	7642	7095	5679
Oxygen	1228	6358	5654
Nitrogen	129970	79295	107404
Total Combustibles	1455	1876	1139
Total Gas	140295	94624	119876
OIL QUALITY			
Dielectric Break (kV)	43.8	36	36
Water in Fluid (ppm)	13	27	21
Acid Number (mg KOH/g)	0.008	0.008	0.001
Interfacial Tens.(dynes/cm)	44.1		
ASTM Color	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.9615	0.969	0.971
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	40C	35c	40c
Pressure	1	1	1.25
Liquid Level	ok	ok	
GAS DIAGNOSTICS			
Rogers Ratio			
Cellulose Ratio (CO2/CO)			
IEEE/ANSI (C57.104-1991)			

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Crane #16	MVA:	0.5
Transformer No.:	L243299C	Gallons:	125
Manufacturer:	GE	PCB's	silicone
Voltage:	2400/480	% Imp.	

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/00	8/25/99
Acetylene	1	9	0
Hydrogen	172	231	55
Ethylene	1	7	0
Methane	52	131	24
Ethane	5	21	0
Carbon Monoxide	1288	1657	845
Carbon Dioxide	7054	6117	5087
Oxygen	1381	6293	12063
Nitrogen	120462	77762	111158
Total Combustibles	1524	1956	924
Total Gas	130421	92128	129232
OIL QUALITY			
Dielectric Break (kV)	45	33	46
Water in Fluid (ppm)	11	25	20
Acid Number (mg KOH/g)	0.006	0.01	0.005
Interfacial Tens.(dynes/cm)	45.1		
ASTM Color	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.9675	0.968	0.974
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	30C	40c	45c
Pressure	0	0	0.5
Liquid Level	ok	ok	

GAS DIAGNOSTICS

Rogers Ratio

Cellulose Ratio (CO2/CO)

IEEE/ANSI (C57.104-1991) retest monthly

COMMENTS

This unit is a concern based on rise in combustible gas levels.
Consider additional testing/inspection.
Apply pressure.

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Crane #15	MVA:	0.5
Transformer No.:	L243299A	Gallons:	125
Manufacturer:	GE	PCB's	silicone
Voltage:	2400/480	% Imp.	5.18

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/00	8/25/99
Acetylene	0	0	0
Hydrogen	213	265	132
Ethylene	1	4	0
Methane	48	113	40
Ethane	7	27	1
Carbon Monoxide	1279	1473	1211
Carbon Dioxide	7016	5545	5493
Oxygen	2297	4649	5763
Nitrogen	113647	67429	117171
Total Combustibles	1548	1882	1384
Total Gas	124508	79505	129723
OIL QUALITY			
Dielectric Break (kV)	47.9	37	35
Water in Fluid (ppm)	12	13	29
Acid Number (mg KOH/g)	0.008	0.007	0.001
Interfacial Tens.(dynes/cm)	44.5		
ASTM Color	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.9745	0.968	0.973
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	40C	35c	
Pressure	0	0	0.5
Liquid Level	ok	ok	

GAS DIAGNOSTICS

Rogers Ratio

Cellulose Ratio (CO2/CO)

IEEE/ANSI (C57.104-1991) retest quarterly

COMMENTS

Apply pressure.

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Crane #12	MVA:	0.75
Transformer No.:	L243298	Gallons:	125
Manufacturer:	GE	PCB's	silicone
Voltage:	2400/480	% Imp.	5.64

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/00	8/25/99
Acetylene	0	0	0
Hydrogen	197	243	109
Ethylene	1	4	0
Methane	68	138	43
Ethane	6	22	2
Carbon Monoxide	1157	1309	995
Carbon Dioxide	4895	3751	3893
Oxygen	2323	6243	6584
Nitrogen	110044	66640	112328
Total Combustibles	1429	1716	1149
Total Gas	118691	78350	123954
OIL QUALITY			
Dielectric Break (kV)	47.3	33	37
Water in Fluid (ppm)	9.4	12	22
Acid Number (mg KOH/g)	0.006	0.005	0.002
Interfacial Tens.(dynes/cm)	43.7		
ASTM Color	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.9615	0.971	0.973
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	34C	35c	
Pressure	0	0	0.5
Liquid Level	ok	ok	

GAS DIAGNOSTICS

Rogers Ratio

Cellulose Ratio (CO2/CO)

IEEE/ANSI (C57.104-1991) retest quarterly

COMMENTS

Apply pressure.

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Building 73	MVA:	0.5
Transformer No.:	PCT83390101	Gallons:	141
Manufacturer:	West.	PCB's	cert.non
Voltage:	12470/480	% Imp.	5.86

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/00	8/25/99
Acetylene	0	0	0
Hydrogen	17	37	9
Ethylene	0	2	9
Methane	16	51	5
Ethane	1	6	0
Carbon Monoxide	824	1347	680
Carbon Dioxide	6681	6940	4699
Oxygen	2328	3837	8862
Nitrogen	86484	59584	71937
Total Combustibles	858	1443	694
Total Gas	95351	71804	86182
OIL QUALITY			
Dielectric Break (kV)	42.2	43	49
Water in Fluid (ppm)	3.4	6	16
Acid Number (mg KOH/g)	0.039	0.033	0.038
Interfacial Tens.(dynes/cm)	32.1	27	27
ASTM Color	L1.0	L1.0	L1.0
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.8665	0.876	0.871
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	25C	35c	40c
Pressure	4	0	0.5
Liquid Level	ok	ok	

GAS DIAGNOSTICS

Rogers Ratio

Cellulose Ratio (CO2/CO)

IEEE/ANSI (C57.104-1991) retest quarterly

COMMENTS

Apply pressure.

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Building 73	MVA:	0.5
Transformer No.:	PAT80910101	Gallons:	141
Manufacturer:	West.	PCB's	cert.non
Voltage:	12470/480	% Imp.	5.77

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/99	8/25/99
Acetylene	0	0	0
Hydrogen	16	42	7
Ethylene	0	2	0
Methane	16	56	6
Ethane	1	8	0
Carbon Monoxide	759	1391	645
Carbon Dioxide	4828	6001	3473
Oxygen	3059	3564	11258
Nitrogen	84595	65093	81355
Total Combustibles	792	1499	658
Total Gas	93274	76157	96744
OIL QUALITY			
Dielectric Break (kV)	43.6	35	47
Water in Fluid (ppm)	4.5	8	11
Acid Number (mg KOH/g)	0.031	0.027	0.028
Interfacial Tens.(dynes/cm)	35.7	28	28
ASTM Color	1	L1.5	L1.0
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.8675	0.873	0.871
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	35F	40c	40c
Pressure	4	0	0
Liquid Level	ok	ok	

GAS DIAGNOSTICS

Rogers Ratio

Cellulose Ratio (CO2/CO) <7 indicates severe overheating near insulation

IEEE/ANSI (C57.104-1991) retest quarterly

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	BWTP	MVA:	0.75
Transformer No.:	PCT786301	Gallons:	179
Manufacturer:	West.	PCB's	cert.non
Voltage:	12470/480	% Imp.	6.24

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/00	8/25/99
Acetylene	0	0	0
Hydrogen	2	0	0
Ethylene	1	1	0
Methane	2	2	0
Ethane	0	0	0
Carbon Monoxide	73	38	0
Carbon Dioxide	1236	553	412
Oxygen	20698	17164	22184
Nitrogen	67356	47659	46262
Total Combustibles	78	41	0
Total Gas	67356	65417	68858
OIL QUALITY			
Dielectric Break (kV)	47.9	30	53
Water in Fluid (ppm)	5.1	8	24
Acid Number (mg KOH/g)	0.053	0.047	0.041
Interfacial Tens.(dynes/cm)	31.1	26	25
ASTM Color	L1.5	L1.5	L1.5
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.88	0.885	0.887
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	32C	30c	40c
Pressure	3.5	0	0
Liquid Level	ok	ok	
GAS DIAGNOSTICS			
Rogers Ratio			
Cellulose Ratio (CO2/CO)			
IEEE/ANSI (C57.104-1991)			

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 8A	MVA:	2
Transformer No.:	PQH-0714	Gallons:	451
Manufacturer:		PCB's	rtemp
Voltage:	12470/460	% Imp.	5.4

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/00	8/25/99
Acetylene	0	0	0
Hydrogen	5	5	3
Ethylene	6	19	1
Methane	14	30	2
Ethane	6	18	1
Carbon Monoxide	635	885	574
Carbon Dioxide	4654	4642	3431
Oxygen	62	4325	3520
Nitrogen	53850	47229	63510
Total Combustibles	666	957	581
Total Gas	59232	57139	71043
OIL QUALITY			
Dielectric Break (kV)	39.5	34	50
Water in Fluid (ppm)	20.1	5	16
Acid Number (mg KOH/g)	0.022	0.02	0.017
Interfacial Tens.(dynes/cm)	45	38	38
ASTM Color	L2.5	L2.5	L2.5
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.8745	0.883	0.887
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	45C	45C	46c
Pressure			0
Liquid Level	ok	ok	
GAS DIAGNOSTICS			
Rogers Ratio			
Cellulose Ratio (CO2/CO)			
IEEE/ANSI (C57.104-1991)			

COMMENTS

Tap changer leaking.

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	**Date:**	9/25/01
Address:	5555 N Channel Blvd. PDX	**Report by**	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	**Class:**	
Substation/Site:	Portable	**MVA:**	1
Transformer No.:	PO15676	**Gallons:**	240
Manufacturer:	GE	**PCB's**	silicone
Voltage:	12470/460	**% Imp.**	5.5

Lab Used	JACO
DISSOLVED GASES PPM	9/11/01
Acetylene	0
Hydrogen	52
Ethylene	0
Methane	42
Ethane	0
Carbon Monoxide	1254
Carbon Dioxide	5849
Oxygen	3851
Nitrogen	92059
Total Combustibles	1351
Total Gas	103110

OIL QUALITY	
Dielectric Break (kV)	43.5
Water in Fluid (ppm)	6.8
Acid Number (mg KOH/g)	0.011
Interfacial Tens.(dynes/cm)	44.1
ASTM Color	0
Visual Inspection	Pass
Specific Gravity	0.9628

OPERATING CONDITIONS	
AmbientTemp.	70F
Winding Temp.	
Liquid Temp.	32C
Pressure	npg
Liquid Level	ok

GAS DIAGNOSTICS	
Rogers Ratio	
Cellulose Ratio (CO2/CO)	
IEEE/ANSI (C57.104-1991)	retest monthly

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
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(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Portable 32-3	MVA:	2
Transformer No.:	87V1243	Gallons:	600
Manufacturer:	Vantram	PCB's	rtemp
Voltage:	12470/460	% Imp.	5.7

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/00	8/25/99
Acetylene	0	0	0
Hydrogen	7	18	6
Ethylene	18	75	14
Methane	16	48	10
Ethane	5	16	1
Carbon Monoxide	333	962	4501
Carbon Dioxide	4915	6055	596
Oxygen	82	4850	1900
Nitrogen	55557	49061	58342
Total Combustibles	319	1119	627
Total Gas	60933	61085	65369
OIL QUALITY			
Dielectric Break (kV)	39.1	33	49
Water in Fluid (ppm)	21.3	7	13
Acid Number (mg KOH/g)	0.014	0.015	0.008
Interfacial Tens.(dynes/cm)	46.5	39	42
ASTM Color	1.5	L2.0	L2.0
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.8705	0.88	0.883
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	40c	40c	42c
Pressure	0	npg	
Liquid Level	ok	ok	
GAS DIAGNOSTICS			
Rogers Ratio			
Cellulose Ratio (CO2/CO)			
IEEE/ANSI (C57.104-1991)			

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

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Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 5	MVA:	1
Transformer No.:	PO14476	Gallons:	240
Manufacturer:	GE	PCB's	silicone
Voltage:	12470/460	% Imp.	5.5

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/00	8/25/99
Acetylene	0	0	0
Hydrogen	60	91	28
Ethylene	0	1	0
Methane	22	45	6
Ethane	2	6	0
Carbon Monoxide	903	1027	730
Carbon Dioxide	3935	2846	2858
Oxygen	10752	9121	15323
Nitrogen	106413	61294	95893
Total Combustibles	987	1170	764
Total Gas	122087	74431	114837
OIL QUALITY			
Dielectric Break (kV)	46.1	30	32
Water in Fluid (ppm)	5.7	12	26
Acid Number (mg KOH/g)	0.006	0.002	0.003
Interfacial Tens.(dynes/cm)	43.9		
ASTM Color	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.9622	0.971	0.976
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	38C	40c	33c
Pressure	npg	npg	
Liquid Level	ok	ok	

GAS DIAGNOSTICS

Rogers Ratio

Cellulose Ratio (CO2/CO)

IEEE/ANSI (C57.104-1991) retest quarterly

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 5	MVA:	1.5
Transformer No.:	PO14490	Gallons:	315
Manufacturer:	GE	PCB's	silicone
Voltage:	12470/460	% Imp.	5.54

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/00	8/25/99
Acetylene	0	0	0
Hydrogen	31	53	28
Ethylene	0	2	0
Methane	100	183	76
Ethane	4	16	1
Carbon Monoxide	452	659	458
Carbon Dioxide	1894	1306	1455
Oxygen	14571	9079	13837
Nitrogen	107814	62881	110168
Total Combustibles	587	913	563
Total Gas	124866	74179	126025
OIL QUALITY			
Dielectric Break (kV)	47.1	37	38
Water in Fluid (ppm)	6.3	19	9
Acid Number (mg KOH/g)	0.006	0.002	0.001
Interfacial Tens.(dynes/cm)	44.2		
ASTM Color	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.9632	0.969	0.973
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	39C	35c	33c
Pressure	npg	npg	
Liquid Level	low	low	

GAS DIAGNOSTICS

Rogers Ratio

Cellulose Ratio (CO2/CO)

IEEE/ANSI (C57.104-1991) retest quarterly

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 3	MVA:	1.5
Transformer No.:	R277558	Gallons:	321
Manufacturer:		PCB's	silicone
Voltage:	12470/480	% Imp.	

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/25/00	2/7/00
Acetylene	0	19	0
Hydrogen	46	100	18
Ethylene	0	13	0
Methane	29	83	7
Ethane	2	13	0
Carbon Monoxide	681	1046	535
Carbon Dioxide	9382	8934	730
Oxygen	13861	13060	20371
Nitrogen	127670	78668	102182
Total Combustibles	758	1274	560
Total Gas	151671	101936	130420
OIL QUALITY			
Dielectric Break (kV)	46.1	36	37
Water in Fluid (ppm)	36.5	38	34
Acid Number (mg KOH/g)	0.006	0.005	0.003
Interfacial Tens.(dynes/cm)	44		
ASTM Color	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.9625	0.969	0.973
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	44C	40c	42c
Pressure	3	1.5	1.5
Liquid Level	high	high	
GAS DIAGNOSTICS			
Rogers Ratio			
Cellulose Ratio (CO2/CO)			
IEEE/ANSI (C57.104-1991)			
COMMENTS			

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	6555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 3	MVA:	1
Transformer No.:	R277557	Gallons:	268
Manufacturer:		PCB's	silicone
Voltage:	12470/480	% Imp.	6

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/00	8/25/99
Acetylene	0	0	0
Hydrogen	10	0	0
Ethylene	0	0	0
Methane	3	2	0
Ethane	0	0	0
Carbon Monoxide	78	22	0
Carbon Dioxide	1671	580	460
Oxygen	32373	24101	43478
Nitrogen	105683	66650	97381
Total Combustibles	91	24	0
Total Gas	139818	91355	141319
OIL QUALITY			
Dielectric Break (kV)	43.6	29	31
Water in Fluid (ppm)	42.8	49	42
Acid Number (mg KOH/g)	0.008	0.005	0.002
Interfacial Tens.(dynes/cm)	44.1		
ASTM Color	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.963	0.967	0.981
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	41C	40c	42c
Pressure	0	0	-0.25
Liquid Level	high	high	
GAS DIAGNOSTICS			
Rogers Ratio			
Cellulose Ratio (CO2/CO)			
IEEE/ANSI (C57.104-1991)			

COMMENTS

Apply pressure.

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 1	MVA:	1.5
Transformer No.:	910396-A1	Gallons:	345
Manufacturer:	Square D	PCB's	rtemp
Voltage:	12470/480	% Imp.	6.3

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/00	8/25/99
Acetylene	0	0	0
Hydrogen	4	7	3
Ethylene	19	81	5
Methane	17	46	3
Ethane	3	13	0
Carbon Monoxide	342	665	237
Carbon Dioxide	2584	3022	1378
Oxygen	63	1677	3503
Nitrogen	64497	37442	52834
Total Combustibles	385	812	248
Total Gas	67529	42953	57834
OIL QUALITY			
Dielectric Break (kV)	40.8	41	41
Water in Fluid (ppm)	5.2	8	7
Acid Number (mg KOH/g)	0.042	0.029	0.027
Interfacial Tens.(dynes/cm)	43.1	36	35
ASTM Color	L3.5	L3.5	L3.5
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.8784	0.888	0.892
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	40c	40c	42c
Pressure	2.5	0	0.25
Liquid Level	ok	ok	
GAS DIAGNOSTICS			
Rogers Ratio			
Cellulose Ratio (CO2/CO)			
IEEE/ANSI (C57.104-1991)			

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 1	MVA:	2
Transformer No.:	910396-B1	Gallons:	390
Manufacturer:	Square D	PCB's	rtemp
Voltage:	12470/480	% Imp.	6.05

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/00	8/25/99
Acetylene	0	0	0
Hydrogen	4	5	3
Ethylene	2	9	0
Methane	15	36	3
Ethane	3	13	0
Carbon Monoxide	412	654	190
Carbon Dioxide	4192	4147	1703
Oxygen	74	1711	16668
Nitrogen	53442	33422	85265
Total Combustibles	436	717	196
Total Gas	58144	39997	103832
OIL QUALITY			
Dielectric Break (kV)	43	39	34
Water in Fluid (ppm)	5.2	5	11
Acid Number (mg KOH/g)	0.02	0.028	0.028
Interfacial Tens.(dynes/cm)	44.2	35	36
ASTM Color	3	L3.5	L3.5
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.8765	0.885	0.889
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	38C	40c	42c
Pressure	0	0	-1
Liquid Level	ok	ok	
GAS DIAGNOSTICS			
Rogers Ratio			
Cellulose Ratio (CO2/CO)			
IEEE/ANSI (C57.104-1991)			

COMMENTS

Apply pressure.

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 1	MVA:	2
Transformer No.:	910396-C1	Gallons:	390
Manufacturer:	Square D	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.75

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/00	8/25/99
Acetylene	0	0	0
Hydrogen	26	44	17
Ethylene	1	6	0
Methane	12	24	6
Ethane	3	9	0
Carbon Monoxide	310	550	296
Carbon Dioxide	3629	3540	3125
Oxygen	57	1640	1306
Nitrogen	48849	30201	51796
Total Combustibles	352	633	319
Total Gas	52887	36014	56537
OIL QUALITY			
Dielectric Break (kV)	42.8	34	45
Water in Fluid (ppm)	8.6	2	29
Acid Number (mg KOH/g)	0.025	0.027	0.028
Interfacial Tens.(dynes/cm)	42.3	36	37
ASTM Color	3	L3.5	L3.5
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.8785	0.884	0.885
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	40c	40c	43c
Pressure	0	-1	-1
Liquid Level	ok	ok	
GAS DIAGNOSTICS			
Rogers Ratio			
Cellulose Ratio (CO2/CO)			
IEEE/ANSI (C57.104-1991)			

COMMENTS

Apply pressure.

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 7	MVA:	0.75
Transformer No.:	M590624TLPA	Gallons:	230
Manufacturer:	GE	PCB's	no data
Voltage:	12470/480	% Imp.	5.75

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/00	8/25/99
Acetylene	0	0	0
Hydrogen	41	73	19
Ethylene	5	15	1
Methane	15	37	5
Ethane	3	13	1
Carbon Monoxide	656	917	531
Carbon Dioxide	4176	3797	3035
Oxygen	166	3874	3583
Nitrogen	57805	37500	58715
Total Combustibles	720	1055	557
Total Gas	62867	46226	65891
OIL QUALITY			
Dielectric Break (kV)	45.6	46	37
Water in Fluid (ppm)	8.5	7	17
Acid Number (mg KOH/g)	0.014	0.02	0.014
Interfacial Tens.(dynes/cm)	37.1	31	32
ASTM Color	L0.5	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.8925	0.902	0.901
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	26C	25c	32c
Pressure	-1.5	0	0
Liquid Level	ok	ok	

GAS DIAGNOSTICS

Rogers Ratio

Cellulose Ratio (CO2/CO)

IEEE/ANSI (C57.104-1991) retest quarterly

COMMENTS

Apply pressure.

ENGINEERED SUBSTATION SERVICES INC.

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(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/25/01
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 8	MVA:	0.75
Transformer No.:	M590623TLPA	Gallons:	230
Manufacturer:	GE	PCB's	no data
Voltage:	12470/480	% Imp.	5.75

Lab Used	JACO	ACTI	ACTI
DISSOLVED GASES PPM	9/11/01	8/24/00	8/25/99
Acetylene	0	0	0
Hydrogen	38	62	20
Ethylene	3	8	1
Methane	15	34	8
Ethane	3	11	0
Carbon Monoxide	609	836	502
Carbon Dioxide	3217	2748	2269
Oxygen	114	3386	3246
Nitrogen	56960	37430	58698
Total Combustibles	668	951	531
Total Gas	60959	44515	64744
OIL QUALITY			
Dielectric Break (kV)	41.5	36	39
Water In Fluid (ppm)	13	6	20
Acid Number (mg KOH/g)	0.017	0.02	0.014
Interfacial Tens.(dynes/cm)	38.7	30	31
ASTM Color	L0.5	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.8925	0.898	0.898
OPERATING CONDITIONS			
AmbientTemp.	70F	80F	
Winding Temp.			
Liquid Temp.	27C	25c	27c
Pressure	0		
Liquid Level	NA	ok	

GAS DIAGNOSTICS

Rogers Ratio

Cellulose Ratio (CO2/CO)

IEEE/ANSI (C57.104-1991) retest quarterly

COMMENTS

CHECK PRESSURE

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/13/00
Address:	5566 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Dry Dock 3	MVA:	1
Transformer No.:	16121-1	Gallons:	415
Manufacturer:	Sierra	PCB's	cert.non
Voltage:	12470/480	% Imp.	

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	0	0
Hydrogen	8	2
Ethylene	9	1
Methane	5	1
Ethane	2	0
Carbon Monoxide	463	167
Carbon Dioxide	2522	1697
Oxygen	10690	18258
Nitrogen	46353	64501
Total Combustibles	487	170
Total Gas	60062	84526
OIL QUALITY		
Dielectric Break (kV)	41	51
Water in Fluid (ppm)	4	5
Acid Number (mg KOH/g)	0.008	0.002
Interfacial Tens.(dynes/cm)	36	38
ASTM Color	L1.5	L1.0
Visual Inspection	Pass	Pass
Specific Gravity	0.882	0.887
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	30c	35
Pressure	-1	-0.5
Liquid Level	ok	
GAS DIAGNOSTICS		
Rogers Ratio		
Cellulose Ratio (CO2/CO)		
IEEE/ANSI (C57.104-1991)		

COMMENTS

apply nitrogen

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/13/00
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Dry Dock 3	MVA:	1.5
Transformer No.:	16745-1	Gallons:	327
Manufacturer:	Sierra	PCB's	cert.non
Voltage:	12470/480	% Imp.	

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/25/00
Acetylene	0	0
Hydrogen	14	4
Ethylene	44	10
Methane	12	1
Ethane	2	0
Carbon Monoxide	817	435
Carbon Dioxide	4774	3862
Oxygen	6444	8625
Nitrogen	45159	58658
Total Combustibles	889	450
Total Gas	57266	71595
OIL QUALITY		
Dielectric Break (kV)	48	39
Water in Fluid (ppm)	16	4
Acid Number (mg KOH/g)	0.011	0.005
Interfacial Tens.(dynes/cm)	35	33
ASTM Color	L1.5	L1.0
Visual Inspection	pass	pass
Specific Gravity	0.883	0.882
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	45c	50c
Pressure	-1.5	-1
Liquid Level	ok	

GAS DIAGNOSTICS

Rogers Ratio

Cellulose Ratio (CO2/CO)

IEEE/ANSI (C57.104-1991) retest quarterly

COMMENTS

slight rise in moisture and cabon monoxide - not a major concern
apply nitrogen

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
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(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/13/00
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Dry Dock 3	MVA:	1
Transformer No.:	16121-3	Gallons:	415
Manufacturer:	Sierra	PCB's	cert.non
Voltage:	12470/480	% Imp.	

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	23	0
Hydrogen	60	10
Ethylene	463	80
Methane	161	34
Ethane	103	6
Carbon Monoxide	489	220
Carbon Dioxide	2660	1525
Oxygen	10060	16273
Nitrogen	46183	64986
Total Combustibles	1319	350
Total Gas	60122	83135
OIL QUALITY		
Dielectric Break (kV)	32	48
Water in Fluid (ppm)	22	16
Acid Number (mg KOH/g)	0.005	0.003
Interfacial Tens.(dynes/cm)	36	36
ASTM Color	L1.5	L1.0
Visual Inspection	Pass	Pass
Specific Gravity	0.884	0.877
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	30c	35c
Pressure	-1	0
Liquid Level	ok	

GAS DIAGNOSTICS

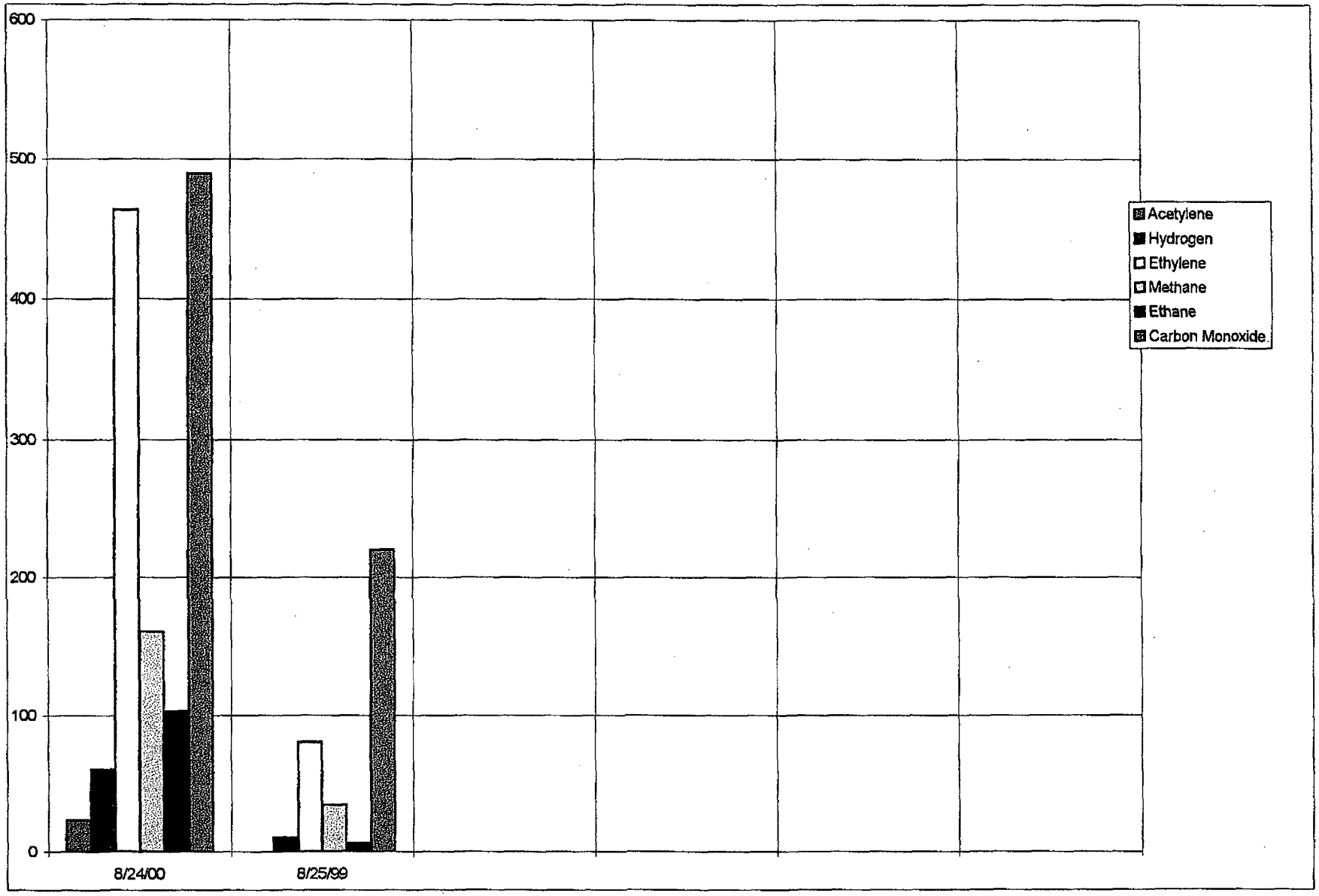
Rogers Ratio

Cellulose Ratio (CO2/CO)

IEEE/ANSI (C57.104-1991) retest quarterly

COMMENTS

This unit is a concern! Notice rise in acetylene, methane, ethane, and ethylene. Evidence of internal arching. Moisture/dielectric ratio has gotten worse. Apply nitrogen. Consider inspection and servicing.


600
500
400
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8/24/00
8/25/99
Acetylene
Hydrogen
Ethylene
Methane
Ethane
Carbon Monoxide

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/13/00
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	32-1	MVA:	2.5
Transformer No.:	79F835	Gallons:	488
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	11400/480	% Imp.	6.4

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	2	0
Hydrogen	3	3
Ethylene	72	42
Methane	8	1
Ethane	17	3
Carbon Monoxide	180	76
Carbon Dioxide	1348	1132
Oxygen	11213	14614
Nitrogen	41374	48525
Total Combustibles	282	125
Total Gas	54217	64396
OIL QUALITY		
Dielectric Break (kV)	39	44
Water in Fluid (ppm)	19	19
Acid Number (mg KOH/g)	0.047	0.038
Interfacial Tens.(dynes/cm)	27	28
ASTM Color	G8.0	L5.0
Visual Inspection	Pass	Pass
Specific Gravity	0.894	0.888
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	50c	45c
Pressure	1.5	2
Liquid Level	ok	
GAS DIAGNOSTICS		
Rogers Ratio		
Cellulose Ratio (CO2/CO)		
IEEE/ANSI (C57.104-1991)		
COMMENTS		

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/13/00
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 4-5	MVA:	0.33
Transformer No.:	79F6705	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

	Lab Used	ACTI	ACTI
DISSOLVED GASES PPM		8/24/00	8/25/99
	Acetylene	0	0
	Hydrogen	12	4
	Ethylene	9	1
	Methane	17	5
	Ethane	19	4
	Carbon Monoxide	243	117
	Carbon Dioxide	2594	2384
	Oxygen	4640	2316
	Nitrogen	4640	53131
	Total Combustibles	300	131
	Total Gas	50838	57961
OIL QUALITY			
	Dielectric Break (kV)	39	46
	Water in Fluid (ppm)	12	27
	Acid Number (mg KOH/g)	0.029	0.029
	Interfacial Tens.(dynes/cm)	29	28
	ASTM Color	G8.0	L5.0
	Visual Inspection	Pass	Pass
	Specific Gravity	0.985	0.899
OPERATING CONDITIONS			
	AmbientTemp.	80F	
	Winding Temp.		
	Liquid Temp.	35c	35c
	Pressure	0	0.5
	Liquid Level	ok	ok
GAS DIAGNOSTICS			
	Rogers Ratio		
	Cellulose Ratio (CO2/CO)		
	IEEE/ANSI (C57.104-1991)		

COMMENTS

apply nitrogen

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/13/00
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 4-2	MVA:	0.33
Transformer No.:	7916702	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

	Lab Used	ACTI	ACTI
DISSOLVED GASES PPM		8/24/00	8/25/99
Acetylene		0	0
Hydrogen		0	1
Ethylene		2	0
Methane		2	0
Ethane		3	0
Carbon Monoxide		92	38
Carbon Dioxide		1005	922
Oxygen		10084	4099
Nitrogen		41027	42245
Total Combustibles		96	39
Total Gas		52215	47305
OIL QUALITY			
Dielectric Break (kV)		32	50
Water in Fluid (ppm)		14	21
Acid Number (mg KOH/g)		0.02	0.02
Interfacial Tens.(dynes/cm)		26	39
ASTM Color		L5.0	L5.0
Visual Inspection		Pass	Pass
Specific Gravity		0.892	0.896
OPERATING CONDITIONS			
AmbientTemp.		80F	
Winding Temp.			
Liquid Temp.		35c	35c
Pressure		0	0.5
Liquid Level		ok	ok
GAS DIAGNOSTICS			
Rogers Ratio			
Cellulose Ratio (CO2/CO)			
IEEE/ANSI (C57.104-1991)			

COMMENTS

apply nitrogen

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/13/00
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 4-4	MVA:	0.33
Transformer No.:	79F6704	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

	Lab Used	ACTI	ACTI
DISSOLVED GASES PPM		8/24/00	8/25/99
Acetylene		3	0
Hydrogen		7	4
Ethylene		96	26
Methane		17	7
Ethane		21	6
Carbon Monoxide		326	251
Carbon Dioxide		2730	2011
Oxygen		4460	3101
Nitrogen		43393	64046
Total Combustibles		470	294
Total Gas		51053	69452
OIL QUALITY			
Dielectric Break (kV)		38	41
Water in Fluid (ppm)		9	23
Acid Number (mg KOH/g)		0.022	0.018
Interfacial Tens.(dynes/cm)		29	31
ASTM Color		L5.0	L5.0
Visual Inspection		Pass	Pass
Specific Gravity		0.895	0.889
OPERATING CONDITIONS			
AmbientTemp.		80F	
Winding Temp.			
Liquid Temp.		35c	35c
Pressure		0	0.5
Liquid Level		ok	ok
GAS DIAGNOSTICS			
Rogers Ratio			
Cellulose Ratio (CO2/CO)			
IEEE/ANSI (C57.104-1991)			

COMMENTS

apply nitrogen

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer;	Cascade General Shipyard	Date:	9/15/99
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 4-11	MVA:	0.33
Transformer No.:	79F6701	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	0	0
Hydrogen	22	10
Ethylene	19	3
Methane	28	5
Ethane	21	2
Carbon Monoxide	262	145
Carbon Dioxide	3118	2688
Oxygen	4220	1774
Nitrogen	43362	47864
Total Combustibles	372	165
Total Gas	52072	52491
OIL QUALITY		
Dielectric Break (kV)	34	39
Water in Fluid (ppm)	8	14
Acid Number (mg KOH/g)	0.02	0.021
Interfacial Tens.(dynes/cm)	28	31
ASTM Color	G8.0	L6.0
Visual Inspection	Pass	Pass
Specific Gravity	0.897	0.892
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	35c	35c
Pressure	0	0.5
Liquid Level	ok	ok
GAS DIAGNOSTICS		
Rogers Ratio		
Cellulose Ratio (CO2/CO)		
IEEE/ANSI (C57.104-1991)		

COMMENTS

apply nitrogen

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/13/00
Address:	5556 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 12-2	MVA:	1
Transformer No.:	79F67112	Gallons:	316
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.5

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	0	0
Hydrogen	6	9
Ethylene	10	1
Methane	4	0
Ethane	1	0
Carbon Monoxide	194	49
Carbon Dioxide	710	666
Oxygen	5171	6757
Nitrogen	50162	47613
Total Combustibles	215	59
Total Gas	56258	55096
OIL QUALITY		
Dielectric Break (kV)	35	37
Water in Fluid (ppm)	8	20
Acid Number (mg KOH/g)	0.023	0.034
Interfacial Tens.(dynes/cm)	26	29
ASTM Color	G8.0	L6.0
Visual Inspection	Pass	Pass
Specific Gravity	0.899	0.888
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	40c	40c
Pressure	0	0.5
Liquid Level	ok	ok
GAS DIAGNOSTICS		
Rogers Ratio		
Cellulose Ratio (CO2/CO)		
IEEE/ANSI (C57.104-1991)		

COMMENTS

apply nitrogen

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/13/00
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 4-3	MVA:	0.33
Transformer No.:	79F9703	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

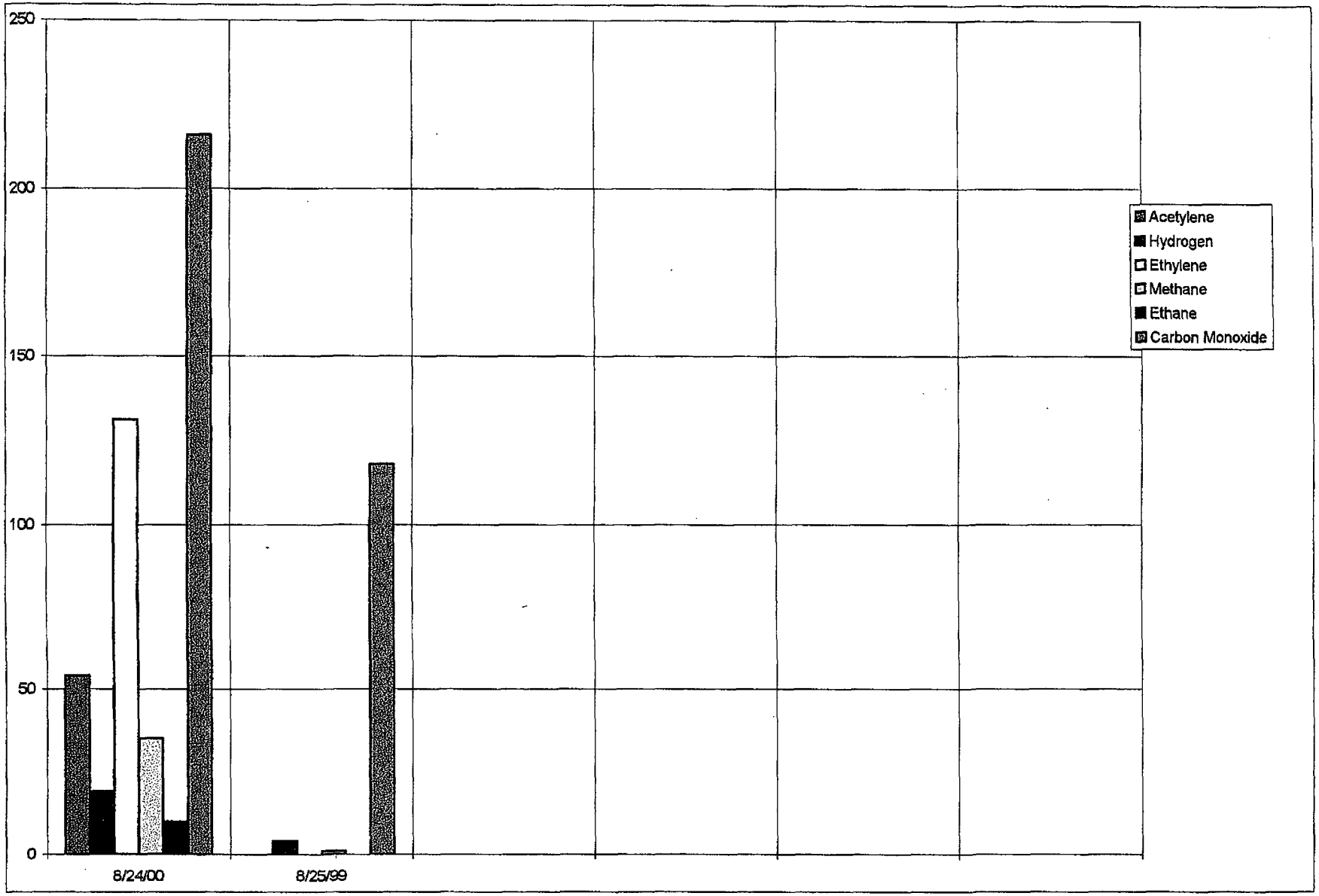
	Lab Used	ACTI	ACTI
DISSOLVED GASES PPM		8/24/00	8/25/99
	Acetylene	54	0
	Hydrogen	19	4
	Ethylene	131	0
	Methane	35	1
	Ethane	10	0
	Carbon Monoxide	216	118
	Carbon Dioxide	1642	2229
	Oxygen	7397	3642
	Nitrogen	41905	60095
	Total Combustibles	465	123
	Total Gas	51409	66089
OIL QUALITY			
	Dielectric Break (kV)	35	43
	Water in Fluid (ppm)	6	25
	Acid Number (mg KOH/g)	0.03	0.023
	Interfacial Tens.(dynes/cm)	27	28
	ASTM Color	L5.0	L5.0
	Visual Inspection	Pass	Pass
	Specific Gravity	0.894	0.89
OPERATING CONDITIONS			
	AmbientTemp.	80F	
	Winding Temp.		
	Liquid Temp.	30c	40c
	Pressure	0	1
	Liquid Level	ok	ok

GAS DIAGNOSTICS

Rogers Ratio 1-0-2-0 circulating currents and overheated joints
Cellulose Ratio (CO2/CO)
IEEE/ANSI (C57.104-1991)

COMMENTS

Evidence of acetylene is a concern, as well as rise in ethylene. Monitor unit and consider further testing/inspection. Apply nitrogen.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0
8/24/00
8/25/99
Acetylene
Hydrogen
Ethylene
Methane
Ethane
Carbon Monoxide

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/13/00
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 4-1	MVA:	0.33
Transformer No.:	79F9701	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	0	0
Hydrogen	15	1
Ethylene	9	1
Methane	7	0
Ethane	4	0
Carbon Monoxide	173	50
Carbon Dioxide	716	519
Oxygen	711	6527
Nitrogen	26269	53768
Total Combustibles	208	52
Total Gas	27904	60866
OIL QUALITY		
Dielectric Break (kV)	44	43
Water in Fluid (ppm)	26	16
Acid Number (mg KOH/g)	0.031	0.024
Interfacial Tens.(dynes/cm)	25	28
ASTM Color	G8.0	L5.5
Visual Inspection	Pass	Pass
Specific Gravity	0.893	0.896
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	40c	35c
Pressure	0	0
Liquid Level	ok	ok
GAS DIAGNOSTICS		
Rogers Ratio		
Cellulose Ratio (CO2/CO)		
IEEE/ANSI (C57.104-1991)		

COMMENTS

Apply nitrogen.

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/13/00
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 4-12	MVA:	0.33
Transformer No.:	79F97012	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	0	0
Hydrogen	4	2
Ethylene	3	0
Methane	4	0
Ethane	2	0
Carbon Monoxide	137	42
Carbon Dioxide	518	1128
Oxygen	5742	2699
Nitrogen	42332	52838
Total Combustibles	150	44
Total Gas	48742	56710
OIL QUALITY		
Dielectric Break (kV)	40	42
Water in Fluid (ppm)	34	27
Acid Number (mg KOH/g)	0.027	0.024
Interfacial Tens.(dynes/cm)	24	35
ASTM Color	L5.0	L5.0
Visual Inspection	Pass	Pass
Specific Gravity	0.892	0.892
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	30c	35c
Pressure	-3	0
Liquid Level	low	
GAS DIAGNOSTICS		
Rogers Ratio		
Cellulose Ratio (CO2/CO)		
IEEE/ANSI (C57.104-1991)		

COMMENTS

Apply nitrogen.
Moisture increasing.

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/13/00
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 12-4	MVA:	1
Transformer No.:	79F6714	Gallons:	316
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/460	% Imp.	5.5

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	4	0
Hydrogen	7	4
Ethylene	145	38
Methane	82	25
Ethane	154	34
Carbon Monoxide	667	381
Carbon Dioxide	4173	3077
Oxygen	4595	2461
Nitrogen	45116	59156
Total Combustibles	1059	482
Total Gas	54942	65175
OIL QUALITY		
Dielectric Break (kV)	37	46
Water in Fluid (ppm)	21	26
Acid Number (mg KOH/g)	0.025	0.019
Interfacial Tens.(dynes/cm)	31	42
ASTM Color	G8.0	L5.5
Visual Inspection	Pass	Pass
Specific Gravity	0.897	0.89
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	40c	35c
Pressure	0	0
Liquid Level	ok	

GAS DIAGNOSTICS

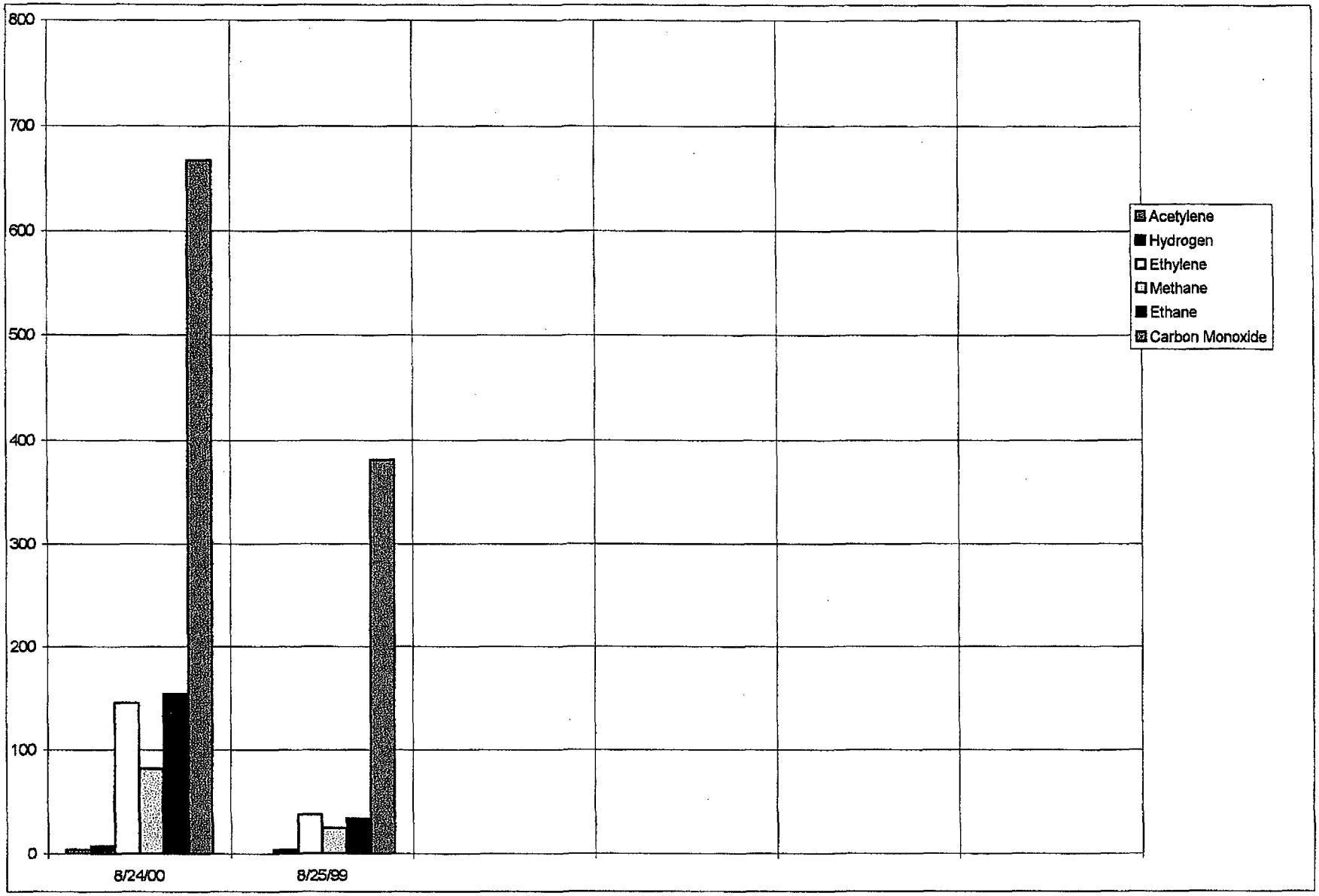
Rogers Ratio 2-1-0-0 slight overheating

Cellulose Ratio (CO2/CO)

IEEE/ANSI (C57.104-1991) retest quarterly

COMMENTS

Combustible gas rise is a concern. Consider further testing/inspection.
Apply nitorgen.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700
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8/24/00
8/25/99
Acetylene
Hydrogen
Ethylene
Methane
Ethane
Carbon Monoxide

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/13/00
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 4-6	MVA:	0.33
Transformer No.:	79F6706	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/460	% Imp.	5.1

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	0	0
Hydrogen	17	4
Ethylene	4	0
Methane	4	0
Ethane	6	0
Carbon Monoxide	145	64
Carbon Dioxide	1841	1654
Oxygen	8873	2452
Nitrogen	42355	46951
Total Combustibles	176	68
Total Gas	53245	51125
OIL QUALITY		
Dielectric Break (kV)	40	46
Water in Fluid (ppm)	22	19
Acid Number (mg KOH/g)	0.027	0.029
Interfacial Tens.(dynes/cm)	27	28
ASTM Color	G8.0	L5.5
Visual Inspection	Pass	Pass
Specific Gravity	0.896	0.895
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	40c	35c
Pressure	0.5	0.5
Liquid Level	low	
GAS DIAGNOSTICS		
Rogers Ratio		
Cellulose Ratio (CO2/CO)		
IEEE/ANSI (C57.104-1991)		
COMMENTS		

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/13/00
Address:	5565 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 4-9	MVA:	0.33
Transformer No.:	79F6709	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/460	% Imp.	5.1

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	0	0
Hydrogen	52	27
Ethylene	14	2
Methane	40	7
Ethane	23	1
Carbon Monoxide	581	297
Carbon Dioxide	4425	2964
Oxygen	4863	3123
Nitrogen	49077	65723
Total Combustibles	710	334
Total Gas	59075	72144
OIL QUALITY		
Dielectric Break (kV)	39	39
Water In Fluid (ppm)	9	6
Acid Number (mg KOH/g)	0.022	0.017
Interfacial Tens.(dynes/cm)	31	32
ASTM Color	L5.0	L5.5
Visual Inspection	Pass	Pass
Specific Gravity	0.895	0.894
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	35c	35c
Pressure	0	0.25
Liquid Level	ok	
GAS DIAGNOSTICS		
Rogers Ratio		
Cellulose Ratio (CO2/CO)		
IEEE/ANSI (C57.104-1991)		

COMMENTS

Apply pressure

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/14/00
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 4-10	MVA:	0.33
Transformer No.:	79F67010	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/460	% Imp.	5.1

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/99	8/25/99
Acetylene	0	0
Hydrogen	24	6
Ethylene	10	1
Methane	23	5
Ethane	20	4
Carbon Monoxide	280	135
Carbon Dioxide	1260	1049
Oxygen	5009	1404
Nitrogen	41857	50845
Total Combustibles	357	151
Total Gas	48483	53449
OIL QUALITY		
Dielectric Break (kV)	41	46
Water in Fluid (ppm)	3	23
Acid Number (mg KOH/g)	0.02	0.01
Interfacial Tens.(dynes/cm)	31	31
ASTM Color	L5.0	L5.0
Visual Inspection	Pass	Pass
Specific Gravity	0.898	0.89
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	35c	38
Pressure	0	0
Liquid Level	low	
GAS DIAGNOSTICS		
Rogers Ratio		
Cellulose Ratio (CO2/CO)		
IEEE/ANSI (C57.104-1991)		

COMMENTS

Apply pressure.

Tc# 40

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/14/00
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 4-8	MVA:	0.33
Transformer No.:	79F6708	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/460	% Imp.	5.1

Lab Used	ACTI	ATCI
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	43	14
Hydrogen	56	7
Ethylene	793	318
Methane	176	58
Ethane	168	40
Carbon Monoxide	478	195
Carbon Dioxide	2010	1375
Oxygen	4556	1634
Nitrogen	44549	52821
Total Combustibles	1716	632
Total Gas	52831	56461
OIL QUALITY		
Dielectric Break (kV)	33	40
Water in Fluid (ppm)	14	11
Acid Number (mg KOH/g)	0.031	0.031
Interfacial Tens.(dynes/cm)	28	42
ASTM Color	L2.0	L2.0
Visual Inspection	Pass	Pass
Specific Gravity	0.894	0.886
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	40c	33c
Pressure	-1	-1.5
Liquid Level	ok	

GAS DIAGNOSTICS

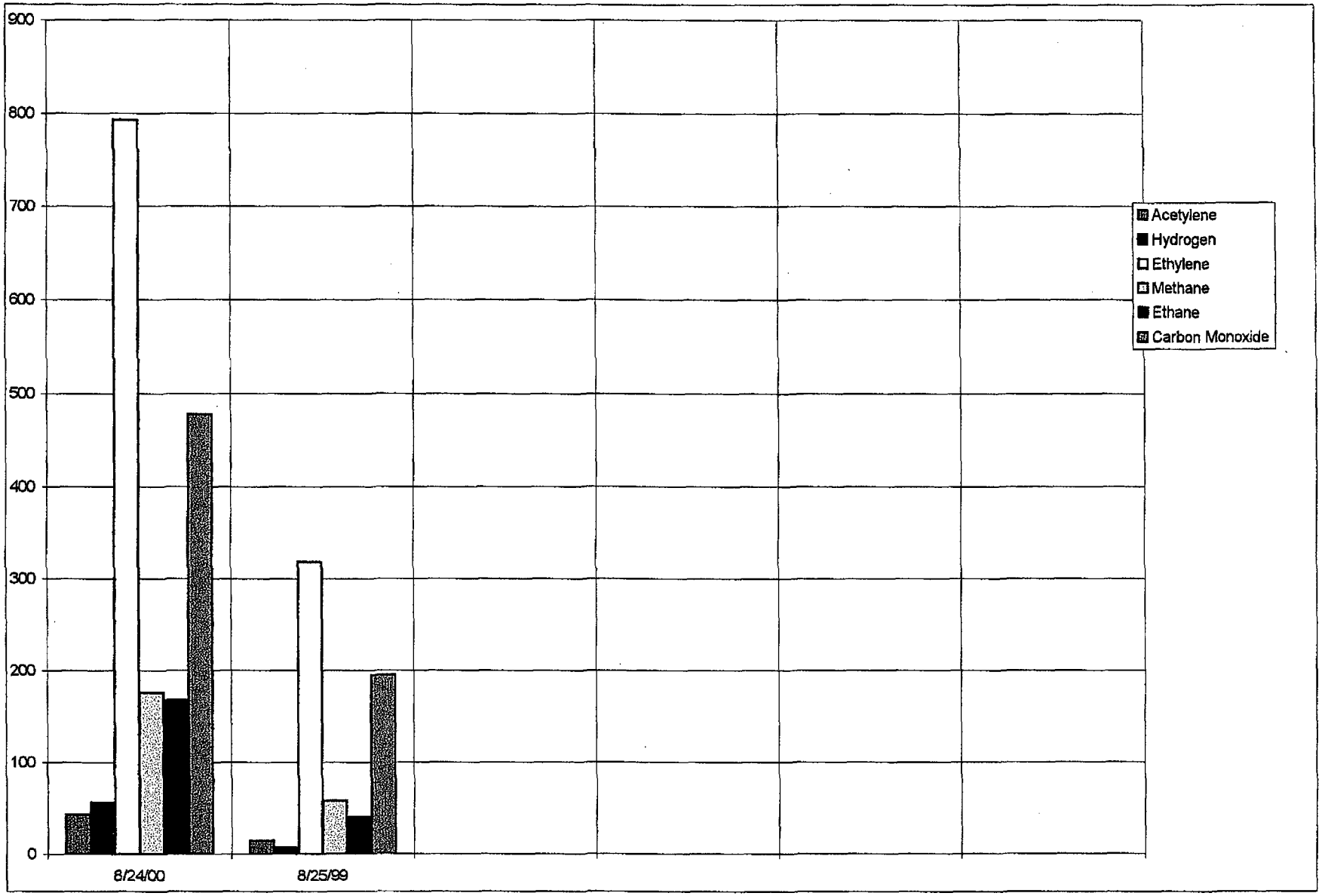
Rogers Ratio

Cellulose Ratio (CO2/CO)

IEEE/ANSI (C57.104-1991) retest quarterly

COMMENTS

This unit is a concern. There is a significant increase in combustible gases.
Consider additional testing/inspection.
Apply pressure.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8/24/00
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Acetylene
Hydrogen
Ethylene
Methane
Ethane
Carbon Monoxide

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/14/00
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 12-1	MVA:	1
Transformer No.:	79F6711	Gallons:	316
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/460	%Imp.	5.5

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	0	0
Hydrogen	6	0
Ethylene	0	0
Methane	2	0
Ethane	0	0
Carbon Monoxide	77	458
Carbon Dioxide	669	42
Oxygen	12705	3557
Nitrogen	44877	39437
Total Combustibles	85	42
Total Gas	58336	43495
OIL QUALITY		
Dielectric Break (kV)	35	42
Water in Fluid (ppm)	21	20
Acid Number (mg KOH/g)	0.027	0.02
Interfacial Tens.(dynes/cm)	31	37
ASTM Color	L2.5	L2.5
Visual Inspection	Pass	Pass
Specific Gravity	0.883	0.879
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	40c	
Pressure	0	0
Liquid Level	ok	
GAS DIAGNOSTICS		
Rogers Ratio		
Cellulose Ratio (CO2/CO)		
IEEE/ANSI (C57.104-1991)		

COMMENTS

Apply pressure.

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/14/00
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Dry Dock	MVA:	1
Transformer No.:	771382	Gallons:	310
Manufacturer:		PCB's	cert-non
Voltage:		% Imp.	

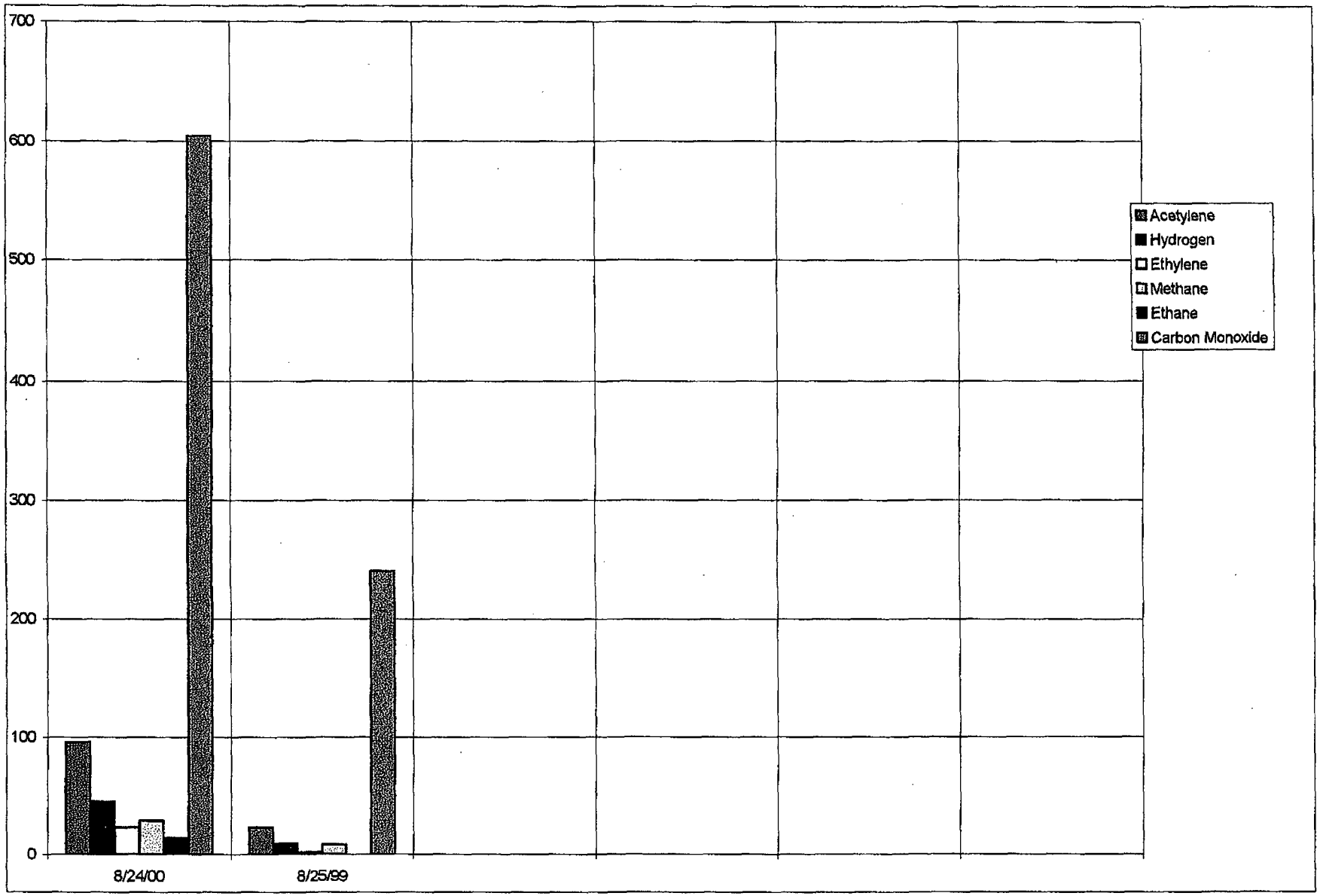
	Lab Used	ACTI	ACTI
DISSOLVED GASES PPM		8/24/00	8/25/99
Acetylene		96	23
Hydrogen		45	9
Ethylene		23	2
Methane		29	8
Ethane		14	0
Carbon Monoxide		604	240
Carbon Dioxide		3964	2148
Oxygen		9375	10799
Nitrogen		48206	61624
Total Combustibles		811	282
Total Gas		62356	74852
OIL QUALITY			
Dielectric Break (kV)		44	50
Water in Fluid (ppm)		5	13
Acid Number (mg KOH/g)		0.002	0.002
Interfacial Tens.(dynes/cm)		41	38
ASTM Color		L0.5	L0.5
Visual Inspection		Pass	Pass
Specific Gravity		0.886	0.883
OPERATING CONDITIONS			
AmbientTemp.		80F	
Winding Temp.			
Liquid Temp.		40c	50c
Pressure		0	0.25
Liquid Level		ok	

GAS DIAGNOSTICS

Rogers Ratio 0-0-1-2 Arc, with power follow-through
Cellulose Ratio (CO2/CO)
IEEE/ANSI (C57.104-1991) restest quarterly

COMMENTS

Rise in combustible gases is a concern. Consider additional testing/inspection.
Apply pressure.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8/24/00
8/25/99
Acetylene
Hydrogen
Ethylene
Methane
Ethane
Carbon Monoxide

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/14/00
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	C.U.S.	MVA:	1.5
Transformer No.:	SBV567601	Gallons:	259
Manufacturer:	West.	PCB's	cert-non
Voltage:	12470/240	% Imp.	5.5

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	0	0
Hydrogen	15	5
Ethylene	67	20
Methane	25	4
Ethane	6	0
Carbon Monoxide	765	375
Carbon Dioxide	3399	2534
Oxygen	4625	3174
Nitrogen	52421	61525
Total Combustibles	878	404
Total Gas	67637	67637
OIL QUALITY		
Dielectric Break (kV)	42	49
Water in Fluid (ppm)	2	8
Acid Number (mg KOH/g)	0.028	0.02
Interfacial Tens.(dynes/cm)	31	32
ASTM Color	L2.0	L1.5
Visual Inspection	Pass	Pass
Specific Gravity	0.881	0.883
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	40c	40C
Pressure	0	0.25
Liquid Level	ok	
GAS DIAGNOSTICS		
Rogers Ratio		
Cellulose Ratio (CO2/CO)		
IEEE/ANSI (C57.104-1991)		

COMMENTS

Apply pressure.

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/14/00
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	C.U.S.	MVA:	1.5
Transformer No.:	SBV567602	Gallons:	259
Manufacturer:	West.	PCB's	cert-non
Voltage:	12470/240	% Imp.	5.47

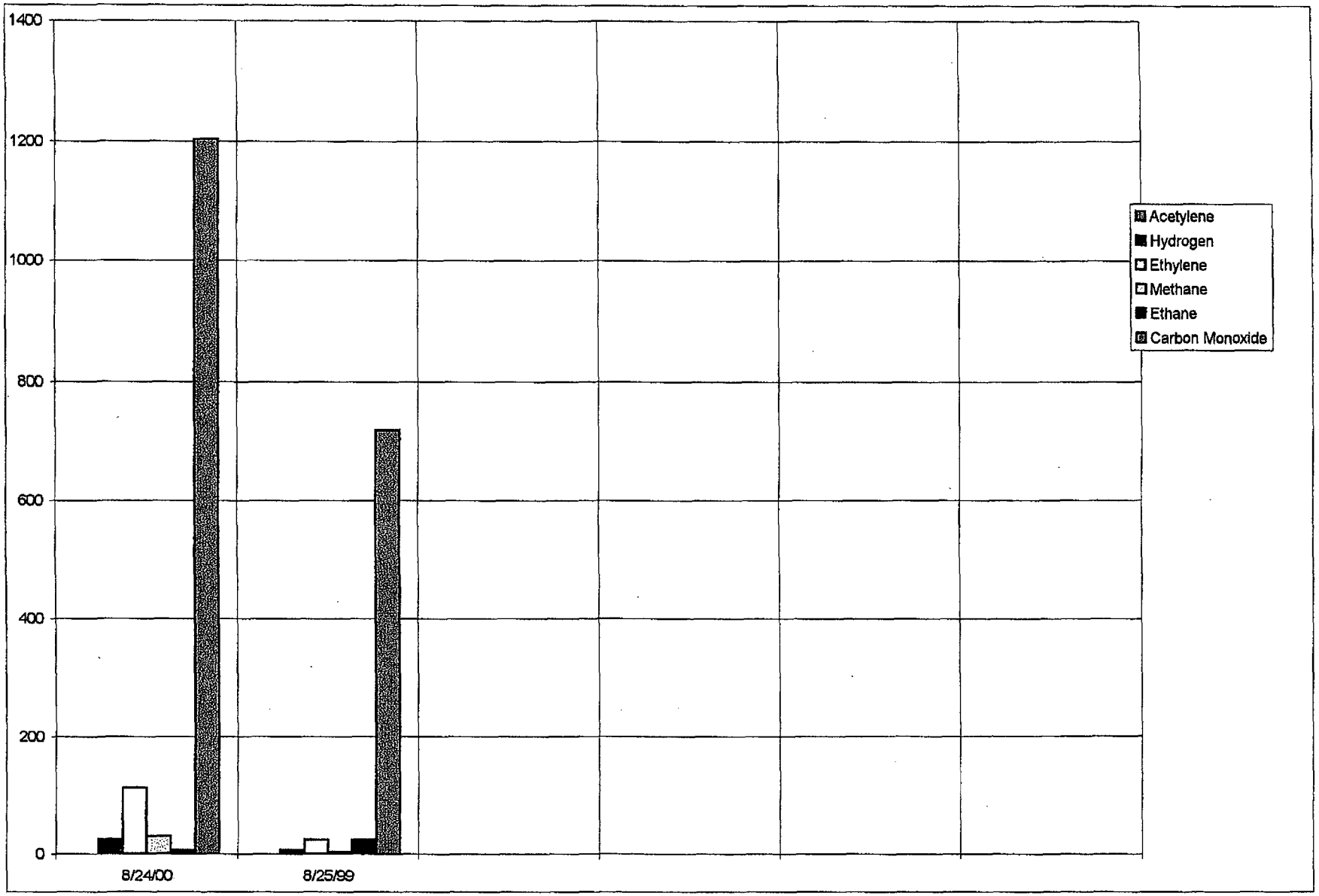
Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	0	0
Hydrogen	25	7
Ethylene	113	24
Methane	30	3
Ethane	6	24
Carbon Monoxide	1204	719
Carbon Dioxide	8179	6154
Oxygen	7605	8665
Nitrogen	50096	67269
Total Combustibles	1378	753
Total Gas	67258	82842
OIL QUALITY		
Dielectric Break (kV)	39	49
Water in Fluid (ppm)	5	10
Acid Number (mg KOH/g)	0.023	0.018
Interfacial Tens.(dynes/cm)	30	30
ASTM Color	L1.5	L1.5
Visual Inspection	Pass	Pass
Specific Gravity	0.875	0.887
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	40c	40C
Pressure	0	0.5
Liquid Level	ok	

GAS DIAGNOSTICS

Rogers Ratio 1-0-2-0 core 7 tank circulating currents/overheated joints
Cellulose Ratio (CO2/CO) <7 indicating severe overheating near insulation
IEEE/ANSI (C57.104-1991) retest quarterly

COMMENTS

Rise in combustible gases, as well as carbon dioxide is a concern.
Consider additional testing/inspection.
Apply pressure.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Acetylene
Hydrogen
Ethylene
Methane
Ethane
Carbon Monoxide

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/14/00
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	C.U.S.	MVA:	1.5
Transformer No.:	SBV567604	Gallons:	259
Manufacturer:	West.	PCB's	cert-non
Voltage:	12470/240	% Imp.	5.47

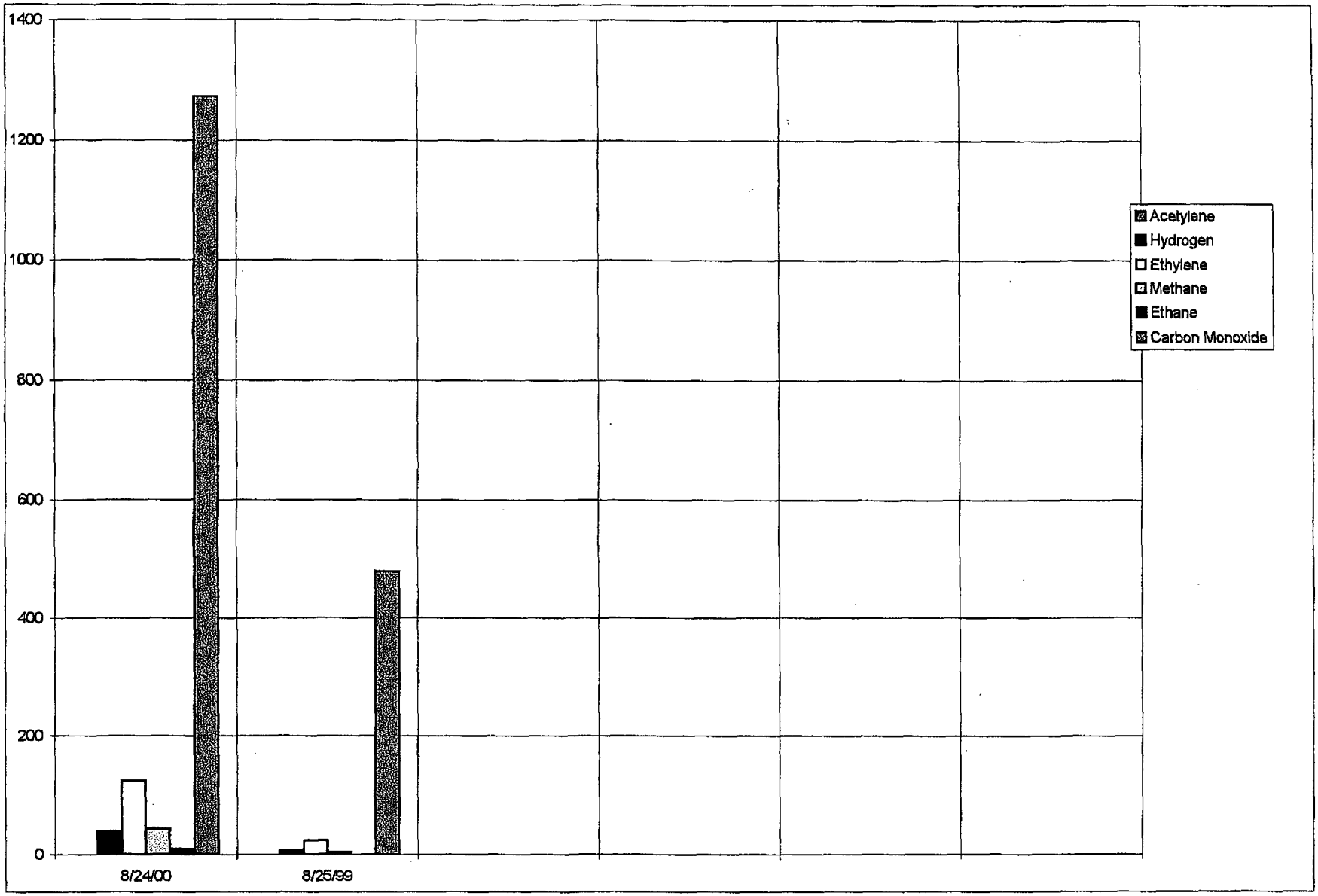
	Lab Used	ACTI	ACTI
DISSOLVED GASES PPM		8/24/00	8/25/99
	Acetylene	0	0
	Hydrogen	38	6
	Ethylene	124	23
	Methane	43	4
	Ethane	9	0
	Carbon Monoxide	1273	479
	Carbon Dioxide	6061	3031
	Oxygen	4599	4430
	Nitrogen	64589	60212
	Total Combustibles	1487	512
	Total Gas	76736	68186
OIL QUALITY			
	Dielectric Break (kV)	45	50
	Water in Fluid (ppm)	2	7
	Acid Number (mg KOH/g)	0.021	0.021
	Interfacial Tens.(dynes/cm)	31	30
	ASTM Color	L2.0	L1.5
	Visual Inspection	Pass	Pass
	Specific Gravity	0.882	0.876
OPERATING CONDITIONS			
	AmbientTemp.	80F	
	Winding Temp.		
	Liquid Temp.	35c	40C
	Pressure	-0.6	0
	Liquid Level	ok	

GAS DIAGNOSTICS

Rogers Ratio 1-0-2-0 core 7 tank circulating currents/overheated joints
Cellulose Ratio (CO2/CO) <7 indicating severe overheating near insulation
IEEE/ANSI (C57.104-1991) retest quarterly

COMMENTS

Rise in combustible gases, as well as carbon dioxide is a concern.
Consider additional testing/inspection.
Apply pressure.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8/24/00
8/25/99
Acetylene
Hydrogen
Ethylene
Methane
Ethane
Carbon Monoxide

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/14/00
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	C.U.S.	MVA:	1.5
Transformer No.:	SBV567603	Gallons:	259
Manufacturer:	West.	PCB's	cert-non
Voltage:	12470/240	% Imp.	5.51

	Lab Used	ACTI	ACTI
DISSOLVED GASES PPM		8/24/00	8/25/99
	Acetylene	0	0
	Hydrogen	12	8
	Ethylene	62	20
	Methane	24	7
	Ethane	5	0
	Carbon Monoxide	846	624
	Carbon Dioxide	3542	3828
	Oxygen	5320	2350
	Nitrogen	44842	62237
	Total Combustibles	949	659
	Total Gas	54653	69074
OIL QUALITY			
	Dielectric Break (kV)	40	47
	Water in Fluid (ppm)	6	9
	Acid Number (mg KOH/g)	0.03	0.019
	Interfacial Tens.(dynes/cm)	31	37
	ASTM Color	L2.0	L1.5
	Visual Inspection	Pass	Pass
	Specific Gravity	0.88	0.877
OPERATING CONDITIONS			
	AmbientTemp.	80F	
	Winding Temp.		
	Liquid Temp.	30c	35c
	Pressure	-1	-0.75
	Liquid Level	ok	

GAS DIAGNOSTICS

Rogers Ratio 1-0-2-0 core 7 tank circulating currents/overheated joints

Cellulose Ratio (CO2/CO)

IEEE/ANSI (C57.104-1991) retest quarterly

COMMENTS

Apply pressure.

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/14/00
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	C.U.S.	MVA:	1
Transformer No.:	PAT716001	Gallons:	224
Manufacturer:	West.	PCB's	cert-non
Voltage:	12470/480	% Imp.	5.81

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	0	0
Hydrogen	19	8
Ethylene	48	14
Methane	26	6
Ethane	5	0
Carbon Monoxide	827	595
Carbon Dioxide	3024	3116
Oxygen	5555	2541
Nitrogen	47669	68869
Total Combustibles	925	623
Total Gas	57173	75150
OIL QUALITY		
Dielectric Break (kV)	48	49
Water in Fluid (ppm)	4	10
Acid Number (mg KOH/g)	0.028	0.022
Interfacial Tens.(dynes/cm)	31	29
ASTM Color	L1.5	L1.5
Visual Inspection	Pass	Pass
Specific Gravity	0.878	0.876
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	30c	20c
Pressure	-1	-0.5
Liquid Level	ok	
GAS DIAGNOSTICS		
Rogers Ratio		
Cellulose Ratio (CO2/CO)		
IEEE/ANSI (C57.104-1991)		

COMMENTS

Needs a sample valve.
Apply pressure.

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/14/00
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 4-7	MVA:	0.33
Transformer No.:	79F67097	Gallons:	176
Manufacturer:	Elect. Tech.	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	0	0
Hydrogen	32	3
Ethylene	2	0
Methane	3	14
Ethane	1	13
Carbon Monoxide	113	88
Carbon Dioxide	543	1129
Oxygen	7225	2829
Nitrogen	38481	55237
Total Combustibles	151	118
Total Gas	46400	59313
OIL QUALITY		
Dielectric Break (kV)	35	46
Water in Fluid (ppm)	10	26
Acid Number (mg KOH/g)	0.03	0.024
Interfacial Tens.(dynes/cm)	29	28
ASTM Color	L5.0	L5.0
Visual Inspection	Pass	Pass
Specific Gravity	0.892	0.891
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	40c	35c
Pressure	0	0.25
Liquid Level	ok	
GAS DIAGNOSTICS		
Rogers Ratio		
Cellulose Ratio (CO2/CO)		
IEEE/ANSI (C57.104-1991)		

COMMENTS

Apply pressure.

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/14/00
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 4	MVA:	1.5
Transformer No.:	PG08188	Gallons:	295
Manufacturer:	GE	PCB's	silicone
Voltage:	12470/480	% Imp.	

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	0	0
Hydrogen	70	35
Ethylene	4	0
Methane	57	25
Ethane	6	0
Carbon Monoxide	963	887
Carbon Dioxide	2850	4012
Oxygen	5509	6046
Nitrogen	55553	110799
Total Combustibles	1100	947
Total Gas	65012	121804
OIL QUALITY		
Dielectric Break (kV)	33	38
Water in Fluid (ppm)	12	16
Acid Number (mg KOH/g)	0.01	0.003
Interfacial Tens.(dynes/cm)		
ASTM Color	L0.5	L0.5
Visual Inspection	Pass	Pass
Specific Gravity	0.977	0.975
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	40c	35c
Pressure	npg	npg
Liquid Level	high	
GAS DIAGNOSTICS		
Rogers Ratio		
Cellulose Ratio (CO2/CO)		
IEEE/ANSI (C57.104-1991)		

COMMENTS

No pressure guage.

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	**Date:**	9/14/00
Address:	5555 N Channel Blvd. PDX	**Report by**	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	**Class:**	
Substation/Site:	Sub 6	**MVA:**	1
Transformer No.:	836002311	**Gallons:**	392
Manufacturer:	RTE	**PCB's**	rtemp
Voltage:	12470/460	**% Imp.**	5.6

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	0	0
Hydrogen	9	4
Ethylene	10	1
Methane	27	2
Ethane	24	1
Carbon Monoxide	646	299
Carbon Dioxide	2455	1657
Oxygen	5580	8657
Nitrogen	43475	67461
Total Combustibles	716	307
Total Gas	52226	78081
OIL QUALITY		
Dielectric Break (kV)	38	47
Water in Fluid (ppm)	16	9
Acid Number (mg KOH/g)	0.014	0.011
Interfacial Tens.(dynes/cm)	34	34
ASTM Color	L3.5	L3.5
Visual Inspection	Pass	Pass
Specific Gravity	0.877	0.879
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	40c	40c
Pressure	npg	npg
Liquid Level	ok	
GAS DIAGNOSTICS		
Rogers Ratio		
Cellulose Ratio (CO2/CO)		
IEEE/ANSI (C57.104-1991)		

COMMENTS

No pressure guage.

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/14/00
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 6	MVA:	1.6
Transformer No.:	836002464	Gallons:	540
Manufacturer:	RTE	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.6

	Lab Used	ACTI	ACTI
DISSOLVED GASES PPM		8/24/00	8/25/00
	Acetylene	0	0
	Hydrogen	8	4
	Ethylene	13	2
	Methane	34	10
	Ethane	16	0
	Carbon Monoxide	620	363
	Carbon Dioxide	1809	1652
	Oxygen	4814	2059
	Nitrogen	42454	54285
	Total Combustibles	691	379
	Total Gas	49768	58373
OIL QUALITY			
	Dielectric Break (kV)	33	42
	Water in Fluid (ppm)	18	7
	Acid Number (mg KOH/g)	0.017	0.012
	Interfacial Tens.(dynes/cm)	35	35
	ASTM Color	L3.5	L3.5
	Visual Inspection	Pass	Pass
	Specific Gravity	0.882	0.88
OPERATING CONDITIONS			
	AmbientTemp.	80F	
	Winding Temp.		
	Liquid Temp.	40c	40c
	Pressure	npg	npg
	Liquid Level	ok	
GAS DIAGNOSTICS			
	Rogers Ratio		
	Cellulose Ratio (CO2/CO)		
	IEEE/ANSI (C57.104-1991)		

COMMENTS

No pressure guage.

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	**Date:**	9/14/00
Address:	5555 N Channel Blvd. PDX	**Report by**	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	**Class:**	
Substation/Site:	Berth 308	**MVA:**	0.3
Transformer No.:	H425083M68	**Gallons:**	122
Manufacturer:	GE	**PCB's**	no data
Voltage:	13200/480	**% Imp.**	1.71

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	0	0
Hydrogen	21	15
Ethylene	117	37
Methane	30	12
Ethane	15	2
Carbon Monoxide	650	510
Carbon Dioxide	4198	3711
Oxygen	55425	9215
Nitrogen	46437	68927
Total Combustibles	833	576
Total Gas	56893	82428
OIL QUALITY		
Dielectric Break (kV)	50	49
Water in Fluid (ppm)	19	13
Acid Number (mg KOH/g)	0.018	0.012
Interfacial Tens.(dynes/cm)	30	30
ASTM Color	L2.0	L1.5
Visual Inspection	Pass	Pass
Specific Gravity	0.887	0.887
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	30c	32c
Pressure	npg	npg
Liquid Level	ok	

GAS DIAGNOSTICS

Rogers Ratio 1-0-2-0 core & tank circulating currents, overheated joints

Cellulose Ratio (CO2/CO)

IEEE/ANSI (C57.104-1991) retest quaterly

COMMENTS

No pressure guage.

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/14/00
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Berth 307	MVA:	0.3
Transformer No.:	H425084M68	Gallons:	122
Manufacturer:	GE	PCB's	no data
Voltage:	13200/480	% Imp.	1.71

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	0	0
Hydrogen	26	5
Ethylene	27	4
Methane	84	23
Ethane	27	1
Carbon Monoxide	1307	666
Carbon Dioxide	4962	3833
Oxygen	5119	2245
Nitrogen	61602	62613
Total Combustibles	1466	699
Total Gas	73149	69390
OIL QUALITY		
Dielectric Break (kV)	43	53
Water in Fluid (ppm)	11	10
Acid Number (mg KOH/g)	0.011	0.009
Interfacial Tens.(dynes/cm)	31	32
ASTM Color	L1.5	L1.5
Visual Inspection	Pass	Pass
Specific Gravity	0.885	0.885
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	40c	35c
Pressure	npg	npg
Liquid Level	ok	

GAS DIAGNOSTICS

Rogers Ratio

Cellulose Ratio (CO2/CO) <7 indicates severe overheating near the insulation

IEEE/ANSI (C57.104-1991) retest quaterly

COMMENTS

Carbon Monoxide level indicates thermal decomposition of cellulose. Monitor unit.

No pressure guage.

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/14/00
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Berth 308	MVA:	0.3
Transformer No.:	H425082M68	Gallons:	122
Manufacturer:	GE	PCB's	no data
Voltage:	13200/480	% Imp.	1.71

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	0	0
Hydrogen	0	0
Ethylene	4	0
Methane	3	0
Ethane	0	0
Carbon Monoxide	133	46
Carbon Dioxide	1018	688
Oxygen	18404	20235
Nitrogen	53758	52512
Total Combustibles	140	46
Total Gas	73320	73481
OIL QUALITY		
Dielectric Break (kV)	34	38
Water in Fluid (ppm)	26	29
Acid Number (mg KOH/g)	0.012	0.018
Interfacial Tens.(dynes/cm)	24	33
ASTM Color	L1.0	L1.5
Visual Inspection	Pass	Pass
Specific Gravity	0.878	0.877
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	45c	36c
Pressure	npg	npg
Liquid Level	high	
GAS DIAGNOSTICS		
Rogers Ratio		
Cellulose Ratio (CO2/CO)		
IEEE/ANSI (C57.104-1991)		

COMMENTS

No pressure guage.

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/14/00
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 7A	MVA:	2
Transformer No.:	PQH0715	Gallons:	415
Manufacturer:		PCB's	rtemp
Voltage:	12470/460	% Imp.	5.4

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	0	0
Hydrogen	14	5
Ethylene	32	6
Methane	43	7
Ethane	27	2
Carbon Monoxide	1346	811
Carbon Dioxide	7301	4227
Oxygen	4656	2748
Nitrogen	51068	58570
Total Combustibles	1462	831
Total Gas	64487	66375
OIL QUALITY		
Dielectric Break (kV)	32	43
Water in Fluid (ppm)	24	8
Acid Number (mg KOH/g)	0.033	0.022
Interfacial Tens.(dynes/cm)	38	36
ASTM Color	L3.0	L3.0
Visual Inspection	Pass	Pass
Specific Gravity	0.881	0.884
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	45c	42c
Pressure	npg	npg
Liquid Level	high	

GAS DIAGNOSTICS

Rogers Ratio

Cellulose Ratio (CO2/CO) <7 indicates severe heating near insulation

IEEE/ANSI (C57.104-1991) retest quarterly

COMMENTS Carbon Monoxide level indicates thermal decomposition of cellulose. Monitor unit.

No pressure guage.

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	**Date:**	9/14/00
Address:	5555 N Channel Blvd. PDX	**Report by**	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	**Class:**	
Substation/Site:	Crane #11	**MVA:**	0.3
Transformer No.:	L243300	**Gallons:**	121
Manufacturer:		**PCB's**	silicone
Voltage:	2400/480	**% Imp.**	

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	0	0
Hydrogen	232	200
Ethylene	3	0
Methane	117	25
Ethane	18	0
Carbon Monoxide	1408	953
Carbon Dioxide	5743	5877
Oxygen	6514	9078
Nitrogen	66260	102299
Total Combustibles	1778	1178
Total Gas	80295	118431
OIL QUALITY		
Dielectric Break (kV)	39	36
Water in Fluid (ppm)	23	24
Acid Number (mg KOH/g)	0.007	0.005
Interfacial Tens.(dynes/cm)		
ASTM Color	L0.5	L0.5
Visual Inspection	Pass	Pass
Specific Gravity	0.965	0.971
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	45c	42c
Pressure	0	-0.5
Liquid Level	ok	
GAS DIAGNOSTICS		
Rogers Ratio		
Cellulose Ratio (CO2/CO)		
IEEE/ANSI (C57.104-1991)	retest quarterly	

COMMENTS

Apply pressure.

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	**Date:**	9/14/00
Address:	5555 N Channel Blvd. PDX	**Report by**	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	**Class:**	
Substation/Site:	Crane #14	**MVA:**	0.75
Transformer No.:	L243297	**Gallons:**	142
Manufacturer:		**PCB's**	silicone
Voltage:	2400/480	**% Imp.**	5.7

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	0	0
Hydrogen	208	501
Ethylene	4	0
Methane	122	41
Ethane	20	1
Carbon Monoxide	1224	853
Carbon Dioxide	3758	3068
Oxygen	4803	4504
Nitrogen	68964	106965
Total Combustibles	1578	1396
Total Gas	79103	115933
OIL QUALITY		
Dielectric Break (kV)	33	34
Water in Fluid (ppm)	11	26
Acid Number (mg KOH/g)	0.006	0.001
Interfacial Tens.(dynes/cm)		
ASTM Color	L0.5	L0.5
Visual Inspection	Pass	Pass
Specific Gravity	0.967	0.969
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	35c	35c
Pressure	0	-0.5
Liquid Level	ok	
GAS DIAGNOSTICS		
Rogers Ratio		
Cellulose Ratio (CO2/CO)		
IEEE/ANSI (C57.104-1991)	retest quarterly	

COMMENTS

Apply pressure.

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	**Date:**	9/14/00
Address:	5555 N Channel Blvd. PDX	**Report by**	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	**Class:**	
Substation/Site:	Crane #17	**MVA:**	0.5
Transformer No.:	L243297	**Gallons:**	125
Manufacturer:		**PCB's**	silicone
Voltage:	2400/480	**% Imp.**	

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	0	0
Hydrogen	203	198
Ethylene	3	1
Methane	166	51
Ethane	31	0
Carbon Monoxide	1473	889
Carbon Dioxide	7095	5679
Oxygen	6358	5654
Nitrogen	79295	107404
Total Combustibles	1876	1139
Total Gas	94624	119876
OIL QUALITY		
Dielectric Break (kV)	36	36
Water in Fluid (ppm)	27	21
Acid Number (mg KOH/g)	0.008	0.001
Interfacial Tens.(dynes/cm)		
ASTM Color	L0.5	L0.5
Visual Inspection	Pass	Pass
Specific Gravity	0.969	0.971
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	35c	40c
Pressure	1	1.25
Liquid Level	ok	
GAS DIAGNOSTICS		
Rogers Ratio		
Cellulose Ratio (CO2/CO)		
IEEE/ANSI (C57.104-1991)	retest quarterly	

COMMENTS

Valve stem broken.

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	**Date:**	9/14/00
Address:	5555 N Channel Blvd. PDX	**Report by**	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	**Class:**	
Substation/Site:	Crane #16	**MVA:**	0.5
Transformer No.:	L243299C	**Gallons:**	125
Manufacturer:	GE	**PCB's**	silicone
Voltage:	2400/480	**% Imp.**	

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	9	0
Hydrogen	231	55
Ethylene	7	0
Methane	131	24
Ethane	21	0
Carbon Monoxide	1557	845
Carbon Dioxide	6117	5087
Oxygen	6293	12063
Nitrogen	77762	111158
Total Combustibles	1956	924
Total Gas	92128	129232
OIL QUALITY		
Dielectric Break (kV)	33	46
Water in Fluid (ppm)	25	20
Acid Number (mg KOH/g)	0.01	0.005
Interfacial Tens.(dynes/cm)		
ASTM Color	L0.5	L0.5
Visual Inspection	Pass	Pass
Specific Gravity	0.968	0.974
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	40c	45c
Pressure	0	0.5
Liquid Level	ok	

GAS DIAGNOSTICS

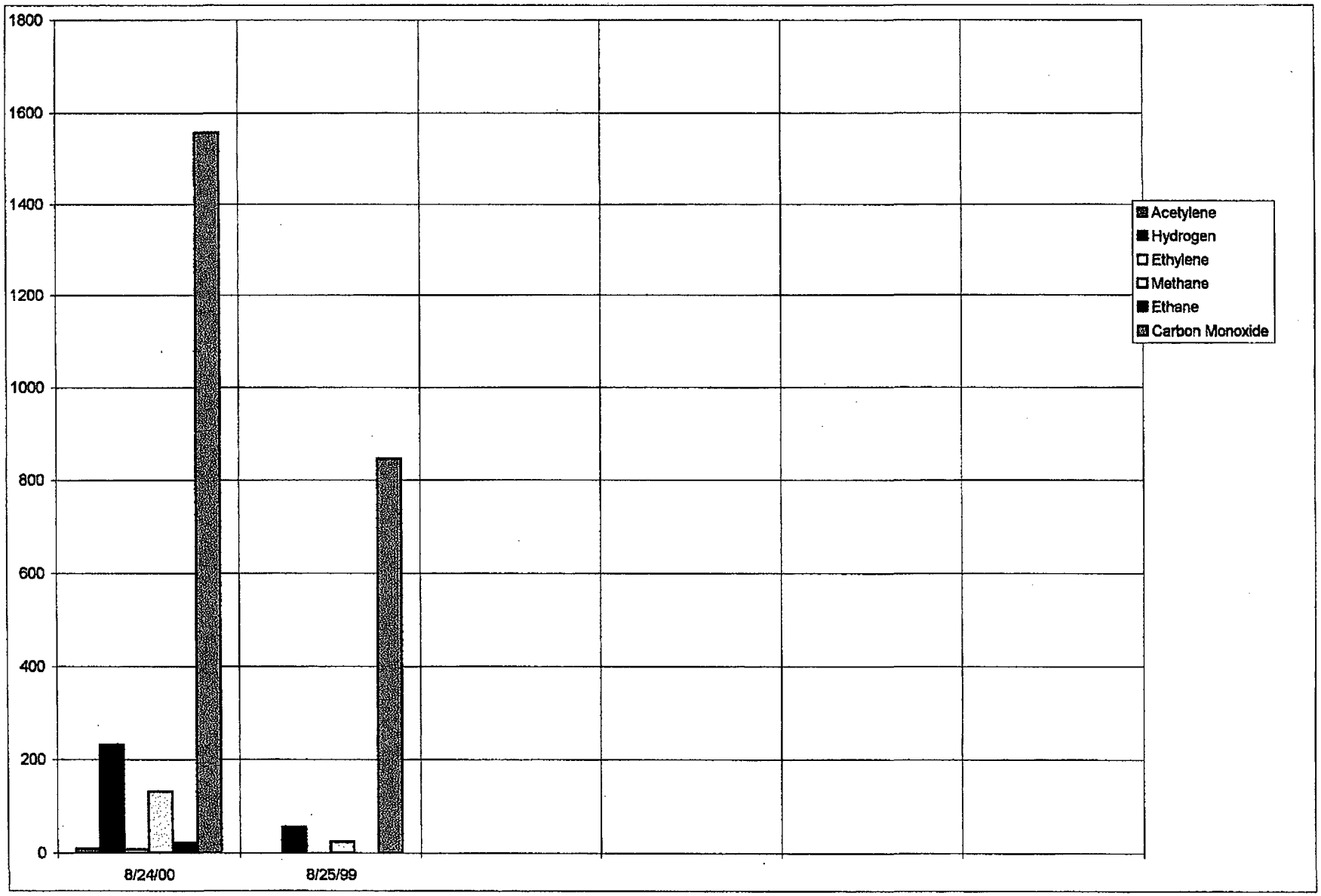
Rogers Ratio 0-0-0-1 flashover, no power through

Cellulose Ratio (CO2/CO)

IEEE/ANSI (C57.104-1991) retest monthly

COMMENTS

This unit is a concern based on rise in combustible gas levels.
Consider additional testing/inspection.
Apply pressure.


1800
1600
1400
1200
1000
800
600
400
200
0
8/24/00
8/25/99
Acetylene
Hydrogen
Ethylene
Methane
Ethane
Carbon Monoxide

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	**Date:**	9/14/00
Address:	5555 N Channel Blvd. PDX	**Report by**	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	**Class:**	
Substation/Site:	Crane #15	**MVA:**	0.5
Transformer No.:	L243299A	**Gallons:**	125
Manufacturer:	GE	**PCB's**	silicone
Voltage:	2400/480	**% Imp.**	5.18

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	0	0
Hydrogen	265	132
Ethylene	4	0
Methane	113	40
Ethane	27	1
Carbon Monoxide	1473	1211
Carbon Dioxide	5545	5493
Oxygen	4649	5763
Nitrogen	67429	117171
Total Combustibles	1882	1384
Total Gas	79505	129723
OIL QUALITY		
Dielectric Break (kV)	37	35
Water in Fluid (ppm)	13	29
Acid Number (mg KOH/g)	0.007	0.001
Interfacial Tens.(dynes/cm)		
ASTM Color	L0.5	L0.5
Visual Inspection	Pass	Pass
Specific Gravity	0.968	0.973
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	35c	
Pressure	0	0.5
Liquid Level	ok	
GAS DIAGNOSTICS		
Rogers Ratio		
Cellulose Ratio (CO2/CO)		
IEEE/ANSI (C57.104-1991)	retest quarterly	

COMMENTS

Apply pressure.

ENGINEERED SUBSTATION SERVICES INC.

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(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	**Date:**	9/14/00
Address:	5555 N Channel Blvd. PDX	**Report by**	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	**Class:**	
Substation/Site:	Crane #12	**MVA:**	0.75
Transformer No.:	L243298	**Gallons:**	125
Manufacturer:	GE	**PCB's**	silicone
Voltage:	2400/480	**% Imp.**	5.64

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/26/99
Acetylene	0	0
Hydrogen	243	109
Ethylene	4	0
Methane	138	43
Ethane	22	2
Carbon Monoxide	1309	995
Carbon Dioxide	3751	3893
Oxygen	6243	6584
Nitrogen	66640	112328
Total Combustibles	1716	1149
Total Gas	78350	123954
OIL QUALITY		
Dielectric Break (kV)	33	37
Water in Fluid (ppm)	12	22
Acid Number (mg KOH/g)	0.005	0.002
Interfacial Tens.(dynes/cm)		
ASTM Color	L0.5	L0.5
Visual Inspection	Pass	Pass
Specific Gravity	0.971	0.973
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	35c	
Pressure	0	0.5
Liquid Level	ok	
GAS DIAGNOSTICS		
Rogers Ratio		
Cellulose Ratio (CO2/CO)		
IEEE/ANSI (C57.104-1991)	retest quarterly	

COMMENTS

Apply pressure.

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	**Date:**	9/14/00
Address:	5555 N Channel Blvd. PDX	**Report by**	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	**Class:**	
Substation/Site:	Building 73	**MVA:**	0.5
Transformer No.:	PCT83390101	**Gallons:**	141
Manufacturer:	West.	**PCB's**	cert.non
Voltage:	12470/480	**% Imp.**	5.86

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	0	0
Hydrogen	37	9
Ethylene	2	9
Methane	51	5
Ethane	6	0
Carbon Monoxide	1347	680
Carbon Dioxide	6940	4699
Oxygen	3837	8862
Nitrogen	59584	71937
Total Combustibles	1443	694
Total Gas	71804	86182
OIL QUALITY		
Dielectric Break (kV)	43	49
Water in Fluid (ppm)	6	16
Acid Number (mg KOH/g)	0.033	0.038
Interfacial Tens.(dynes/cm)	27	27
ASTM Color	L1.0	L1.0
Visual Inspection	Pass	Pass
Specific Gravity	0.876	0.871
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	35c	40c
Pressure	0	0.5
Liquid Level	ok	

GAS DIAGNOSTICS

Rogers Ratio

Cellulose Ratio (CO2/CO) <7 indicates severe overheating near insulation

IEEE/ANSI (C57.104-1991) retest quarterly

COMMENTS

Apply pressure.

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/14/00
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Building 73	MVA:	0.5
Transformer No.:	PAT80910101	Gallons:	141
Manufacturer:	West.	PCB's	cert.non
Voltage:	12470/480	% Imp.	5.77

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/99	8/25/99
Acetylene	0	0
Hydrogen	42	7
Ethylene	2	0
Methane	56	6
Ethane	8	0
Carbon Monoxide	1391	645
Carbon Dioxide	6001	3473
Oxygen	3564	11258
Nitrogen	65093	81355
Total Combustibles	1499	658
Total Gas	76157	96744
OIL QUALITY		
Dielectric Break (kV)	35	47
Water in Fluid (ppm)	8	11
Acid Number (mg KOH/g)	0.027	0.028
Interfacial Tens.(dynes/cm)	28	28
ASTM Color	L1.5	L1.0
Visual Inspection	Pass	Pass
Specific Gravity	0.873	0.871
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	40c	40c
Pressure	0	0
Liquid Level	ok	

GAS DIAGNOSTICS

Rogers Ratio

Cellulose Ratio (CO2/CO) <7 indicates severe overheating near insulation

IEEE/ANSI (C57.104-1991) retest quarterly

COMMENTS

Apply pressure.

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	**Date:**	9/14/00
Address:	5555 N Channel Blvd. PDX	**Report by**	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	**Class:**	
Substation/Site:	BWTP	**MVA:**	0.75
Transformer No.:	PCT786301	**Gallons:**	179
Manufacturer:	West.	**PCB's**	cert.non
Voltage:	12470/480	**% Imp.**	6.24

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	0	0
Hydrogen	0	0
Ethylene	1	0
Methane	2	0
Ethane	0	0
Carbon Monoxide	38	0
Carbon Dioxide	553	412
Oxygen	17164	22184
Nitrogen	47659	46262
Total Combustibles	41	0
Total Gas	65417	68858
OIL QUALITY		
Dielectric Break (kV)	30	53
Water in Fluid (ppm)	8	24
Acid Number (mg KOH/g)	0.047	0.041
Interfacial Tens.(dynes/cm)	26	25
ASTM Color	L1.5	L1.5
Visual Inspection	Pass	Pass
Specific Gravity	0.885	0.887
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	30c	40c
Pressure	0	0
Liquid Level	ok	
GAS DIAGNOSTICS		
Rogers Ratio		
Cellulose Ratio (CO2/CO)		
IEEE/ANSI (C57.104-1991)		

COMMENTS

Apply pressure.

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/14/00
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 8A	MVA:	2
Transformer No.:	PQH-0714	Gallons:	451
Manufacturer:		PCB's	rtemp
Voltage:	12470/460	% tmp.	5.4

Lab Used	*ACTI*	*ACTI*
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	0	0
Hydrogen	5	3
Ethylene	19	1
Methane	30	2
Ethane	18	1
Carbon Monoxide	885	574
Carbon Dioxide	4642	3431
Oxygen	4326	3520
Nitrogen	47229	63510
Total Combustibles	957	581
Total Gas	57139	71043
OIL QUALITY		
Dielectric Break (kV)	34	50
Water in Fluid (ppm)	5	16
Acid Number (mg KOH/g)	0.02	0.017
Interfacial Tens.(dynes/cm)	38	38
ASTM Color	L2.5	L2.5
Visual Inspection	Pass	Pass
Specific Gravity	0.883	0.887
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	45C	46c
Pressure		0
Liquid Level	ok	
GAS DIAGNOSTICS		
Rogers Ratio		
Cellulose Ratio (CO2/CO)		
IEEE/ANSI (C57.104-1991)	retest quarterly	

COMMENTS

Tap changer leaking.

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	**Date:**	9/14/00
Address:	5555 N Channel Blvd. PDX	**Report by**	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	**Class:**	
Substation/Site:	Portable	**MVA:**	2.5
Transformer No.:	PO15676	**Gallons:**	415
Manufacturer:	GE	**PCB's**	silicone
Voltage:	12470/460	**% Imp.**	5.38

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	0	0
Hydrogen	127	30
Ethylene	2	0
Methane	120	11
Ethane	12	0
Carbon Monoxide	1900	1011
Carbon Dioxide	6650	4294
Oxygen	4489	25625
Nitrogen	77976	154314
Total Combustibles	2161	1052
Total Gas	91276	185286
OIL QUALITY		
Dielectric Break (kV)	34	33
Water In Fluid (ppm)	21	30
Acid Number (mg KOH/g)	0.025	0.002
Interfacial Tens.(dynes/cm)		
ASTM Color	L0.5	L0.5
Visual Inspection	Pass	Pass
Specific Gravity	0.97	0.976
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	43c	45c
Pressure	npg	
Liquid Level	ok	

GAS DIAGNOSTICS

Rogers Ratio

Cellulose Ratio (CO2/CO)

IEEE/ANSI (C57.104-1991) retest monthly

COMMENTS

Monitor rise in carbon monoxide and carbon dioxide.

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

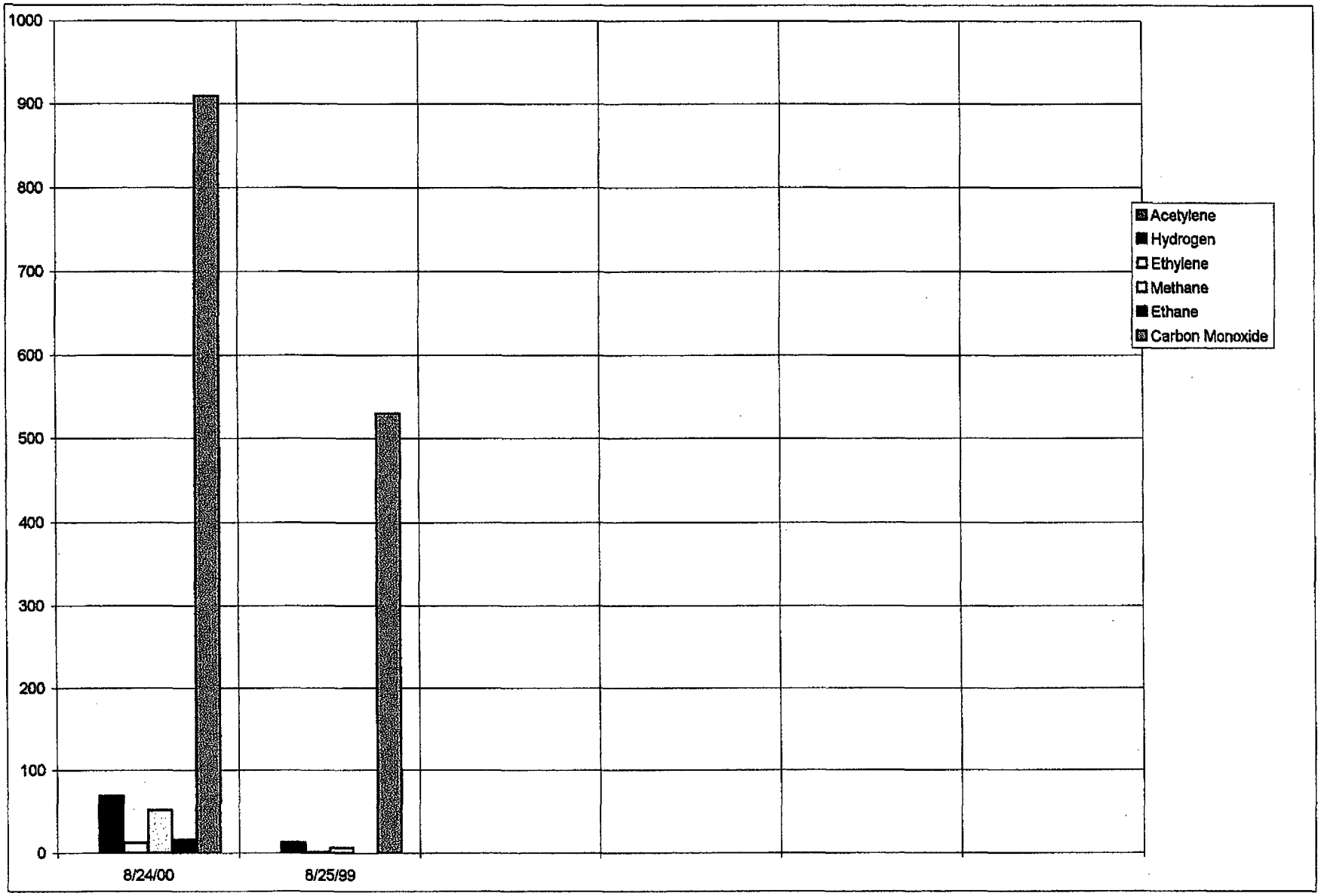
Customer:	Cascade General Shipyard	**Date:**	9/14/00
Address:	5555 N Channel Blvd. PDX	**Report by**	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	**Class:**	
Substation/Site:	Portable 32-4	**MVA:**	2
Transformer No.:	87V1244	**Gallons:**	600
Manufacturer:	Vantram	**PCB's**	rtemp
Voltage:	12470/460	**% Imp.**	5.7

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	0	c
Hydrogen	69	13
Ethylene	12	1
Methane	51	6
Ethane	16	0
Carbon Monoxide	909	530
Carbon Dioxide	8021	5536
Oxygen	4906	2033
Nitrogen	47118	52353
Total Combustibles	1057	550
Total Gas	61102	60471
OIL QUALITY		
Dielectric Break (kV)	36	47
Water in Fluid (ppm)	10	17
Acid Number (mg KOH/g)	0.012	0.008
Interfacial Tens.(dynes/cm)	39	39
ASTM Color	L2.0	L2.0
Visual Inspection	Pass	Pass
Specific Gravity	0.876	0.882
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	40c	40c
Pressure	npg	
Liquid Level	ok	
GAS DIAGNOSTICS		
Rogers Ratio		
Cellulose Ratio (CO2/CO)		
IEEE/ANSI (C57.104-1991)	retest monthly	

COMMENTS

Noticeable rise in gases.

X1 leaks


1000
900
800
700
600
500
400
300
200
100
0
8/24/00
8/25/99
Acetylene
Hydrogen
Ethylene
Methane
Ethane
Carbon Monoxide

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/14/00
Address:	5565 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Portable 32-3	MVA:	2
Transformer No.:	87V1243	Gallons:	600
Manufacturer:	Vantram	PCB's	rtemp
Voltage:	12470/460	% Imp.	5.7

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	0	0
Hydrogen	18	6
Ethylene	75	14
Methane	48	10
Ethane	16	1
Carbon Monoxide	962	4501
Carbon Dioxide	6055	596
Oxygen	4850	1900
Nitrogen	49061	58342
Total Combustibles	1119	627
Total Gas	61085	65369
OIL QUALITY		
Dielectric Break (kV)	33	49
Water in Fluid (ppm)	7	13
Acid Number (mg KOH/g)	0.015	0.008
Interfacial Tens.(dynes/cm)	39	42
ASTM Color	L2.0	L2.0
Visual Inspection	Pass	Pass
Specific Gravity	0.88	0.883
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	40c	42c
Pressure	npg	
Liquid Level	ok	

GAS DIAGNOSTICS

Rogers Ratio 1-0-2-0 core & tank circulating currents, overheated joints

Cellulose Ratio (CO2/CO)

IEEE/ANSI (C57.104-1991) retest quarterly

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	**Date:**	9/14/00
Address:	5555 N Channel Blvd. PDX	**Report by**	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	**Class:**	
Substation/Site:	Sub 5	**MVA:**	1
Transformer No.:	PO14476	**Gallons:**	240
Manufacturer:	GE	**PCB's**	silicone
Voltage:	12470/460	**% Imp.**	5.5

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	0	0
Hydrogen	91	28
Ethylene	1	0
Methane	45	6
Ethane	6	0
Carbon Monoxide	1027	730
Carbon Dioxide	2846	2858
Oxygen	9121	15323
Nitrogen	61294	95893
Total Combustibles	1170	764
Total Gas	74431	114837
OIL QUALITY		
Dielectric Break (kV)	30	32
Water in Fluid (ppm)	12	26
Acid Number (mg KOH/g)	0.002	0.003
Interfacial Tens.(dynes/cm)		
ASTM Color	L0.5	L0.5
Visual Inspection	Pass	Pass
Specific Gravity	0.971	0.976
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	40c	33c
Pressure	npg	
Liquid Level	ok	
GAS DIAGNOSTICS		
Rogers Ratio		
Cellulose Ratio (CO2/CO)		
IEEE/ANSI (C57.104-1991)	retest quarterly	

COMMENTS

Needs new sample valve.

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/14/00
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 5	MVA:	1.5
Transformer No.:	PO14490	Gallons:	315
Manufacturer:	GE	PCB's	silicone
Voltage:	12470/460	% Imp.	5.54

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	0	0
Hydrogen	53	28
Ethylene	2	0
Methane	183	76
Ethane	16	1
Carbon Monoxide	659	458
Carbon Dioxide	1306	1455
Oxygen	9079	13837
Nitrogen	62881	110168
Total Combustibles	913	563
Total Gas	74179	126025
OIL QUALITY		
Dielectric Break (kV)	37	38
Water in Fluid (ppm)	19	9
Acid Number (mg KOH/g)	0.002	0.001
Interfacial Tens.(dynes/cm)		
ASTM Color	L0.5	L0.5
Visual Inspection	Pass	Pass
Specific Gravity	0.069	0.973
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	35c	33c
Pressure	npg	
Liquid Level	low	

GAS DIAGNOSTICS

Rogers Ratio 2-0-0-0 slight overheating

Cellulose Ratio (CO2/CO)

IEEE/ANSI (C57.104-1991) retest quarterly

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	**Date:**	9/14/00
Address:	5555 N Channel Blvd. PDX	**Report by**	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	**Class:**	
Substation/Site:	Sub 4	**MVA:**	1
Transformer No.:	PCT2521-0101	**Gallons:**	200
Manufacturer:	West.	**PCB's**	silicone
Voltage:	12470/460	**% Imp.**	5.94

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	0	0
Hydrogen	76	21
Ethylene	4	0
Methane	163	53
Ethane	15	0
Carbon Monoxide	2188	1612
Carbon Dioxide	9890	9722
Oxygen	7908	10872
Nitrogen	69059	103563
Total Combustibles	2446	1686
Total Gas	89303	125843
OIL QUALITY		
Dielectric Break (kV)	33	36
Water in Fluid (ppm)	16	14
Acid Number (mg KOH/g)	0.015	0.003
Interfacial Tens.(dynes/cm)		
ASTM Color	L0.5	L0.5
Visual Inspection	Pass	Pass
Specific Gravity	0.967	0.974
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	45c	50c
Pressure	0	-0.25
Liquid Level	ok	

GAS DIAGNOSTICS

Rogers Ratio 1-0-0-0 slight overheating

Cellulose Ratio (CO2/CO)

IEEE/ANSI (C57.104-1991) retest monthly

COMMENTS

Gases levels rising.

Apply pressure.

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	**Date:**	9/14/00
Address:	5555 N Channel Blvd. PDX	**Report by**	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	**Class:**	
Substation/Site:	Sub 3	**MVA:**	1.5
Transformer No.:	R277558	**Gallons:**	321
Manufacturer:		**PCB's**	silicone
Voltage:	12470/480	**% Imp.**	

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/25/00	8/25/99
Acetylene	19	0
Hydrogen	100	18
Ethylene	13	0
Methane	83	7
Ethane	13	0
Carbon Monoxide	1046	535
Carbon Dioxide	8934	730
Oxygen	13060	20371
Nitrogen	78668	102182
Total Combustibles	1274	560
Total Gas	101936	130420
OIL QUALITY		
Dielectric Break (kV)	36	37
Water in Fluid (ppm)	38	34
Acid Number (mg KOH/g)	0.005	0.003
Interfacial Tens.(dynes/cm)		
ASTM Color	L0.5	L0.5
Visual Inspection	Pass	Pass
Specific Gravity	0.969	0.973
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	40c	42c
Pressure	1.5	1.5
Liquid Level	high	

GAS DIAGNOSTICS

Rogers Ratio 0-0-1-1 Arc, with power follow-through

Cellulose Ratio (CO2/CO)

IEEE/ANSI (C57.104-1991) retest quarterly

COMMENTS

Gases levels rising. Acetylene is a concern, as well as moisture level.
Consider additional testing/inspection.

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	**Date:**	9/14/00
Address:	5555 N Channel Blvd. PDX	**Report by**	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	**Class:**	
Substation/Site:	Sub 3	**MVA:**	1
Transformer No.:	R277557	**Gallons:**	268
Manufacturer:		**PCB's**	silicone
Voltage:	12470/480	**% Imp.**	6

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	0	0
Hydrogen	0	0
Ethylene	0	0
Methane	2	0
Ethane	0	0
Carbon Monoxide	22	0
Carbon Dioxide	580	460
Oxygen	24101	43478
Nitrogen	66650	97381
Total Combustibles	24	0
Total Gas	91355	141319
OIL QUALITY		
Dielectric Break (kV)	29	31
Water in Fluid (ppm)	49	42
Acid Number (mg KOH/g)	0.005	0.002
Interfacial Tens.(dynes/cm)		
ASTM Color	L0.5	L0.5
Visual Inspection	Pass	Pass
Specific Gravity	0.967	0.981
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	40c	42c
Pressure	0	-0.25
Liquid Level	high	
GAS DIAGNOSTICS		
Rogers Ratio		
Cellulose Ratio (CO2/CO)		
IEEE/ANSI (C57.104-1991)		

COMMENTS

Moisture level high, consider filtering.
Apply pressure.

ENGINEERED SUBSTATION SERVICES INC.

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Canby, Oregon 97013
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	**Date:**	9/14/00
Address:	5555 N Channel Blvd. PDX	**Report by**	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	**Class:**	
Substation/Site:	Sub 1	**MVA:**	1.5
Transformer No.:	910396-A1	**Gallons:**	345
Manufacturer:	Square D	**PCB's**	rtemp
Voltage:	12470/480	**% Imp.**	6.3

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	0	0
Hydrogen	7	3
Ethylene	81	5
Methane	46	3
Ethane	13	0
Carbon Monoxide	665	237
Carbon Dioxide	3022	1378
Oxygen	1677	3503
Nitrogen	37442	52834
Total Combustibles	812	248
Total Gas	42953	57834
OIL QUALITY		
Dielectric Break (kV)	41	41
Water in Fluid (ppm)	8	7
Acid Number (mg KOH/g)	0.029	0.027
Interfacial Tens.(dynes/cm)	36	35
ASTM Color	L3.5	L3.5
Visual Inspection	Pass	Pass
Specific Gravity	0.888	0.892
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	40c	42c
Pressure	0	0.25
Liquid Level	ok	

GAS DIAGNOSTICS

Rogers Ratio

Cellulose Ratio (CO2/CO)

IEEE/ANSI (C57.104-1991) retest quarterly

COMMENTS

Apply pressure.

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	**Date:**	9/14/00
Address:	5555 N Channel Blvd. PDX	**Report by**	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	**Class:**	
Substation/Site:	Sub 1	**MVA:**	2
Transformer No.:	910396-B1	**Gallons:**	390
Manufacturer:	Square D	**PCB's**	rtemp
Voltage:	12470/480	**% Imp.**	6.05

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	0	0
Hydrogen	5	3
Ethylene	9	0
Methane	36	3
Ethane	13	0
Carbon Monoxide	654	190
Carbon Dioxide	4147	1703
Oxygen	1711	16668
Nitrogen	33422	85265
Total Combustibles	717	196
Total Gas	39997	103832
OIL QUALITY		
Dielectric Break (kV)	39	34
Water in Fluid (ppm)	5	11
Acid Number (mg KOH/g)	0.028	0.028
Interfacial Tens.(dynes/cm)	35	36
ASTM Color	L3.5	L3.5
Visual Inspection	Pass	Pass
Specific Gravity	0.885	0.889
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	40c	42c
Pressure	0	-1
Liquid Level	ok	
GAS DIAGNOSTICS		
Rogers Ratio		
Cellulose Ratio (CO2/CO)		
IEEE/ANSI (C57.104-1991)		

COMMENTS

Apply pressure.

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/14/00
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 1	MVA:	2
Transformer No.:	910396-C1	Gallons:	390
Manufacturer:	Square D	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.75

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	0	0
Hydrogen	44	17
Ethylene	6	0
Methane	24	6
Ethane	9	0
Carbon Monoxide	550	296
Carbon Dioxide	3540	3125
Oxygen	1640	1306
Nitrogen	30201	51796
Total Combustibles	633	319
Total Gas	36014	56537
OIL QUALITY		
Dielectric Break (kV)	34	45
Water in Fluid (ppm)	2	29
Acid Number (mg KOH/g)	0.027	0.028
Interfacial Tens.(dynes/cm)	36	37
ASTM Color	L3.5	L3.5
Visual Inspection	Pass	Pass
Specific Gravity	0.884	0.885
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	40c	43c
Pressure	-1	-1
Liquid Level	ok	
GAS DIAGNOSTICS		
Rogers Ratio		
Cellulose Ratio (CO2/CO)		
IEEE/ANSI (C57.104-1991)		

COMMENTS

Apply pressure.

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
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(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	**Date:**	9/14/00
Address:	5555 N Channel Blvd. PDX	**Report by**	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	**Class:**	
Substation/Site:	Sub 7	**MVA:**	0.75
Transformer No.:	M590624TLPA	**Gallons:**	230
Manufacturer:	GE	**PCB's**	no data
Voltage:	12470/480	**% Imp.**	5.75

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	0	0
Hydrogen	73	19
Ethylene	15	1
Methane	37	5
Ethane	13	1
Carbon Monoxide	917	531
Carbon Dioxide	3797	3035
Oxygen	3874	3583
Nitrogen	37500	58715
Total Combustibles	1055	557
Total Gas	46226	65891
OIL QUALITY		
Dielectric Break (kV)	46	37
Water in Fluid (ppm)	7	17
Acid Number (mg KOH/g)	0.02	0.014
Interfacial Tens.(dynes/cm)	31	32
ASTM Color	L0.5	L0.5
Visual Inspection	Pass	Pass
Specific Gravity	0.902	0.901
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	25c	32c
Pressure	0	0
Liquid Level	ok	
GAS DIAGNOSTICS		
Rogers Ratio		
Cellulose Ratio (CO2/CO)		
IEEE/ANSI (C57.104-1991)	retest quarterly	

COMMENTS

Apply pressure.

ENGINEERED SUBSTATION SERVICES INC.

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(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	**Date:**	9/14/00
Address:	5555 N Channel Blvd. PDX	**Report by**	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	**Class:**	
Substation/Site:	Sub 8	**MVA:**	0.75
Transformer No.:	M590623TLPA	**Gallons:**	230
Manufacturer:	GE	**PCB's**	no data
Voltage:	12470/480	**% Imp.**	5.75

	Lab Used	8/25/99	
DISSOLVED GASES PPM			
	Acetylene	0	0
	Hydrogen	62	20
	Ethylene	8	1
	Methane	34	8
	Ethane	11	0
	Carbon Monoxide	836	502
	Carbon Dioxide	2748	2269
	Oxygen	3386	3246
	Nitrogen	37430	58698
	Total Combustibles	951	531
	Total Gas	44515	64744
OIL QUALITY			
	Dielectric Break (kV)	36	39
	Water In Fluid (ppm)	5	20
	Acid Number (mg KOH/g)	0.02	0.014
	Interfacial Tens.(dynes/cm)	30	31
	ASTM Color	L0.5	L0.5
	Visual Inspection	Pass	Pass
	Specific Gravity	0.898	0.898
OPERATING CONDITIONS			
	AmbientTemp.	80F	
	Winding Temp.		
	Liquid Temp.	25c	27c
	Pressure		
	Liquid Level	ok	
GAS DIAGNOSTICS			
	Rogers Ratio		
	Cellulose Ratio (CO2/CO)		
	IEEE/ANSI (C57.104-1991)	retest quarterly	

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

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Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	**Date:**	9/14/00
Address:	5555 N Channel Blvd. PDX	**Report by**	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	**Class:**	
Substation/Site:	Starboard Side Dry Dock 4	**MVA:**	3
Transformer No.:	STO49655804	**Gallons:**	535
Manufacturer:	GE	**PCB's**	rtemp
Voltage:	12470/480	**% Imp.**	6.27

Lab Used	ACTI	ACTI
DISSOLVED GASES PPM	8/24/00	8/25/99
Acetylene	0	0
Hydrogen	8	4
Ethylene	12	1
Methane	20	1
Ethane	10	0
Carbon Monoxide	492	1629
Carbon Dioxide	1660	246
Oxygen	3131	13901
Nitrogen	32808	92760
Total Combustibles	542	252
Total Gas	38141	108542
OIL QUALITY		
Dielectric Break (kV)	43	45
Water in Fluid (ppm)	9	19
Acid Number (mg KOH/g)	0.057	0.067
Interfacial Tens.(dynes/cm)	26	24
ASTM Color	G8.0	L7.5
Visual Inspection	Pass	Pass
Specific Gravity	0.893	0.893
OPERATING CONDITIONS		
AmbientTemp.	80F	
Winding Temp.		
Liquid Temp.	20c	40c
Pressure	npg	
Liquid Level	low	
GAS DIAGNOSTICS		
Rogers Ratio		
Cellulose Ratio (CO2/CO)		

IEEE/ANSI (C57.104-1991) *retest quarterly*

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

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(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	6555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Dry Dock 3	MVA:	1
Transformer No.:	16121-1	Gallons:	415
Manufacturer:	Sierra	PCB's	cert.non
Voltage:	12470/480	% Imp.	

Lab Used	*JACO*	*JACO*	*ACTI*	*ACTI*
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0
Hydrogen	5	6	8	2
Ethylene	3	3	9	1
Methane	2	2	5	1
Ethane	0	1	2	0
Carbon Monoxide	236	271	463	167
Carbon Dioxide	2634	3000	2522	1597
Oxygen	8019	14222	10690	18258
Nitrogen	49272	63382	46353	64501
Total Combustibles	246	283	487	170
Total Gas	60171	80888	60062	84526
OIL QUALITY				
Dielectric Break (kV)	49.4	43.8	41	51
Water in Fluid (ppm)	11.4	10.3	4	5
Acid Number (mg KOH/g)	0.003	0.006	0.008	0.002
Interfacial Tens.(dynes/cm)	36.7	42.3	36	38
ASTM Color	1	1	L1.5	L1.0
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.877	0.0876	0.882	0.887
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	43C	36C	30c	35
Pressure	-0.2	0	-1	-0.5
Liquid Level	ok	ok	ok	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				

COMMENTS

needs pressure

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Dry Dock 3	MVA:	1.5
Transformer No.:	16745-1	Gallons:	327
Manufacturer:	Sierra	PCB's	cert.non
Voltage:	12470/480	% Imp.	

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0
Hydrogen	8	11	14	4
Ethylene	16	59	44	10
Methane	5	5	12	1
Ethane	1	1	2	0
Carbon Monoxide	499	606	817	435
Carbon Dioxide	3524	5669	4774	3862
Oxygen	3753	3488	6444	8625
Nitrogen	52432	58303	45159	58658
Total Combustibles	529	682	889	450
Total Gas	60238	68142	57266	71595
OIL QUALITY				
Dielectric Break (kV)	46.8	44.5	48	39
Water in Fluid (ppm)	16.3	15.3	16	4
Acid Number (mg KOH/g)	0.008	0.008	0.011	0.005
Interfacial Tens.(dynes/cm)	39.2	37.6	35	33
ASTM Color	1	1	L1.5	L1.0
Visual Inspection	pass	pass	pass	pass
Specific Gravity	0.8774	0.08755	0.883	0.882
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	52c	54C	45c	50c
Pressure	-0.5	-1	-1.5	-1
Liquid Level	ok	ok	ok	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				

COMMENTS

needs pressure

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Dry Dock 3	MVA:	1
Transformer No.:	16121-3	Gallons:	415
Manufacturer:	Sierra	PCB's	cert.non
Voltage:	12470/480	% Imp.	

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	35	16	23	0
Hydrogen	86	53	60	10
Ethylene	758	472	463	80
Methane	284	177	161	34
Ethane	93	53	103	6
Carbon Monoxide	274	282	489	220
Carbon Dioxide	2815	2846	2660	1525
Oxygen	7615	11160	10060	16273
Nitrogen	54980	57721	46183	64986
Total Combustibles	1530	1053	1319	350
Total Gas	66940	72780	60122	83135
OIL QUALITY				
Dielectric Break (kV)	30	40	32	48
Water in Fluid (ppm)	39.8	22.2	22	16
Acid Number (mg KOH/g)	0.006	0.0008	0.005	0.003
Interfacial Tens.(dynes/cm)	41.7	39.1	36	35
ASTM Color	1	1	L1.5	L1.0
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.876	0.8754	0.884	0.877
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	40C	35C	30c	35c
Pressure	0.5	0	-1	0
Liquid Level	ok	ok	ok	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				

COMMENTS

this has concerns - obvious gassing issue not effecting insulation - possible bad tap changer or lead connection - moisture level has increased

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	32-1	MVA:	2.5
Transformer No.:	79F835	Gallons:	488
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	11400/480	% Imp.	6.4

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	1	1	2	0
Hydrogen	6	4	3	3
Ethylene	31	34	72	42
Methane	7	11	8	1
Ethane	4	5	17	3
Carbon Monoxide	93	84	180	76
Carbon Dioxide	967	1044	1348	1132
Oxygen	4756	79	11213	14614
Nitrogen	40693	42924	41374	48525
Total Combustibles	142	139	282	125
Total Gas	46558	44186	54217	64396
OIL QUALITY				
Dielectric Break (kV)	37.8	37.8	39	44
Water in Fluid (ppm)	26.2	26.5	19	19
Acid Number (mg KOH/g)	0.04	0.042	0.047	0.038
Interfacial Tens.(dynes/cm)	34.4	34	27	28
ASTM Color	5.5	5.5	G8.0	L5.0
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.878	0.8775	0.894	0.888
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	54C	50C	50c	45c
Pressure	0	0	1.5	2
Liquid Level	HIGH	HIGH	ok	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				

COMMENTS

UNITS NEEDS PRESSURE

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 4-5	MVA:	0.33
Transformer No.:	79F6705	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0
Hydrogen	5	4	12	4
Ethylene	1	2	9	1
Methane	6	9	17	5
Ethane	6	11	19	4
Carbon Monoxide	77	66	243	117
Carbon Dioxide	1354	1217	2594	2384
Oxygen	116	62	4640	2316
Nitrogen	37435	32068	4640	53131
Total Combustibles	95	92	300	131
Total Gas	39000	33439	50838	57961
OIL QUALITY				
Dielectric Break (kV)	38	38.7	39	46
Water in Fluid (ppm)	20.9	21.3	12	27
Acid Number (mg KOH/g)	0.023	0.025	0.029	0.029
Interfacial Tens.(dynes/cm)	37.8	37	29	28
ASTM Color	6	6	G8.0	L5.0
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.883	0.883	0.899	0.899
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	40C	38C	35c	35c
Pressure	0	0	0	0.5
Liquid Level	ok	ok	ok	ok
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				

COMMENTS

needs pressure

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
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(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 4-2	MVA:	0.33
Transformer No.:	7916702	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0
Hydrogen	15	2	0	1
Ethylene	1	1	2	0
Methane	5	7	2	0
Ethane	6	9	3	0
Carbon Monoxide	41	42	92	38
Carbon Dioxide	638	577	1005	922
Oxygen	97	77	10084	4099
Nitrogen	40879	32254	41027	42245
Total Combustibles	68	61	96	39
Total Gas	41682	32969	52215	47305
OIL QUALITY				
Dielectric Break (kV)	44.8	44.9	32	50
Water in Fluid (ppm)	19.8	17.8	14	21
Acid Number (mg KOH/g)	0.025	0.025	0.02	0.02
Interfacial Tens.(dynes/cm)	32.7	32.6	26	39
ASTM Color	5.5	5.5	L5.0	L5.0
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.884	0.8835	0.892	0.896
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	29C	18C	35c	35c
Pressure	1	0	0	0.5
Liquid Level	ok	ok	ok	ok
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 4-4	MVA:	0.33
Transformer No.:	79F6704	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	1	0	3	0
Hydrogen	7	0	7	4
Ethylene	21	2	96	26
Methane	4	1	17	7
Ethane	3	1	21	6
Carbon Monoxide	111	5	326	251
Carbon Dioxide	1931	113	2730	2011
Oxygen	97	2	4460	3101
Nitrogen	37203	1423	43393	64046
Total Combustibles	147	9	470	294
Total Gas	39378	1642	51053	69452
OIL QUALITY				
Dielectric Break (kV)	34.8	37.8	38	41
Water in Fluid (ppm)	22.7	19	9	23
Acid Number (mg KOH/g)	0.02	0.028	0.022	0.018
Interfacial Tens.(dynes/cm)	37.7	38	29	31
ASTM Color	5.5	5.5	L5.0	L5.0
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.883	0.8825	0.895	0.889
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	36C	38C	35c	35c
Pressure	0	0	0	0.5
Liquid Level	ok	ok	ok	ok
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				

COMMENTS

needs pressure

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-11	MVA:	0.33
Transformer No.:	79F6701	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0
Hydrogen	12	15	22	10
Ethylene	6	5	19	3
Methane	10	16	28	5
Ethane	10	14	21	2
Carbon Monoxide	75	113	262	145
Carbon Dioxide	2061	2727	3118	2688
Oxygen	62	70	4220	1774
Nitrogen	39662	47808	43362	47864
Total Combustibles	112	163	372	165
Total Gas	41897	50768	52072	52491
OIL QUALITY				
Dielectric Break (kV)	33.8	30	34	39
Water in Fluid (ppm)	14.5	22.4	8	14
Acid Number (mg KOH/g)	0.02	0.02	0.02	0.021
Interfacial Tens.(dynes/cm)	33	33.9	28	31
ASTM Color	5.5	5.5	G8.0	L6.0
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.886	0.886	0.897	0.892
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	40C	40C	35c	35c
Pressure	1	0	0	0.5
Liquid Level	low	ok	ok	ok
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				
COMMENTS				

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
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(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 12-2	MVA:	1
Transformer No.:	79F67112	Gallons:	316
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.5

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0
Hydrogen	3	4	6	9
Ethylene	1	4	10	1
Methane	0	5	4	0
Ethane	3	4	1	0
Carbon Monoxide	56	93	194	49
Carbon Dioxide	496	604	710	666
Oxygen	1051	67	5171	6757
Nitrogen	34960	38646	50162	47613
Total Combustibles	63	110	215	59
Total Gas	36570	39427	56258	55096
OIL QUALITY				
Dielectric Break (kV)	40.9	42.9	35	37
Water in Fluid (ppm)	43.6	27	8	20
Acid Number (mg KOH/g)	0.023	0.042	0.023	0.034
Interfacial Tens.(dynes/cm)	32	32.7	26	29
ASTM Color	L6.0	6	G8.0	L6.0
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.882	0.882	0.899	0.888
OPERATING CONDITIONS				
AmbientTemp.	70F	70F	80F	
Winding Temp.				
Liquid Temp.	40C	45C	40c	40c
Pressure	0	0	0	0.5
Liquid Level	ok	ok	ok	ok
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				

COMMENTS

moisture level has increased - needs pressure

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	6555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-3	MVA:	0.33
Transformer No.:	79F9703	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	12	15	54	0
Hydrogen	13	24	19	4
Ethylene	32	40	131	0
Methane	13	16	35	1
Ethane	5	7	10	0
Carbon Monoxide	146	139	216	118
Carbon Dioxide	1840	1982	1642	2229
Oxygen	200	71	7397	3642
Nitrogen	43047	48411	41905	60095
Total Combustibles	221	241	465	123
Total Gas	45308	50705	51409	66089
OIL QUALITY				
Dielectric Break (kV)	41.8	42.7	35	43
Water in Fluid (ppm)	22.1	20.1	6	25
Acid Number (mg KOH/g)	0.023	0.022	0.03	0.023
Interfacial Tens.(dynes/cm)	32.8	32.9	27	28
ASTM Color	5	5	L5.0	L5.0
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.881	0.881	0.894	0.89
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	43C	42C	30c	40c
Pressure	1.6	1.5	0	1
Liquid Level	ok	ok	ok	ok
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				
COMMENTS				

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 4-1	MVA:	0.33
Transformer No.:	79F9701	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0
Hydrogen	9	33	15	1
Ethylene	2	3	9	1
Methane	2	3	7	0
Ethane	0	2	4	0
Carbon Monoxide	57	75	173	50
Carbon Dioxide	463	733	716	519
Oxygen	56	105	711	6527
Nitrogen	31874	41678	26269	53768
Total Combustibles	70	116	208	52
Total Gas	32463	42632	27904	60866
OIL QUALITY				
Dielectric Break (kV)	42	42.5	44	43
Water in Fluid (ppm)	26.7	25.9	26	16
Acid Number (mg KOH/g)	0.031	0.028	0.031	0.024
Interfacial Tens.(dynes/cm)	33.5	33.4	25	28
ASTM Color	6	6	G8.0	L5.5
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.881	0.8808	0.893	0.896
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	42C	40c	40c	35c
Pressure	0	0	0	0
Liquid Level	ok	ok	ok	ok
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				

COMMENTS

needs pressure

ENGINEERED SUBSTATION SERVICES INC.

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(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-12	MVA:	0.33
Transformer No.:	79F97012	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0
Hydrogen	7	12	4	2
Ethylene	6	4	3	0
Methane	3	9	4	0
Ethane	1	10	2	0
Carbon Monoxide	85	85	137	42
Carbon Dioxide	1173	987	518	1128
Oxygen	233	94	5742	2699
Nitrogen	39298	43319	42332	52838
Total Combustibles	102	120	160	44
Total Gas	40806	41620	48742	56710
OIL QUALITY				
Dielectric Break (kV)	38.5	38.3	40	42
Water in Fluid (ppm)	38.4	40.8	34	27
Acid Number (mg KOH/g)	0.023	0.025	0.027	0.024
Interfacial Tens.(dynes/cm)	32	32.2	24	35
ASTM Color	5.5	5.5	L5.0	L5.0
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.883	0.883	0.892	0.892
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	40C	38C	30c	35c
Pressure	0	0	-3	0
Liquid Level	low	low	low	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				

COMMENTS

needs pressure

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 12-4	MVA:	1
Transformer No.:	79F6714	Gallons:	316
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/460	% Imp.	5.5

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	1	1	4	0
Hydrogen	6	5	7	4
Ethylene	45	39	145	38
Methane	30	28	82	25
Ethane	35	31	154	34
Carbon Monoxide	388	373	667	381
Carbon Dioxide	2763	3506	4173	3077
Oxygen	109	61	4595	2461
Nitrogen	43211	42245	45116	59156
Total Combustibles	505	477	1059	482
Total Gas	46588	46289	54942	65175
OIL QUALITY				
Dielectric Break (kV)	39.2	38.8	37	46
Water in Fluid (ppm)	21.5	23.1	21	26
Acid Number (mg KOH/g)	0.017	0.022	0.025	0.019
Interfacial Tens.(dynes/cm)	37.5	37.6	31	42
ASTM Color	5.5	5.5	G8.0	L5.5
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.881	0.8805	0.897	0.89
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	48C	42C	40c	35c
Pressure	2	1	0	0
Liquid Level	ok	ok	ok	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				
COMMENTS				

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 4-6	MVA:	0.33
Transformer No.:	79F6706	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/460	% Imp.	5.1

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0
Hydrogen	8	6	17	4
Ethylene	1	2	4	0
Methane	6	10	4	0
Ethane	6	11	6	0
Carbon Monoxide	103	79	145	64
Carbon Dioxide	1711	1555	1841	1654
Oxygen	194	115	8873	2452
Nitrogen	43089	65591	42355	46951
Total Combustibles	124	108	176	68
Total Gas	45118	68369	53245	51125
OIL QUALITY				
Dielectric Break (kV)	36.5	35.5	40	46
Water in Fluid (ppm)	27.3	26.4	22	19
Acid Number (mg KOH/g)	0.023	0.028	0.027	0.029
Interfacial Tens.(dynes/cm)	34.4	34.5	27	28
ASTM Color	5.5	5.5	G8.0	L5.5
Visual Inspection	*Pass*	*Pass*	*Pass*	*Pass*
Specific Gravity	0.882	0.8815	0.896	0.895
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	42C	40c	40c	35c
Pressure	3.5	0.5	0.5	0.5
Liquid Level	low	low	low	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				
COMMENTS				

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 4-9	MVA:	0.33
Transformer No.:	79F6709	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	ntemp
Voltage:	12470/460	% Imp.	5.1

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0
Hydrogen	13	21	52	27
Ethylene	3	3	14	2
Methane	11	14	40	7
Ethane	7	7	23	1
Carbon Monoxide	149	193	581	297
Carbon Dioxide	2358	3430	4425	2964
Oxygen	119	80	4863	3123
Nitrogen	40454	50300	49077	65723
Total Combustibles	183	238	710	334
Total Gas	43114	54048	59075	72144
OIL QUALITY				
Dielectric Break (kV)	40.8	40.4	39	39
Water in Fluid (ppm)	22.7	17.2	9	6
Acid Number (mg KOH/g)	0.023	0.02	0.022	0.017
Interfacial Tens.(dynes/cm)	37	37.1	31	32
ASTM Color	5.5	5.5	L5.0	L5.5
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.881	0.881	0.895	0.894
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	50C	40C	35c	35c
Pressure	0	0.5	0	0.25
Liquid Level	ok	ok	ok	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				

COMMENTS

needs pressu

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 4-10	MVA:	0.33
Transformer No.:	79F67010	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/460	% Imp.	5.1

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/1999	8/25/1999
Acetylene	0	0	0	0
Hydrogen	23	20	24	6
Ethylene	3	2	10	1
Methane	9	8	23	5
Ethane	5	4	20	4
Carbon Monoxide	119	108	280	135
Carbon Dioxide	1188	999	1260	1049
Oxygen	83	73	5009	1404
Nitrogen	49589	44424	41857	50845
Total Combustibles	159	142	357	151
Total Gas	51019	45638	48483	53449
OIL QUALITY				
Dielectric Break (kV)	34.9	34.4	41	46
Water in Fluid (ppm)	10.5	25	3	23
Acid Number (mg KOH/g)	0.011	0.02	0.02	0.01
Interfacial Tens.(dynes/cm)	36	36.1	31	31
ASTM Color	L5.0	L5.0	L5.0	L5.0
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.883	0.883	0.898	0.89
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	40C	40C	35c	38
Pressure	1	0.5	0	0
Liquid Level	ok	low	low	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				
COMMENTS				

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 4-8	MVA:	0.33
Transformer No.:	79F6708	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/460	% Imp.	5.1

Lab Used	JACO	JACO	ACTI	ATCI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	12	13	43	14
Hydrogen	34	44	56	7
Ethylene	385	435	793	318
Methane	66	75	176	58
Ethane	45	49	168	40
Carbon Monoxide	183	207	478	195
Carbon Dioxide	1852	1995	2010	1375
Oxygen	178	81	4556	1634
Nitrogen	48665	60842	44549	52821
Total Combustibles	725	823	1716	632
Total Gas	51420	63741	52831	56461
OIL QUALITY				
Dielectric Break (kV)	35	35.5	33	40
Water in Fluid (ppm)	29.7	15.5	14	11
Acid Number (mg KOH/g)	0.028	0.036	0.031	0.031
Interfacial Tens.(dynes/cm)	35.5	35.7	28	42
ASTM Color	2.5	2.5	L2.0	L2.0
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.882	0.8815	0.894	0.886
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	45C	40c	40c	33c
Pressure	1.5	1.5	-1	-1.5
Liquid Level	ok	ok	ok	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				
COMMENTS				

ENGINEERED SUBSTATION SERVICES INC.

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(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 12-1	MVA:	1
Transformer No.:	79F6711	Gallons:	316
Manufacturer:	Elect. Tech.	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.5

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2001	8/25/2001
Acetylene	0	0	0	0
Hydrogen	9	6	6	0
Ethylene	1	1	0	0
Methane	2	6	2	0
Ethane	0	6	0	0
Carbon Dioxide	575	63	77	458
Carbon Monoxide	57	577	669	42
Oxygen	708	68	12705	3557
Nitrogen	35834	40156	44877	39437
Total Combustibles	69	82	85	42
Total Gas	36986	40883	58336	43495
OIL QUALITY TESTS				
Dielectric Break	32.2	33.6	35	42
Water in Fluid	43	41.1	21	20
Acid Number	0.025	0.025	0.027	0.02
Interfacial Tens.	41.5	41.5	31	37
ASTM Color	L3.0	L3.0	L2.5	L2.5
Visual Inspection	PASS	PASS	PASS	PASS
Specific Gravity	0.874	0.8735	0.883	0.879
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	41C	37C	40C	
Pressure	0	0	0	
Liquid Level	OK	LOW	OK	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				

COMMENTS

needs pressure

ENGINEERED SUBSTATION SERVICES INC.

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(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Dry Dock	MVA:	1
Transformer No.:	771382	Gallons:	310
Manufacturer:		PCB's	cert-non
Voltage:		% Imp.	

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	25	25	96	23
Hydrogen	36	34	45	9
Ethylene	8	7	23	2
Methane	21	20	29	8
Ethane	4	4	14	0
Carbon Monoxide	473	437	604	240
Carbon Dioxide	3652	4637	3964	2148
Oxygen	4645	8500	9375	10799
Nitrogen	57089	60561	48206	61624
Total Combustibles	567	527	811	282
Total Gas	65953	74225	62356	74852
OIL QUALITY				
Dielectric Break (kV)	46.9	45.4	44	50
Water in Fluid (ppm)	20.5	12.5	5	13
Acid Number (mg KOH/g)	0.003	0.011	0.002	0.002
Interfacial Tens.(dynes/cm)	45.9	48.6	41	38
ASTM Color	0.5	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.8785	0.8785	0.886	0.883
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	54C	47C	40C	60C
Pressure	0	0	0	0.25
Liquid Level	ok	ok	ok	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				

COMMENTS

needs pressure

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	C.U.S.	MVA:	1.5
Transformer No.:	SBV567601	Gallons:	259
Manufacturer:	West.	PCB's	cert-non
Voltage:	12470/240	% Imp.	5.5

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0
Hydrogen	8	11	15	5
Ethylene	17	19	67	20
Methane	10	11	25	4
Ethane	1	2	6	0
Carbon Monoxide	381	492	765	375
Carbon Dioxide	3077	3569	3399	2534
Oxygen	613	517	4625	3174
Nitrogen	69414	88262	52421	61525
Total Combustibles	417	535	878	404
Total Gas	73521	92883	67637	67637
OIL QUALITY				
Dielectric Break (kV)	43.2	45.1	42	49
Water in Fluid (ppm)	7.4	4	2	8
Acid Number (mg KOH/g)	0.017	0.025	0.028	0.02
Interfacial Tens.(dynes/cm)	35.9	37.1	31	32
ASTM Color	1.5	L2.0	L2.0	L1.5
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.8725	0.8715	0.881	0.883
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	45C	35C	40c	40C
Pressure	5	4.5	0	0.25
Liquid Level	ok	ok	ok	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				
COMMENTS				

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	C.U.S.	MVA:	1.5
Transformer No.:	SBV567602	Gallons:	259
Manufacturer:	West.	PCB's	cert-non
Voltage:	12470/240	% Imp.	5.47

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0
Hydrogen	9	11	25	7
Ethylene	28	33	113	24
Methane	9	11	30	3
Ethane	1	2	6	24
Carbon Monoxide	555	750	1204	719
Carbon Dioxide	4150	8100	8179	6154
Oxygen	4481	4819	7605	8665
Nitrogen	55090	67128	50096	67269
Total Combustibles	602	807	1378	753
Total Gas	64303	80854	67258	82842
OIL QUALITY				
Dielectric Break (kV)	43.6	45.6	39	49
Water in Fluid (ppm)	8.5	2.3	5	10
Acid Number (mg KOH/g)	0.014	0.008	0.023	0.018
Interfacial Tens.(dynes/cm)	34.3	34.3	30	30
ASTM Color	1.5	L1.5	L1.5	L1.5
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.8725	0.8715	0.875	0.887
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	45C	40C	40c	40C
Pressure	1	0.5	0	0.5
Liquid Level	ok	ok	ok	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
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(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	C.U.S.	MVA:	1.5
Transformer No.:	SBV567604	Gallons:	259
Manufacturer:	West.	PCB's	cert-non
Voltage:	12470/240	% Imp.	5.47

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0
Hydrogen	10	13	38	6
Ethylene	21	27	124	23
Methane	10	12	43	4
Ethane	2	2	9	0
Carbon Monoxide	559	659	1273	479
Carbon Dioxide	3659	4586	6061	3031
Oxygen	540	758	4599	4430
Nitrogen	69395	84601	64589	60212
Total Combustibles	602	713	1487	512
Total Gas	74196	90658	76736	68186
OIL QUALITY				
Dielectric Break (kV)	44.6	43.5	45	50
Water in Fluid (ppm)	5.1	4.6	2	7
Acid Number (mg KOH/g)	0.023	0.025	0.021	0.021
Interfacial Tens.(dynes/cm)	44.6	35.4	31	30
ASTM Color	1.5	L2.0	L2.0	L1.5
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.8725	0.872	0.882	0.876
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	45C	37C	35c	40C
Pressure	4.2	4	-0.5	0
Liquid Level	ok	ok	ok	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				
COMMENTS				

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	C.U.S.	MVA:	1.5
Transformer No.:	SBV567603	Gallons:	259
Manufacturer:	West.	PCB's	cert-non
Voltage:	12470/240	% Imp.	5.51

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0
Hydrogen	11	13	12	8
Ethylene	24	22	62	20
Methane	11	11	24	7
Ethane	2	2	5	0
Carbon Monoxide	542	673	846	624
Carbon Dioxide	3609	4435	3542	3828
Oxygen	556	863	5320	2350
Nitrogen	70667	87451	44842	62237
Total Combustibles	590	721	949	659
Total Gas	73422	93460	54653	69074
OIL QUALITY				
Dielectric Break (kV)	49.4	40.4	40	47
Water in Fluid (ppm)	5.7	8	6	9
Acid Number (mg KOH/g)	0.023	0.022	0.03	0.019
Interfacial Tens.(dynes/cm)	36.7	36.9	31	37
ASTM Color	1.5	L2.0	L2.0	L1.5
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.8732	0.8725	0.88	0.877
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	42C	33C	30c	35c
Pressure	5.2	5	-1	-0.75
Liquid Level	ok	ok	ok	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				
COMMENTS				

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	C.U.S.	MVA:	1
Transformer No.:	PAT716001	Gallons:	224
Manufacturer:	West.	PCB's	cert-non
Voltage:	12470/480	% Imp.	5.81

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0
Hydrogen	16	12	19	8
Ethylene	15	17	48	14
Methane	11	11	26	6
Ethane	2	2	5	0
Carbon Monoxide	488	536	827	595
Carbon Dioxide	3315	3834	3024	3116
Oxygen	182	230	5555	2541
Nitrogen	68969	75203	47669	68869
Total Combustibles	531	578	925	623
Total Gas	72997	79845	57173	75150
OIL QUALITY				
Dielectric Break (kV)	45.6	39.4	48	49
Water in Fluid (ppm)	6.8	3.4	4	10
Acid Number (mg KOH/g)	0.023	0.034	0.028	0.022
Interfacial Tens.(dynes/cm)	34.3	35.4	31	29
ASTM Color	1.5	2	L1.5	L1.5
Visual Inspection	Pass	2	Pass	Pass
Specific Gravity	0.8725	0.873	0.878	0.876
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	36C	21C	30C	20C
Pressure	4	3	-1	-0.5
Liquid Level	ok	ok	ok	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-7	MVA:	0.33
Transformer No.:	79F67097	Gallons:	176
Manufacturer:	Elect. Tech.	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/25/2000
Acetylene	0	0	0
Hydrogen	31	6	3
Ethylene	1	1	0
Methane	4	11	14
Ethane	3	13	13
Carbon Dioxide	605	513	1129
Carbon Monoxide	62	56	88
Oxygen	81	113	2829
Nitrogen	37234	40010	55237
Total Combustibles	101	87	118
Total Gas	38021	40723	59313
OIL QUALITY TESTS			
Dielectric Break	41.8	41.6	46
Water in Fluid	36.6	29.9	26
Acid Number	0.023	0.036	0.024
Interfacial Tens.	34.9	34.6	28
ASTM Color	5.5	5.5	L5.0
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.883	0.883	0.891
OPERATING CONDITIONS			
AmbientTemp.	90F	70F	
Winding Temp.			
Liquid Temp.	40C	35C	
Pressure	0	0	
Liquid Level		OK	
GAS DIAGNOSTICS			
Rogers Ratio			
Cellulose Ratio (CO2/CO)			
IEEE/ANSI (C57.104-1991)			

COMMENTS

Apply pressure.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ed Barrow/Ken Swingle	Class:	
Substation/Site:	Sub 4	MVA:	1.5
Transformer No.:	P008188	Gallons:	295
Manufacturer:	GE	PCB's	silicone
Voltage:	12470/480	% Imp.	

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0
Hydrogen	56	65	70	35
Ethylene	1	1	4	0
Methane	30	32	57	25
Ethane	2	2	6	0
Carbon Monoxide	879	980	963	887
Carbon Dioxide	4254	4672	2850	4012
Oxygen	1409	4772	6509	6046
Nitrogen	98789	117878	55553	110799
Total Combustibles	968	1080	1100	947
Total Gas	105420	128402	65012	1211804
OIL QUALITY				
Dielectric Break (kV)	50.4	44.2	33	38
Water in Fluid (ppm)	13.4	10.9	12	16
Acid Number (mg KOH/g)	0.006	0.008	0.01	0.003
Interfacial Tens.(dynes/cm)	43.7	43.7		
ASTM Color	0	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.9618	0.9615	0.977	0.976
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	45C	42C	40C	35C
Pressure		npg	npg	npg
Liquid Level	high	high	high	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 6	MVA:	1
Transformer No.:	836002311	Gallons:	392
Manufacturer:	RTE	PCB's	rtemp
Voltage:	12470/460	% Imp.	5.6

Lab Used	JACO	JACO	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/25/1999
Acetylene	0	0	0
Hydrogen	9	7	4
Ethylene	3	3	1
Methane	12	12	2
Ethane	6	6	1
Carbon Monoxide	394	421	1657
Carbon Dioxide	*2622*	*2676*	*299*
Oxygen	64	71	8657
Nitrogen	47270	51466	67461
Total Combustibles	424	449	307
Total Gas	50280	54662	78081
OIL QUALITY			
Dielectric Break (kV)	34.9	41	47
Water in Fluid (ppm)	15.1	21.3	9
Acid Number (mg KOH/g)	0.02	0.018	0.011
Interfacial Tens.(dynes/cm)	40.5	37.2	34
ASTM Color	3	3	L3.5
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.873	0.873	0.879
OPERATING CONDITIONS			
AmbientTemp.	80F	70F	
Winding Temp.			
Liquid Temp.	50C	52C	
Pressure		NG	
Liquid Level	OK		
GAS DIAGNOSTICS			
Rogers Ratio			
Cellulose Ratio (CO2/CO)			
IEEE/ANSI (C57.104-1991)			

COMMENTS

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 6	MVA:	1.5
Transformer No.:	836002464	Gallons:	540
Manufacturer:	RTE	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.6

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/2000
Acetylene	0	0	0	0
Hydrogen	13	5	8	4
Ethylene	4	4	13	2
Methane	14	15	34	10
Ethane	4	4	16	0
Carbon Monoxide	353	377	620	363
Carbon Dioxide	1849	1703	1809	1652
Oxygen	126	60	4814	2059
Nitrogen	44029	48969	42454	54285
Total Combustibles	388	405	691	379
Total Gas	46392	51137	49768	58373
OIL QUALITY				
Dielectric Break (kV)	34.9	45.2	33	42
Water in Fluid (ppm)	16.3	21.3	18	7
Acid Number (mg KOH/g)	0.011	0.02	0.017	0.012
Interfacial Tens.(dynes/cm)	39.1	36.5	35	35
ASTM Color	3	3	L3.5	L3.5
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.872	0.872	0.882	0.88
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	40C	37C	40c	40c
Pressure	npg	npg	npg	npg
Liquid Level	ok	ok	ok	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				

COMMENTS

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Berth 308	MVA:	0.3
Transformer No.:	H425083M68	Gallons:	122
Manufacturer:	GE	PCB's	no data
Voltage:	13200/480	% Imp.	1.71

	Lab Used	JACO	ACTI
DISSOLVED GASES PPM		8/12/2002	8/25/1999
Acetylene		0	0
Hydrogen		4	15
Ethylene		31	37
Methane		6	12
Ethane		3	2
Carbon Monoxide		106	510
Carbon Dioxide		3180	3711
Oxygen		12749	9215
Nitrogen		48905	68927
Total Combustibles		150	576
Total Gas		64984	82428
OIL QUALITY			
Dielectric Break (kV)		49.2	49
Water in Fluid (ppm)		6.3	13
Acid Number (mg KOH/g)		0.017	0.012
Interfacial Tens.(dynes/cm)		36.2	30
ASTM Color		1.5	L1.5
Visual Inspection		Pass	Pass
Specific Gravity		0.8805	0.887
OPERATING CONDITIONS			
AmbientTemp.		80F	
Winding Temp.			
Liquid Temp.		39C	32C
Pressure			npg
Liquid Level		ok	
GAS DIAGNOSTICS			
Rogers Ratio			
Cellulose Ratio (CO2/CO)			
IEEE/ANSI (C57.104-1991)			
COMMENTS			

	32C
	npg

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Berth 307	MVA:	0.3
Transformer No.:	H425084M68	Gallons:	122
Manufacturer:	GE	PCB's	no data
Voltage:	12470/480	% Imp.	1.71

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0
Hydrogen	10	11	26	5
Ethylene	7	7	27	4
Methane	26	28	84	23
Ethane	5	5	27	1
Carbon Monoxide	745	812	1307	666
Carbon Dioxide	3539	4614	4962	3833
Oxygen	81	106	5119	2245
Nitrogen	62736	66237	61602	62613
Total Combustibles	793	863	1466	699
Total Gas	67149	71820	73149	69390
OIL QUALITY				
Dielectric Break (kV)	52.2	44.7	43	53
Water in Fluid (ppm)	6.3	3.4	11	10
Acid Number (mg KOH/g)	0.011	0.014	0.011	0.009
Interfacial Tens.(dynes/cm)	38.5	37.2	31	32
ASTM Color	1	L1.5	L1.5	L1.5
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.8804	0.88	0.885	0.885
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	46C	36C	40C	35C
Pressure		npg	npg	npg
Liquid Level	ok	ok	ok	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				
COMMENTS				

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5565 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Berth 306	MVA:	0.3
Transformer No.:	H425082M68	Gallons:	122
Manufacturer:	GE	PCB's	no data
Voltage:	13200/480	% Imp.	1.71

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0
Hydrogen	0	1	0	0
Ethylene	2	2	4	0
Methane	1	1	3	0
Ethane	0	0	0	0
Carbon Monoxide	30	33	133	46
Carbon Dioxide	884	884	1018	688
Oxygen	15456	22095	18404	20235
Nitrogen	49169	51645	53758	52512
Total Combustibles	33	37	140	46
Total Gas	65542	74661	73320	73481
OIL QUALITY				
Dielectric Break (kV)	49.9	43.7	34	38
Water in Fluid (ppm)	35.8	25	26	29
Acid Number (mg KOH/g)	0.008	0.014	0.012	0.018
Interfacial Tens.(dynes/cm)	37.9	38.2	24	33
ASTM Color	L1.5	L1.5	L1.0	L1.5
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.8735	0.874	0.878	0.877
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	51C	40C	45C	36C
Pressure		npg	npg	npg
Liquid Level	high	high	high	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				
COMMENTS				

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 7A	MVA:	2
Transformer No.:	PQH0715	Gallons:	415
Manufacturer:		PCB's	rtemp
Voltage:	12470/460	% Imp.	5.4

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0
Hydrogen	7	6	14	5
Ethylene	8	7	32	6
Methane	16	16	43	7
Ethane	6	5	27	2
Carbon Monoxide	777	856	1346	811
Carbon Dioxide	3401	5619	7301	4227
Oxygen	55	81	4656	2748
Nitrogen	47037	52630	51068	58570
Total Combustibles	813	889	1462	831
Total Gas	51306	59219	64487	66375
OIL QUALITY				
Dielectric Break (kV)	39.5	39.2	32	43
Water in Fluid (ppm)	12.8	14.4	24	8
Acid Number (mg KOH/g)	0.02	0.014	0.033	0.022
Interfacial Tens.(dynes/cm)	37.7	37.6	38	36
ASTM Color	L3.0	L3.0	L3.0	L3.0
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.873	0.8725	0.881	0.884
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	55C	44C	45c	42c
Pressure	npg	npg	npg	npg
Liquid Level	ok		high	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Crane #14	MVA:	0.75
Transformer No.:	L243297	Gallons:	142
Manufacturer:		PCB's	silicone
Voltage:	2400/480	% Imp.	5.7

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0
Hydrogen	168	174	208	501
Ethylene	1	1	4	0
Methane	51	56	122	41
Ethane	5	6	20	1
Carbon Monoxide	941	1054	1224	853
Carbon Dioxide	4392	4861	3758	3068
Oxygen	1018	1881	4803	4504
Nitrogen	100744	110743	68964	106965
Total Combustibles	1166	1291	1578	1396
Total Gas	107320	118776	79103	115933
OIL QUALITY				
Dielectric Break (kV)	47.3	46.7	33	34
Water in Fluid (ppm)	21.6	11	11	26
Acid Number (mg KOH/g)	0.008	0.008	0.006	0.001
Interfacial Tens.(dynes/cm)				
ASTM Color	0	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.9638	0.963	0.967	0.969
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	39C	40C	35C	35C
Pressure	-0.3	-0.5	0	-0.5
Liquid Level	ok	ok	ok	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				

COMMENTS

needs pressure

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Crane #17	MVA:	0.5
Transformer No.:	L243299B	Gallons:	125
Manufacturer:		PCB's	silicone
Voltage:	2400/480	% Imp.	

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0
Hydrogen	126	170	203	198
Ethylene	0	0	3	1
Methane	72	78	166	61
Ethane	7	7	31	0
Carbon Monoxide	1009	1200	1473	889
Carbon Dioxide	5743	7642	7095	5679
Oxygen	701	1228	6358	5654
Nitrogen	104201	129970	79295	107404
Total Combustibles	1214	1455	1876	1139
Total Gas	111869	140295	94624	119876
OIL QUALITY				
Dielectric Break (kV)	49.6	43.8	36	36
Water in Fluid (ppm)	19.6	13	27	21
Acid Number (mg KOH/g)	0.008	0.008	0.008	0.001
Interfacial Tens.(dynes/cm)				
ASTM Color	0	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.9625	0.9615	0.969	0.971
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	41C	40C	35C	40C
Pressure	1.2	1	1	1.25
Liquid Level	ok	ok	ok	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	kh
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Crane #16	MVA:	0.5
Transformer No.:	L243299C	Gallons:	125
Manufacturer:	GE	PCB's	silicone
Voltage:	2400/480	% Imp.	

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/24/1999
Acetylene	0	1	9	0
Hydrogen	181	172	231	55
Ethylene	2	1	7	0
Methane	56	52	131	24
Ethane	6	5	21	0
Carbon Monoxide	1231	1288	1557	845
Carbon Dioxide	5961	7054	6117	5087
Oxygen	802	1381	6293	12063
Nitrogen	117262	120462	77762	111158
Total Combustibles	1476	1524	1956	924
Total Gas	125501	130421	92128	129232
OIL QUALITY				
Dielectric Break (kV)	49.1	45	33	46
Water in Fluid (ppm)	14.4	11	25	20
Acid Number (mg KOH/g)	0.006	0.006	0.01	0.005
Interfacial Tens.(dynes/cm)				
ASTM Color	0	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.9625	0.9675	0.968	0.974
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	41C	30C	40C	45C
Pressure	0.3	0	0	0.5
Liquid Level	ok	ok	ok	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				
COMMENTS				

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Crane #15	MVA:	0.5
Transformer No.:	L243299A	Gallons:	125
Manufacturer:	GE	PCB's	silicone
Voltage:	2400/480	% Imp.	5.18

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0
Hydrogen	210	213	265	132
Ethylene	1	1	4	0
Methane	45	48	113	40
Ethane	7	7	27	1
Carbon Monoxide	1177	1279	1473	1221
Carbon Dioxide	5351	7016	5545	5493
Oxygen	751	2297	4649	117171
Nitrogen	102283	113647	67429	1384
Total Combustibles	1440	1548	1882	129723
Total Gas	109825	124508	79505	
OIL QUALITY				
Dielectric Break (kV)	51	47.9	37	35
Water in Fluid (ppm)	15.5	12	13	29
Acid Number (mg KOH/g)	0.008	0.008	0.007	0.001
Interfacial Tens.(dynes/cm)				
ASTM Color	0	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.9635	0.9745	0.968	0.973
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	40C	40C	35C	
Pressure	-0.5	0	0	0.5
Liquid Level	ok	ok	ok	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				

COMMENTS

needs pressure

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Crane #12	MVA:	0.75
Transformer No.:	L243298	Gallons:	125
Manufacturer:	GE	PCB's	silicone
Voltage:	2400/480	% Imp.	5.64

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0
Hydrogen	186	197	243	109
Ethylene	1	1	4	0
Methane	61	68	138	43
Ethane	6	6	22	2
Carbon Monoxide	1019	1157	1309	995
Carbon Dioxide	4351	4895	3751	3893
Oxygen	1554	2323	6243	6584
Nitrogen	100220	110044	66640	112328
Total Combustibles	1272	1429	1716	1149
Total Gas	107397	118691	78350	123954
OIL QUALITY				
Dielectric Break (kV)	43.9	47.3	33	37
Water in Fluid (ppm)	18.6	9.4	12	22
Acid Number (mg KOH/g)	0.006	0.006	0.005	0.002
Interfacial Tens.(dynes/cm)				
ASTM Color	0	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.9625	0.9615	0.971	0.973
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	37C	34C	35C	
Pressure	-0.2	0	0	0.5
Liquid Level	ok	ok	ok	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				

COMMENTS

needs pressure

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Building 73	MVA:	0.5
Transformer No.:	PCT83390101	Gallons:	141
Manufacturer:	West.	PCB's	cert.non
Voltage:	12470/480	% Imp.	5.86

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0
Hydrogen	16	17	37	9
Ethylene	1	0	2	9
Methane	16	16	51	5
Ethane	0	1	6	0
Carbon Monoxide	714	824	1347	680
Carbon Dioxide	4455	6681	6940	4699
Oxygen	882	2328	3837	8862
Nitrogen	69985	85484	58584	71937
Total Combustibles	747	858	1443	694
Total Gas	76069	95351	71804	86182
OIL QUALITY				
Dielectric Break (kV)	42.1	42.2	43	49
Water in Fluid (ppm)	8.5	3.4	6	16
Acid Number (mg KOH/g)	0.028	0.039	0.033	0.038
Interfacial Tens.(dynes/cm)	41.6	32.1	27	27
ASTM Color	1	L1.0	L1.0	L1.0
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.868	0.8665	0.876	0.871
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	35C	25C	35C	40C
Pressure	4	4	0	0.5
Liquid Level	ok	ok	ok	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				
COMMENTS				

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Building 73	MVA:	0.5
Transformer No.:	PAT80910101	Gallons:	141
Manufacturer:	West	PCB's	cert.non
Voltage:	12470/480	% Imp.	5.77

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0
Hydrogen	17	16	42	7
Ethylene	1	0	2	0
Methane	14	16	56	6
Ethane	0	1	8	0
Carbon Monoxide	640	759	1391	645
Carbon Dioxide	3746	4828	6001	3473
Oxygen	1604	3059	3564	11258
Nitrogen	70389	84595	65093	81355
Total Combustibles	672	792	1499	658
Total Gas	76411	93274	76157	96744
OIL QUALITY				
Dielectric Break (kV)	42.4	43.6	35	47
Water in Fluid (ppm)	6.3	4.5	8	11
Acid Number (mg KOH/g)	0.023	0.031	0.027	0.028
Interfacial Tens.(dynes/cm)	33.2	35.7	28	28
ASTM Color	1	1	L1.5	L1.0
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.868	0.8675	0.873	0.871
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	40C	35C	40C	40C
Pressure	5	4	0	0
Liquid Level	ok	ok	ok	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				
COMMENTS				

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	BWTP	MVA:	0.75
Transformer No.:	PCT786301	Gallons:	179
Manufacturer:	West.	PCB's	cert.non
Voltage:	12470/480	% Imp.	6.24

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0
Hydrogen	3	2	0	0
Ethylene	1	1	1	0
Methane	2	2	2	0
Ethane	0	0	0	0
Carbon Monoxide	109	73	38	0
Carbon Dioxide	1688	1236	553	412
Oxygen	12730	20698	17164	22184
Nitrogen	54020	67356	47659	46262
Total Combustibles	115	78	41	0
Total Gas	68553	89368	65417	68858
OIL QUALITY				
Dielectric Break (kV)	45.3	47.9	30	53
Water in Fluid (ppm)	9.7	5.1	8	24
Acid Number (mg KOH/g)	0.043	0.053	0.047	0.041
Interfacial Tens.(dynes/cm)	29.7	31.1	26	25
ASTM Color	L1.5	L1.5	L1.5	L1.5
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.8796	0.88	0.885	0.887
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	34C	32C	30C	40C
Pressure	3.2	3.5	0	0
Liquid Level	ok	ok	ok	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				
COMMENTS				

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 8A	MVA:	2
Transformer No.:	PQH-0714	Gallons:	451
Manufacturer:		PCB's	rtemp
Voltage:	12470/460	% Imp.	5.4

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0
Hydrogen	6	5	5	3
Ethylene	6	6	19	1
Methane	13	14	30	2
Ethane	5	6	18	1
Carbon Monoxide	611	635	886	574
Carbon Dioxide	3178	4654	4642	3431
Oxygen	106	62	4325	3520
Nitrogen	49061	53850	47229	63510
Total Combustibles	641	666	957	581
Total Gas	52986	59232	57139	71043
OIL QUALITY				
Dielectric Break (kV)	39	39.5	34	50
Water in Fluid (ppm)	27.3	20.1	5	16
Acid Number (mg KOH/g)	0.014	0.022	0.02	0.017
Interfacial Tens.(dynes/cm)	45.1	45	38	38
ASTM Color	L2.5	L2.5	L2.5	L2.5
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.875	0.8745	0.883	0.887
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	50C	45C	45C	46c
Pressure				0
Liquid Level	ok	ok	ok	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Portable 32-5	MVA:	1
Transformer No.:	PO15676	Gallons:	240
Manufacturer:	GE	PCB's	silicone
Voltage:	12470/460	% Imp.	5.5

Lab Used	JACO	JACO
DISSOLVED GASES PPM	8/12/2002	9/11/2001
Acetylene	0	0
Hydrogen	47	52
Ethylene	0	0
Methane	42	42
Ethane	3	0
Carbon Monoxide	1236	1254
Carbon Dioxide	5567	5849
Oxygen	5220	3851
Nitrogen	102708	92059
Total Combustibles	1328	1351
Total Gas	114823	103110
OIL QUALITY		
Dielectric Break (kV)	46.7	43.5
Water in Fluid (ppm)	13.9	6.8
Acid Number (mg KOH/g)	0.006	0.011
Interfacial Tens.(dynes/cm)		
ASTM Color	0	0
Visual Inspection	Pass	Pass
Specific Gravity	0.9644	0.9628
OPERATING CONDITIONS		
AmbientTemp.	80f	70F
Winding Temp.		
Liquid Temp.	48C	32C
Pressure		npg
Liquid Level	ok	ok
GAS DIAGNOSTICS		
Rogers Ratio		
Cellulose Ratio (CO2/CO)		
IEEE/ANSI (C57.104-1991)		

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Portable 32-3	MVA:	2
Transformer No.:	87V1243	Gallons:	600
Manufacturer:	Vantram	PCB's	rtemp
Voltage:	12470/460	% Imp.	5.7

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0
Hydrogen	16	7	18	6
Ethylene	1	18	75	14
Methane	16	16	48	10
Ethane	0	5	16	1
Carbon Monoxide	714	333	962	4501
Carbon Dioxide	4455	4915	6055	596
Oxygen	882	82	4850	1900
Nitrogen	69985	55557	49061	58342
Total Combustibles	747	319	1119	627
Total Gas	76069	60933	61085	65369
OIL QUALITY				
Dielectric Break (kV)	32.5	39.1	33	49
Water in Fluid (ppm)	15.7	21.3	7	13
Acid Number (mg KOH/g)	0.008	0.014	0.015	0.008
Interfacial Tens.(dynes/cm)	46.2	46.5	39	42
ASTM Color	1.5	1.5	L2.0	L2.0
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.87	0.8705	0.88	0.883
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	48C	40c	40c	42c
Pressure	0	0	npg	
Liquid Level	ok	ok	ok	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				

COMMENTS

needs pressure

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	6555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 5	MVA:	1
Transformer No.:	PO14476	Gallons:	240
Manufacturer:	GE	PCB's	silicone
Voltage:	12470/460	% Imp.	5.5

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0
Hydrogen	61	60	91	28
Ethylene	0	0	1	0
Methane	21	22	45	6
Ethane	2	2	6	0
Carbon Monoxide	861	903	1027	730
Carbon Dioxide	3985	3935	2846	2858
Oxygen	5442	10752	9121	15323
Nitrogen	91933	106413	61294	95893
Total Combustibles	945	987	1170	764
Total Gas	102305	122087	74431	114837
OIL QUALITY				
Dielectric Break (kV)	42	46.1	30	32
Water in Fluid (ppm)	14.4	5.7	12	26
Acid Number (mg KOH/g)	0.006	0.006	0.002	0.003
Interfacial Tens.(dynes/cm)				
ASTM Color	0	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.9635	0.9622	0.971	0.976
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	40C	38C	40C	33C
Pressure		npg	npg	
Liquid Level	ok	ok	ok	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				
COMMENTS				

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 5	MVA:	1.5
Transformer No.:	PO14490	Gallons:	315
Manufacturer:	GE	PCB's	silicone
Voltage:	12470/460	% Imp.	5.54

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/2000
Acetylene	0	0	0	0
Hydrogen	23	31	53	28
Ethylene	1	0	2	0
Methane	81	100	183	76
Ethane	4	4	16	1
Carbon Monoxide	367	452	659	458
Carbon Dioxide	1691	1894	1306	1455
Oxygen	10942	14571	9079	13837
Nitrogen	97048	107814	62881	110168
Total Combustibles	476	587	913	563
Total Gas	110157	124866	74179	126025
OIL QUALITY				
Dielectric Break (kV)	50.9	47.1	37	38
Water in Fluid (ppm)	9.8	6.3	19	9
Acid Number (mg KOH/g)	0.006	0.006	0.002	0.001
Interfacial Tens.(dynes/cm)				
ASTM Color	0	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.9612	0.9632	0.969	0.973
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	39C	39C	35C	33C
Pressure	npg	npg	npg	
Liquid Level	ok	low	low	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				
COMMENTS				

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4	MVA:	1
Transformer No.:	PCT2521-0101	Gallons:	200
Manufacturer:	West	PCB's	silicone
Voltage:	12470/460	% Imp.	5.94

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0		0
Hydrogen	32	46		21
Ethylene	0	0		0
Methane	78	82		53
Ethane	4	3		0
Carbon Monoxide	1648	2037		1612
Carbon Dioxide	7421	11838		9722
Oxygen	2864	3384		10872
Nitrogen	113524	140967		103563
Total Combustibles	1762	2168		1686
Total Gas	125571	158357		125843
OIL QUALITY				
Dielectric Break (kV)	37.1	45.5		36
Water in Fluid (ppm)	12.4	7.8		14
Acid Number (mg KOH/g)	0.006	0.008		0.003
Interfacial Tens.(dynes/cm)				
ASTM Color	0	0		L0.5
Visual Inspection	Pass	Clear		Pass
Specific Gravity	0.963	0.962		0.974
OPERATING CONDITIONS				
AmbientTemp.	80F			
Winding Temp.				
Liquid Temp.	60C			50C
Pressure	4			-0.25
Liquid Level	ok			
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 3	MVA:	1.5
Transformer No.:	R277558	Gallons:	321
Manufacturer:		PCB's	silicone
Voltage:	12470/480	% Imp.	

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/25/2000	2/7/2000
Acetylene	0	0	19	0
Hydrogen	33	46	100	18
Ethylene	1	0	13	0
Methane	26	29	83	7
Ethane	3	2	13	0
Carbon Monoxide	563	681	1046	535
Carbon Dioxide	6341	9382	8934	730
Oxygen	8119	13861	13060	20371
Nitrogen	99452	127670	78668	102182
Total Combustibles	626	758	1274	560
Total Gas	114538	151671	101936	130420
OIL QUALITY				
Dielectric Break (kV)	47.7	46.1	36	37
Water in Fluid (ppm)	42.8	36.5	38	34
Acid Number (mg KOH/g)	0.006	0.006	0.005	0.003
Interfacial Tens.(dynes/cm)				
ASTM Color	0	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.8638	0.9625	0.969	0.973
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	45C	44C	40C	42C
Pressure	2	3	1.5	1.5
Liquid Level	high	high	high	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				
COMMENTS				

ENGINEERED SUBSTATION SERVICES INC.

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(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 3	MVA:	1
Transformer No.:	R277557	Gallons:	268
Manufacturer:		PCB's	silicone
Voltage:	12470/480	% Imp.	6

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0
Hydrogen	13	10	0	0
Ethylene	0	0	0	0
Methane	4	3	0	0
Ethane	1	0	0	0
Carbon Monoxide	131	78	22	0
Carbon Dioxide	2626	1671	580	460
Oxygen	20870	32373	24101	43478
Nitrogen	93513	105683	66650	97381
Total Combustibles	149	91	24	0
Total Gas	117158	139818	91355	141319
OIL QUALITY				
Dielectric Break (kV)	50.9	43.6	29	31
Water in Fluid (ppm)	48.5	42.8	49	42
Acid Number (mg KOH/g)	0.006	0.008	0.005	0.002
Interfacial Tens.(dynes/cm)				
ASTM Color	0	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.9628	0.963	0.967	0.981
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	42C	41C	40C	42C
Pressure	0	0	0	-0.25
Liquid Level	high	high	high	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				

COMMENTS

needs pressure

high moisture - although a silicone unit

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 1	MVA:	1.5
Transformer No.:	910396-A1	Gallons:	345
Manufacturer:	Square D	PCB's	rtemp
Voltage:	12470/480	% Imp.	6.3

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0
Hydrogen	5	4	7	3
Ethylene	18	19	81	5
Methane	16	17	46	3
Ethane	3	3	13	0
Carbon Monoxide	323	342	665	237
Carbon Dioxide	2610	2584	3022	1378
Oxygen	131	63	1677	3503
Nitrogen	59182	64497	37442	52834
Total Combustibles	365	385	812	248
Total Gas	62288	67529	42953	57834
OIL QUALITY				
Dielectric Break (kV)	41.1	40.8	41	41
Water in Fluid (ppm)	9.9	5.2	8	7
Acid Number (mg KOH/g)	0.02	0.042	0.029	0.027
Interfacial Tens.(dynes/cm)	43.4	43.1	36	35
ASTM Color	L3.5	L3.5	L3.5	L3.5
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.879	0.8784	0.888	0.892
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	41C	40c	40c	42c
Pressure	2.9	2.5	0	0.25
Liquid Level	ok	ok	ok	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				
COMMENTS				

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 1	MVA:	2
Transformer No.:	910396-B1	Gallons:	390
Manufacturer:	Square D	PCB's	rtemp
Voltage:	12470/480	% Imp.	6.05

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0
Hydrogen	6	4	6	3
Ethylene	2	2	9	0
Methane	14	16	36	3
Ethane	3	3	13	0
Carbon Monoxide	375	412	654	190
Carbon Dioxide	3021	4192	4147	1703
Oxygen	73	74	1711	16668
Nitrogen	48738	53442	33422	85265
Total Combustibles	400	436	717	196
Total Gas	52232	58144	39997	103832
OIL QUALITY				
Dielectric Break (kV)	44.4	43	39	34
Water in Fluid (ppm)	19.8	5.2	5	11
Acid Number (mg KOH/g)	0.023	0.02	0.028	0.028
Interfacial Tens.(dynes/cm)	44.3	44.2	35	36
ASTM Color	3	3	L3.5	L3.5
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.877	0.8765	0.885	0.889
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	41C	38C	40c	42c
Pressure	-0.2	0	0	-1
Liquid Level	ok	ok	ok	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				

COMMENTS

needs pressure

ENGINEERED SUBSTATION SERVICES INC.

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(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	6555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 1	MVA:	2
Transformer No.:	910396-C1	Gallons:	390
Manufacturer:	Square D	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.75

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0
Hydrogen	27	26	44	17
Ethylene	2	1	6	0
Methane	10	12	24	6
Ethane	2	3	9	0
Carbon Monoxide	3005	310	550	296
Carbon Dioxide	2853	3629	3540	3125
Oxygen	209	57	1640	1306
Nitrogen	46665	48849	30201	51796
Total Combustibles	346	352	633	319
Total Gas	50073	52887	36014	56537
OIL QUALITY				
Dielectric Break (kV)	42.7	42.8	34	45
Water in Fluid (ppm)	12.8	8.6	2	29
Acid Number (mg KOH/g)	0.025	0.025	0.027	0.028
Interfacial Tens.(dynes/cm)	42.2	42.3	36	37
ASTM Color	3	3	L3.5	L3.5
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.879	0.8785	0.884	0.885
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	43C	40c	40c	43c
Pressure	0	0	-1	-1
Liquid Level	ok	ok	ok	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				

COMMENTS

need pressure

ENGINEERED SUBSTATION SERVICES INC.

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(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 7	MVA:	0.75
Transformer No.:	M690624TLPA	Gallons:	230
Manufacturer:	GE	PCB's	no data
Voltage:	12470/480	% Imp.	5.75

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0
Hydrogen	40	41	73	19
Ethylene	5	5	15	1
Methane	14	15	37	5
Ethane	3	3	13	1
Carbon Monoxide	604	656	917	531
Carbon Dioxide	3089	4176	3797	3035
Oxygen	1080	166	3874	3583
Nitrogen	53589	57805	37500	58715
Total Combustibles	688	720	1056	557
Total Gas	58424	62867	46226	65891
OIL QUALITY				
Dielectric Break (kV)	48.4	45.6	46	37
Water in Fluid (ppm)	11,4	8.5	7	17
Acid Number (mg KOH/g)	0.011	0.014	0.02	0.014
Interfacial Tens.(dynes/cm)	37.1	37.1	31	32
ASTM Color	L0.5	L0.5	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.8924	0.8925	0.902	0.901
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	35C	26C	25C	32C
Pressure	0	-1.5	0	0
Liquid Level	ok	ok	ok	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				

COMMENTS

needs pressure

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/4/2002
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 8	MVA:	0.75
Transformer No.:	M590623TLPA	Gallons:	230
Manufacturer:	GE	PCB's	no data
Voltage:	12470/480	% Imp.	5.75

Lab Used	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0
Hydrogen	38	38	62	20
Ethylene	3	3	8	1
Methane	13	15	34	8
Ethane	3	3	11	0
Carbon Monoxide	538	609	836	502
Carbon Dioxide	2529	3217	2748	2269
Oxygen	79	114	3386	3246
Nitrogen	50254	56960	37430	58698
Total Combustibles	595	668	951	531
Total Gas	53457	60959	44515	64744
OIL QUALITY				
Dielectric Break (kV)	46.9	41.5	36	39
Water in Fluid (ppm)	8	13	5	20
Acid Number (mg KOH/g)	0.014	0.017	0.02	0.014
Interfacial Tens.(dynes/cm)	43	38.7	30	31
ASTM Color	0.05	L0.5	L0.5	0.5
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.8919	0.8925	0.898	0.898
OPERATING CONDITIONS				
AmbientTemp.	80F	70F	80F	
Winding Temp.				
Liquid Temp.	35C	27C	25C	27C
Pressure	0	0		
Liquid Level	NO LG	NA	ok	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				

COMMENTS

needs pressure

ENGINEERED SUBSTATION SERVICES INC.

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Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Dry Dock 3	MVA:	1
Transformer No.:	16121-1	Gallons:	415
Manufacturer:	Sierra	PCB's	cert.non
Voltage:	12470/480	% Imp.	

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0
Hydrogen	5	5	6	8	2
Ethylene	3	3	3	9	1
Methane	2	2	2	5	1
Ethane	0	0	1	2	0
Carbon Monoxide	241	236	271	463	167
Carbon Dioxide	2608	2634	3000	2522	1597
Oxygen	7647	8019	14222	10690	18258
Total Combustibles	251	246	283	487	170
Total Gas	5.69%	60171	80888	60062	84526
OIL QUALITY					
Dielectric Break (kV)	51.3	49.4	43.8	41	51
Water in Fluid (ppm)	9.7	11.4	10.3	4	5
Acid Number (mg KOH/g)	0.003	0.003	0.006	0.008	0.002
Interfacial Tens.(dynes/cm)	38.8	36.7	42.3	36	38
ASTM Color	L1.0	1	1	L1.5	L1.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.877	0.877	0.0876	0.882	0.887
OPERATING CONDITIONS					
AmbientTemp.	79F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	36C	43C	36C	30c	35
Pressure	-1	-0.2	0	-1	-0.5
Liquid Level	ok	ok	ok	ok	
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					

COMMENTS Needs pressure. Has broken valve.

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Dry Dock 3	MVA:	1.5
Transformer No.:	16745-1	Gallons:	327
Manufacturer:	Sierra	PCB's	cert.non
Voltage:	12470/480	% Imp.	

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0
Hydrogen	2	8	11	14	4
Ethylene	13	16	59	44	10
Methane	3	5	5	12	1
Ethane	1	1	1	2	0
Carbon Monoxide	149	499	606	817	435
Carbon Dioxide	2951	3524	5669	4774	3882
Oxygen	11059	3753	3488	6444	8625
Total Combustibles	168	529	682	889	450
Total Gas	5.74	60238	68142	57266	71595
OIL QUALITY					
Dielectric Break (kV)	50.8	46.8	44.5	48	39
Water in Fluid (ppm)	18.2	15.3	15.3	16	4
Acid Number (mg KOH/g)	0.008	0.008	0.008	0.011	0.005
Interfacial Tens.(dynes/cm)	39	39.2	37.6	35	33
ASTM Color	1	1	1	L1.5	L1.0
Visual Inspection	pass	pass	pass	pass	pass
Specific Gravity	0.876	0.8774	0.08755	0.883	0.882
OPERATING CONDITIONS					
AmbientTemp.	79F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	52C	52c	54C	45c	50c
Pressure	-0.5	-0.5	-1	-1.5	-1
Liquid Level	ok	ok	ok	ok	
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					

COMMENTS Need nitrogen. Has broken valve.

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
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(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Dry Dock 3	MVA:	1
Transformer No.:	16121-3	Gallons:	415
Manufacturer:	Sierra	PCB's	cert.non
Voltage:	12470/480	% Imp.	

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	11/14/2002	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	1	0	35	16	23	0
Hydrogen	2	2	86	53	60	10
Ethylene	9	0	758	472	463	80
Methane	2	0	284	177	161	34
Ethane	1	1	93	53	103	6
Carbon Monoxide	16	2	274	282	489	220
Carbon Dioxide	471	346	2815	2846	2660	1525
Oxygen	10706	1989	7615	11160	10060	16273
Total Combustibles	31	5	1530	1053	1319	350
Total Gas	5.8%	46791	66940	72780	60122	83135
OIL QUALITY						
Dielectric Break (kV)	48.2	42.5	30	40	32	48
Water in Fluid (ppm)	27.3	6	39.8	22.2	22	16
Acid Number (mg KOH/g)	0.003	0.003	0.006	0.0008	0.005	0.003
Interfacial Tens.(dynes/cm)	39.8	49.2	41.7	39.1	36	35
ASTM Color	L1.0	0	1	1	L1.5	L1.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.885	0.8938	0.876	0.8754	0.884	0.877
OPERATING CONDITIONS						
AmbientTemp.	79F	60F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	40C	40C	40C	35C	30c	35c
Pressure	2.5	1	0.5	0	-1	0
Liquid Level	ok	ok	ok	ok	ok	
GAS DIAGNOSTICS						
Rogers Ratio						
Cellulose Ratio (CO2/CO)						
IEEE/ANSI (C57.104-1991)						

COMMENTS Moisture level has risen - monitor, may have leached after coils heated following unit repair/new oil 11/14/02.

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	32-1	MVA:	2.5
Transformer No.:	79F835	Gallons:	488
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	11400/480	% Imp.	6.4

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	3	1	1	2	0
Hydrogen	7	6	4	3	3
Ethylene	48	31	34	72	42
Methane	11	7	11	8	1
Ethane	6	4	5	17	3
Carbon Monoxide	83	93	84	180	76
Carbon Dioxide	1127	967	1044	1348	1132
Oxygen	5282	4756	79	11213	14614
Total Combustibles	158	142	139	282	125
Total Gas	44005	46558	44186	54217	64396
OIL QUALITY					
Dielectric Break (kV)	29.7	37.8	37.8	39	44
Water in Fluid (ppm)	27.9	26.2	26.5	19	19
Acid Number (mg KOH/g)	0.042	0.04	0.042	0.047	0.038
Interfacial Tens.(dynes/cm)	34	34.4	34	27	28
ASTM Color	5.5	5.5	5.5	G8.0	L5.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.8778	0.878	0.8775	0.894	0.888
OPERATING CONDITIONS					
AmbientTemp.	74F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	42C	54C	50C	50c	45c
Pressure	0	0	0	1.5	2
Liquid Level	ok	HIGH	HIGH	ok	
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					

COMMENTS

UNITS NEEDS PRESSURE

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-5	MVA:	0.33
Transformer No.:	79F6705	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	5/27/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene		29	0	0	0	0
Hydrogen		32	5	4	12	4
Ethylene		14	1	2	9	1
Methane		9	6	9	17	5
Ethane		2	6	11	19	4
Carbon Monoxide		30	77	66	243	117
Carbon Dioxide		963	1354	1217	2594	2384
Oxygen		1928	116	62	4640	2316
Total Combustibles		116	95	92	300	131
Total Gas		4.86%	39000	33439	50838	57961
OIL QUALITY						
Dielectric Break (kV)		38.4	38	38.7	39	46
Water in Fluid (ppm)		19	20.9	21.3	12	27
Acid Number (mg KOH/g)		0.037	0.023	0.025	0.029	0.029
Interfacial Tens.(dynes/cm)		39	37.8	37	29	28
ASTM Color		5.5	6	6	G8.0	L5.0
Visual Inspection		Pass	Pass	Pass	Pass	Pass
Specific Gravity		0.8815	0.883	0.883	0.899	0.899
OPERATING CONDITIONS						
AmbientTemp.		60F	80F	70F	80F	
Winding Temp.						
Liquid Temp.			40C	38C	35c	35c
Pressure		0	0	0	0	0.5
Liquid Level		ok	ok	ok	ok	ok
GAS DIAGNOSTICS						
Rogers Ratio	0-0-2-1					
Cellulose Ratio (CO2/CO)						
IEEE/ANSI (C57.104-1991)						

COMMENTS not sampled 8/2003
rush sample relative to failure - appears some internal arching has occurred
recommend further testing and inspection

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-2	MVA:	0.33
Transformer No.:	7916702	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/26/1999
Acetylene	0	0	0	0	0
Hydrogen	9	15	2	0	1
Ethylene	1	1	1	2	0
Methane	5	5	7	2	0
Ethane	5	6	9	3	0
Carbon Monoxide	74	41	42	92	38
Carbon Dioxide	967	638	577	1005	922
Oxygen	68	97	77	10084	4099
Total Combustibles	94	68	61	96	39
Total Gas	41103	41682	32969	52215	47305
OIL QUALITY					
Dielectric Break (kV)	42.7	44.8	44.9	32	50
Water in Fluid (ppm)	18	19.8	17.8	14	21
Acid Number (mg KOH/g)	0.025	0.025	0.025	0.02	0.02
Interfacial Tens.(dynes/cm)	32.1	32.7	32.6	26	39
ASTM Color	5.5	5.5	5.5	L5.0	L5.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.883	0.884	0.8835	0.892	0.896
OPERATING CONDITIONS					
AmbientTemp.	79F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	38C	29C	18C	35c	35c
Pressure	2	1	0	0	0.5
Liquid Level	ok	ok	ok	ok	ok
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					

COMMENTS Leaks - need to further inspect - see attached photos.

ENGINEERED SUBSTATION SERVICES INC.

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Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-4	MVA:	0.33
Transformer No.:	79F6704	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	1	1	0	3	0
Hydrogen	4	7	0	7	4
Ethylene	22	21	2	96	26
Methane	3	4	1	17	7
Ethane	3	3	1	21	6
Carbon Monoxide	112	111	5	326	251
Carbon Dioxide	1853	1931	113	2730	2011
Oxygen	122	97	2	4460	3101
Nitrogen	38282	37203	1423	43393	64046
Total Combustibles	117	147	9	470	294
Total Gas	38024	39378	1542	51053	69452
OIL QUALITY					
Dielectric Break (kV)	40	34.8	37.8	38	41
Water in Fluid (ppm)	18	22.7	19	9	23
Acid Number (mg KOH/g)	0.025	0.02	0.028	0.022	0.018
Interfacial Tens.(dynes/cm)	37	37.7	38	29	31
ASTM Color	5.5	5.5	5.5	L5.0	L5.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.8828	0.883	0.8825	0.895	0.889
OPERATING CONDITIONS					
AmbientTemp.	78F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	38C	36C	38C	35c	35c
Pressure	0.5	0	0	0	0.5
Liquid Level	ok	ok	ok	ok	ok
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					

COMMENTS

needs pressure

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-11	MVA:	0.33
Transformer No.:	79F6701	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0
Hydrogen	5	12	15	22	10
Ethylene	4	5	5	19	3
Methane	7	10	16	28	5
Ethane	6	10	14	21	2
Carbon Monoxide	96	75	113	262	145
Carbon Dioxide	1965	2061	2727	3118	2688
Oxygen	69	62	70	4220	1774
Total Combustibles	118	112	163	372	165
Total Gas	40811	41897	50768	52072	52491
OIL QUALITY					
Dielectric Break (kV)	26	33.8	30	34	39
Water in Fluid (ppm)	22.1	14.5	22.4	8	14
Acid Number (mg KOH/g)	0.023	0.02	0.02	0.02	0.021
Interfacial Tens.(dynes/cm)	32.2	33	33.9	28	31
ASTM Color	L6.0	5.5	5.5	G8.0	L6.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.882	0.886	0.886	0.897	0.892
OPERATING CONDITIONS					
AmbientTemp.	70f	80F	70F	80F	
Winding Temp.					
Liquid Temp.	30C	40C	40C	35c	35c
Pressure	0	1	0	0	0.5
Liquid Level	low	low	ok	ok	ok
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					

COMMENTS Needs nitrogen & oil.

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 12-2	MVA:	1
Transformer No.:	79F67112	Gallons:	316
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.5

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0
Hydrogen	5	3	4	6	9
Ethylene	4	1	4	10	1
Methane	1	0	5	4	0
Ethane	0	3	4	1	0
Carbon Monoxide	71	56	93	194	49
Carbon Dioxide	633	496	604	710	666
Oxygen	96	1051	67	5171	6757
Nitrogen	37400	34960	38646	50162	47613
Total Combustibles	81	63	110	215	59
Total Gas	38210	36570	39427	56258	55096
OIL QUALITY					
Dielectric Break (kV)	35.8	40.9	42.9	35	37
Water in Fluid (ppm)	30.2	43.6	27	8	20
Acid Number (mg KOH/g)	0.023	0.023	0.042	0.023	0.034
Interfacial Tens.(dynes/cm)	32.2	32	32.7	26	29
ASTM Color	L6.0	L6.0	6	G8.0	L6.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.882	0.882	0.882	0.899	0.888
OPERATING CONDITIONS					
AmbientTemp.	70F	70F	70F	80F	
Winding Temp.					
Liquid Temp.	30C	40C	45C	40c	40c
Pressure	0	0	0	0	0.5
Liquid Level	ok	ok	ok	ok	ok
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					

COMMENTS

Needs nitrogen

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-3	MVA:	0.33
Transformer No.:	79F9703	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	11	12	15	54	0
Hydrogen	11	13	24	19	4
Ethylene	30	32	40	131	0
Methane	11	13	16	35	1
Ethane	4	5	7	10	0
Carbon Monoxide	156	146	139	216	118
Carbon Dioxide	1820	1840	1982	1642	2229
Oxygen	118	200	71	7397	3642
Nitrogen	40168	43047	48411	41905	60095
Total Combustibles	223	221	241	465	123
Total Gas	42329	45308	50705	51409	66089
OIL QUALITY					
Dielectric Break (kV)	45.6	41.8	42.7	35	43
Water in Fluid (ppm)	19.8	22.1	20.1	6	25
Acid Number (mg KOH/g)	0.023	0.023	0.022	0.03	0.023
Interfacial Tens.(dynes/cm)	32	32.8	32.9	27	28
ASTM Color	5	5	5	L5.0	L5.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.889	0.881	0.881	0.894	0.89
OPERATING CONDITIONS					
AmbientTemp.	69F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	34C	43C	42C	30c	40c
Pressure	0.5	1.6	1.5	0	1
Liquid Level	ok	ok	ok	ok	ok
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					

COMMENTS leaks - see attached photos

ENGINEERED SUBSTATION SERVICES INC.

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Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-1	MVA:	0.33
Transformer No.:	79F9701	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0
Hydrogen	5	9	33	15	1
Ethylene	3	2	3	9	1
Methane	2	2	3	7	0
Ethane	0	0	2	4	0
Carbon Monoxide	66	57	75	173	50
Carbon Dioxide	571	463	733	716	519
Oxygen	42	56	105	711	6527
Total Combustibles	76	70	116	208	52
Total Gas	40436	32463	42632	27904	60866
OIL QUALITY					
Dielectric Break (kV)	46.7	42	42.5	44	43
Water in Fluid (ppm)	29.7	26.7	25.9	26	16
Acid Number (mg KOH/g)	0.031	0.031	0.028	0.031	0.024
Interfacial Tens.(dynes/cm)	33.5	33.5	33.4	25	28
ASTM Color	6	6	6	G8.0	L5.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.8815	0.881	0.8808	0.893	0.896
OPERATING CONDITIONS					
AmbientTemp.	65F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	30C	42C	40c	40c	35c
Pressure	0	0	0	0	0
Liquid Level	ok	ok	ok	ok	ok
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					

COMMENTS

needs pressure

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-12	MVA:	0.33
Transformer No.:	79F97012	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0
Hydrogen	17	7	12	4	2
Ethylene	8	6	4	3	0
Methane	4	3	9	4	0
Ethane	2	1	10	2	0
Carbon Monoxide	86	85	85	137	42
Carbon Dioxide	1503	1173	987	518	1128
Oxygen	122	233	94	5742	2699
Total Combustibles	117	102	120	150	44
Total Gas	38024	40806	41520	48742	56710
OIL QUALITY					
Dielectric Break (kV)	38	38.5	38.3	40	42
Water in Fluid (ppm)	69.7	38.4	40.8	34	27
Acid Number (mg KOH/g)	0.023	0.023	0.025	0.027	0.024
Interfacial Tens.(dynes/cm)	32.4	32	32.2	24	35
ASTM Color	5.5	5.5	5.5	L5.0	L5.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.8825	0.883	0.883	0.892	0.892
OPERATING CONDITIONS					
AmbientTemp.	78F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	38C	40C	38C	30c	35c
Pressure	0	0	0	-3	0
Liquid Level	low	low	low	low	
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					

COMMENTS moisture level has increased considerably
needs pressure and oil

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 12-4	MVA:	1
Transformer No.:	79F6714	Gallons:	316
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/460	% Imp.	5.5

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	1	1	1	4	0
Hydrogen	5	6	5	7	4
Ethylene	42	45	39	145	38
Methane	24	30	28	82	25
Ethane	29	35	31	154	34
Carbon Monoxide	345	388	373	667	381
Carbon Dioxide	2381	2763	3506	4173	3077
Oxygen	79	109	61	4595	2461
Nitrogen	39507	43211	42245	45116	59156
Total Combustibles	446	505	477	1059	482
Total Gas	42413	46588	46289	54942	65175
OIL QUALITY					
Dielectric Break (kV)	34	39.2	38.8	37	46
Water in Fluid (ppm)	18.6	21.5	23.1	21	26
Acid Number (mg KOH/g)	0.02	0.017	0.022	0.025	0.019
Interfacial Tens.(dynes/cm)	31.1	37.5	37.6	31	42
ASTM Color	5.5	5.5	5.5	G8.0	L5.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.881	0.881	0.8805	0.897	0.89
OPERATING CONDITIONS					
AmbientTemp.	65F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	36C	48C	42C	40c	35c
Pressure	1	2	1	0	0
Liquid Level	ok	ok	ok	ok	
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-6	MVA:	0.33
Transformer No.:	79F6706	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/460	% Imp.	5.1

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	1	0	0	0	0
Hydrogen	7	8	6	17	4
Ethylene	2	1	2	4	0
Methane	5	6	10	4	0
Ethane	4	6	11	6	0
Carbon Monoxide	71	103	79	145	64
Carbon Dioxide	1821	1711	1555	1841	1654
Oxygen	71	194	115	8873	2452
Total Combustibles	90	124	108	176	68
Total Gas	49182	45118	58369	53245	51125
OIL QUALITY					
Dielectric Break (kV)	38.5	36.5	35.5	40	46
Water in Fluid (ppm)	25.6	27.3	26.4	22	19
Acid Number (mg KOH/g)	0.025	0.023	0.028	0.027	0.029
Interfacial Tens.(dynes/cm)	34.1	34.4	34.5	27	28
ASTM Color	5.5	5.5	5.5	G8.0	L5.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.884	0.882	0.8815	0.896	0.895
OPERATING CONDITIONS					
AmbientTemp.	70F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	30C	42C	40c	40c	35c
Pressure	2.5	3.5	0.5	0.5	0.5
Liquid Level	low	low	low	low	
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					
COMMENTS					
need to add c					

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-9	MVA:	0.33
Transformer No.:	79F6709	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/460	% Imp.	5.1

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0
Hydrogen	20	13	21	52	27
Ethylene	3	3	3	14	2
Methane	11	11	14	40	7
Ethane	8	7	7	23	1
Carbon Monoxide	145	149	193	581	297
Carbon Dioxide	2281	2358	3430	4425	2964
Oxygen	59	119	80	4863	3123
Total Combustibles	187	183	238	710	334
Total Gas	44146	43114	54048	59075	72144
OIL QUALITY					
Dielectric Break (kV)	41.7	40.8	40.4	39	39
Water in Fluid (ppm)	21.5	22.7	17.2	9	6
Acid Number (mg KOH/g)	0.023	0.023	0.02	0.022	0.017
Interfacial Tens.(dynes/cm)	37	37	37.1	31	32
ASTM Color	5.5	5.5	5.5	L5.0	L5.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.882	0.881	0.881	0.895	0.894
OPERATING CONDITIONS					
AmbientTemp.	60F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	36C	50C	40C	35c	35c
Pressure	0	0	0.5	0	0.25
Liquid Level	Low	ok	ok	ok	
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					

COMMENTS

needs pressure and oil

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-10	MVA:	0.33
Transformer No.:	79F67010	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/460	% Imp.	5.1

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/1999	8/25/1999
Acetylene	0	0	0	0	0
Hydrogen	23	23	20	24	6
Ethylene	3	3	2	10	1
Methane	9	9	8	23	5
Ethane	5	5	4	20	4
Carbon Monoxide	118	119	108	280	135
Carbon Dioxide	1152	1188	999	1260	1049
Oxygen	91	83	73	5009	1404
Total Combustibles	158	159	142	357	151
Total Gas	50412	51019	45638	48483	53449
OIL QUALITY					
Dielectric Break (kV)	34.3	34.9	34.4	41	46
Water in Fluid (ppm)	11.6	10.5	25	3	23
Acid Number (mg KOH/g)	0.02	0.011	0.02	0.02	0.01
Interfacial Tens.(dynes/cm)	34	36	36.1	31	31
ASTM Color	L5.0	L5.0	L5.0	L5.0	L5.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.881	0.883	0.883	0.898	0.89
OPERATING CONDITIONS					
AmbientTemp.	78F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	40C	40C	40C	35c	38
Pressure	0.1	1	0.5	0	0
Liquid Level	ok	ok	low	low	
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					

COMMENTS

needs pressure

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-8	MVA:	0.33
Transformer No.:	79F6708	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/460	% Imp.	5.1

Lab Used	JACO	JACO	JACO	ACTI	ATCI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	10	12	13	43	14
Hydrogen	44	34	44	58	7
Ethylene	365	385	435	793	318
Methane	61	66	75	176	58
Ethane	39	45	49	168	40
Carbon Monoxide	177	183	207	478	195
Carbon Dioxide	1875	1852	1995	2010	1375
Oxygen	71	178	81	4556	1634
Nitrogen	44424	48665	60842	44549	52821
Total Combustibles	696	725	823	1716	632
Total Gas	47066	51420	63741	52831	56461
OIL QUALITY					
Dielectric Break (kV)	34.3	35	35.5	33	40
Water in Fluid (ppm)	20.9	29.7	15.5	14	11
Acid Number (mg KOH/g)	0.031	0.028	0.036	0.031	0.031
Interfacial Tens.(dynes/cm)	34.7	35.5	35.7	28	42
ASTM Color	L2.0	2.5	2.5	L2.0	L2.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.881	0.882	0.8815	0.894	0.886
OPERATING CONDITIONS					
AmbientTemp.	70F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	30C	45C	40c	40c	33c
Pressure	0	1.5	1.5	-1	-1.5
Liquid Level	ok	ok	ok	ok	
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					

COMMENTS

needs pressure

ENGINEERED SUBSTATION SERVICES INC.

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Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 12-1	MVA:	1
Transformer No.:	79F6711	Gallons:	316
Manufacturer:	Elect. Tech.	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.5

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2001	8/25/2001
Acetylene	0	0	0	0	0
Hydrogen	6	9	6	6	0
Ethylene	1	1	1	0	0
Methane	1	2	6	2	0
Ethane	0	0	6	0	0
Carbon Dioxide	589	575	63	77	458
Carbon Monoxide	55	57	577	669	42
Oxygen	3968	708	68	12705	3557
Total Combustibles	63	69	82	85	42
Total Gas	42571	36986	40883	58336	43495
OIL QUALITY TESTS					
Dielectric Break	37	32.2	33.6	35	42
Water in Fluid	41.3	43	41.1	21	20
Acid Number	0.025	0.025	0.025	0.027	0.02
Interfacial Tens.	40	41.5	41.5	31	37
ASTM Color	L3.0	L3.0	L3.0	L2.5	L2.5
Visual Inspection	PASS	PASS	PASS	PASS	PASS
Specific Gravity	0.8725	0.874	0.8735	0.883	0.879
OPERATING CONDITIONS					
AmbientTemp.	78F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	41C	41C	37C	40C	
Pressure	0	0	0	0	
Liquid Level	OK	OK	LOW	OK	
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					

COMMENTS

needs pressure

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Dry Dock	MVA:	1
Transformer No.:	771382	Gallons:	310
Manufacturer:		PCB's	cert-non
Voltage:		% Imp.	

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	23	25	25	96	23
Hydrogen	34	36	34	45	9
Ethylene	8	8	7	23	2
Methane	21	21	20	29	8
Ethane	4	4	4	14	0
Carbon Monoxide	509	473	437	604	240
Carbon Dioxide	3489	3652	4637	3964	2148
Oxygen	4328	4645	8500	9375	10799
Total Combustibles	599	567	527	811	282
Total Gas	6.2%	65953	74225	62358	74852
OIL QUALITY					
Dielectric Break (kV)	51.4	46.9	45.4	44	50
Water in Fluid (ppm)	13.1	20.5	12.5	5	13
Acid Number (mg KOH/g)	0.003	0.003	0.011	0.002	0.002
Interfacial Tens.(dynes/cm)	44.4	45.9	48.6	41	38
ASTM Color	L0.5	0.5	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.8775	0.8785	0.8785	0.886	0.883
OPERATING CONDITIONS					
AmbientTemp.	70F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	45C	54C	47C	40C	50C
Pressure	0.25	0	0	0	0.25
Liquid Level	ok	ok	ok	ok	
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					

COMMENTS

needs pressure

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	C.U.S.	MVA:	1.5
Transformer No.:	SBV567601	Gallons:	259
Manufacturer:	West.	PCB's	cert-non
Voltage:	12470/240	% Imp.	5.5

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0
Hydrogen	8	8	11	15	5
Ethylene	18	17	19	67	20
Methane	10	10	11	25	4
Ethane	2	1	2	6	0
Carbon Monoxide	326	381	492	765	375
Carbon Dioxide	2764	3077	3569	3399	2534
Oxygen	266	613	517	4625	3174
Total Combustibles	364	417	535	878	404
Total Gas	5.72%	73521	92883	67637	67637
OIL QUALITY					
Dielectric Break (kV)	50.4	43.2	45.1	42	49
Water in Fluid (ppm)	8.5	7.4	4	2	8
Acid Number (mg KOH/g)	0.014	0.017	0.025	0.028	0.02
Interfacial Tens.(dynes/cm)	36.1	35.9	37.1	31	32
ASTM Color	1.5	1.5	L2.0	L2.0	L1.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.872	0.8725	0.8715	0.881	0.883
OPERATING CONDITIONS					
AmbientTemp.	70F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	32C	45C	35C	40c	40C
Pressure	4.5	5	4.5	0	0.25
Liquid Level	ok	ok	ok	ok	
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					
COMMENTS					

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	C.U.S.	MVA:	1.5
Transformer No.:	SBV567602	Gallons:	259
Manufacturer:	West.	PCB's	cert-non
Voltage:	12470/240	% Imp.	5.47

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0
Hydrogen	11	9	11	25	7
Ethylene	33	28	33	113	24
Methane	10	9	11	30	3
Ethane	2	1	2	6	24
Carbon Monoxide	678	555	750	1204	719
Carbon Dioxide	4472	4150	8100	8179	6154
Oxygen	3730	4461	4819	7605	8665
Total Combustibles	734	602	807	1378	753
Total Gas	6.93%	64303	80854	67258	82842
OIL QUALITY					
Dielectric Break (kV)	52.3	43.6	45.6	39	49
Water in Fluid (ppm)	7.4	8.5	2.3	5	10
Acid Number (mg KOH/g)	0.011	0.014	0.008	0.023	0.018
Interfacial Tens.(dynes/cm)	34.4	34.3	34.3	30	30
ASTM Color	1.5	1.5	L1.5	L1.5	L1.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.872	0.8725	0.8715	0.875	0.887
OPERATING CONDITIONS					
AmbientTemp.	70F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	40C	45C	40C	40c	40C
Pressure	0	1	0.5	0	0.5
Liquid Level	ok	ok	ok	ok	
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					

COMMENTS

needs nitrogen

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	C.U.S.	MVA:	1.5
Transformer No.:	SBV567604	Gallons:	259
Manufacturer:	West.	PCB's	cert-non
Voltage:	12470/240	% Imp.	5.47

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0
Hydrogen	8	10	13	38	6
Ethylene	26	21	27	124	23
Methane	11	10	12	43	4
Ethane	2	2	2	9	0
Carbon Monoxide	477	559	659	1273	479
Carbon Dioxide	3274	3659	4586	6061	3031
Oxygen	572	540	758	4599	4430
Total Combustibles	524	602	713	1487	512
Total Gas	6.24%	74196	90658	76736	68186
OIL QUALITY					
Dielectric Break (kV)	45.9	44.6	43.5	45	50
Water in Fluid (ppm)	9.1	5.1	4.5	2	7
Acid Number (mg KOH/g)	0.02	0.023	0.025	0.021	0.021
Interfacial Tens.(dynes/cm)	44	44.6	35.4	31	30
ASTM Color	L1.5	1.5	L2.0	L2.0	L1.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.871	0.8725	0.872	0.882	0.876
OPERATING CONDITIONS					
AmbientTemp.	70F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	39C	45C	37C	35c	40C
Pressure	3	4.2	4	-0.5	0
Liquid Level	ok	ok	ok	ok	
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					
COMMENTS					

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	C.U.S.	MVA:	1.5
Transformer No.:	SBV567603	Gallons:	259
Manufacturer:	West.	PCB's	cert-non
Voltage:	12470/240	% Imp.	5.51

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0
Hydrogen	8	11	13	12	8
Ethylene	22	24	22	62	20
Methane	10	11	11	24	7
Ethane	2	2	2	5	0
Carbon Monoxide	486	542	673	846	624
Carbon Dioxide	3221	3609	4435	3542	3828
Oxygen	501	556	853	5320	2350
Total Combustibles	528	590	721	949	659
Total Gas	6.15%	73422	93460	54653	69074
OIL QUALITY					
Dielectric Break (kV)	46.6	49.4	40.4	40	47
Water in Fluid (ppm)	8	5.7	8	6	9
Acid Number (mg KOH/g)	0.02	0.023	0.022	0.03	0.019
Interfacial Tens.(dynes/cm)	35.8	35.7	36.9	31	37
ASTM Color	L1.5	1.5	L2.0	L2.0	L1.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.871	0.8732	0.8725	0.88	0.877
OPERATING CONDITIONS					
AmbientTemp.	70F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	31C	42C	33C	30c	35c
Pressure	4.5	5.2	5	-1	-0.75
Liquid Level	ok	ok	ok	ok	
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	C.U.S.	MVA:	1
Transformer No.:	PAT716001	Gallons:	224
Manufacturer:	West.	PCB's	cert-non
Voltage:	12470/480	% Imp.	5.81

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0
Hydrogen	10	15	12	19	8
Ethylene	16	15	17	48	14
Methane	12	11	11	26	6
Ethane	4	2	2	5	0
Carbon Monoxide	448	488	536	827	595
Carbon Dioxide	3185	3315	3834	3024	3116
Oxygen	158	182	230	5555	2541
Total Combustibles	490	531	578	925	623
Total Gas	6.39%	72997	79845	57173	75150
OIL QUALITY					
Dielectric Break (kV)	50.2	45.6	39.4	48	49
Water in Fluid (ppm)	2.8	6.8	3.4	4	10
Acid Number (mg KOH/g)	0.02	0.023	0.034	0.028	0.022
Interfacial Tens.(dynes/cm)	34.5	34.3	35.4	31	29
ASTM Color	L1.5	1.5	2	L1.5	L1.5
Visual Inspection	Pass	Pass	2	Pass	Pass
Specific Gravity	0.872	0.8725	0.873	0.878	0.876
OPERATING CONDITIONS					
AmbientTemp.	70F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	21C	36C	21C	30C	20C
Pressure	3	4	3	-1	-0.5
Liquid Level	ok	ok	ok	ok	
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					
COMMENTS					

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-7	MVA:	0.33
Transformer No.:	79F670-71	Gallons:	176
Manufacturer:	Elect. Tech.	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/25/2000
Acetylene	0	0	0	0
Hydrogen	23	31	6	3
Ethylene	1	1	1	0
Methane	5	4	11	14
Ethane	5	3	13	13
Carbon Dioxide	492	605	513	1129
Carbon Monoxide	54	62	56	88
Oxygen	59	81	113	2829
Total Combustibles	88	101	87	118
Total Gas	33022	38021	40723	59313
OIL QUALITY TESTS				
Dielectric Break	42.7	41.8	41.6	46
Water in Fluid	29.7	36.6	29.9	26
Acid Number	0.023	0.023	0.036	0.024
Interfacial Tens.	34.7	34.9	34.6	28
ASTM Color	5.5	5.5	5.5	L5.0
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.882	0.883	0.883	0.891
OPERATING CONDITIONS				
AmbientTemp.	79F	90F	70F	
Winding Temp.				
Liquid Temp.	36C	40C	35C	
Pressure	0	0	0	
Liquid Level			OK	
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				

COMMENTS

Apply pressure.

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4	MVA:	1.5
Transformer No.:	P008188	Gallons:	295
Manufacturer:	GE	PCB's	silicone
Voltage:	12470/480	% Imp.	

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0
Hydrogen	52	56	65	70	35
Ethylene	1	1	1	4	0
Methane	30	30	32	57	25
Ethane	2	2	2	6	0
Carbon Monoxide	852	879	980	963	887
Carbon Dioxide	4339	4254	4672	2850	4012
Oxygen	2510	1409	4772	5509	6046
Total Combustibles	937	968	1080	1100	947
Total Gas	10.57%	105420	128402	65012	1211804
OIL QUALITY					
Dielectric Break (kV)	38.7	50.4	44.2	33	38
Water in Fluid (ppm)	15.1	13.4	10.9	12	16
Acid Number (mg KOH/g)	0.003	0.006	0.008	0.01	0.003
Interfacial Tens.(dynes/cm)		43.7	43.7		
ASTM Color	0	0	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.972	0.9618	0.9615	0.977	0.975
OPERATING CONDITIONS					
AmbientTemp.	80F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	42C	45C	42C	40C	35C
Pressure			npg	npg	npg
Liquid Level	high	high	high	high	
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					
COMMENTS					

ENGINEERED SUBSTATION SERVICES INC.

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Canby, Oregon 97013
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 6	MVA:	1
Transformer No.:	836002311	Gallons:	392
Manufacturer:	RTE	PCB's	rtemp
Voltage:	12470/460	% Imp.	5.6

Lab Used	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/25/1999
Acetylene	0	0	0	0
Hydrogen	7	9	7	4
Ethylene	3	3	3	1
Methane	11	12	12	2
Ethane	6	6	6	1
Carbon Monoxide	383	394	421	1657
Carbon Dioxide	2269	2522	2676	299
Oxygen	78	64	71	8657
Nitrogen	47130	47270	51466	67461
Total Combustibles	410	424	449	307
Total Gas	49887	50280	54662	78081
OIL QUALITY				
Dielectric Break (kV)	43.7	34.9	41	47
Water in Fluid (ppm)	29.1	15.1	21.3	9
Acid Number (mg KOH/g)	0.02	0.02	0.018	0.011
Interfacial Tens.(dynes/cm)	37.7	40.5	37.2	34
ASTM Color	3	3	3	L3.5
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.8715	0.873	0.873	0.879
OPERATING CONDITIONS				
AmbientTemp.	70F	80F	70F	
Winding Temp.				
Liquid Temp.	46C	50C	52C	
Pressure			NG	
Liquid Level	OK	OK		
GAS DIAGNOSTICS				
Rogers Ratio				
Cellulose Ratio (CO2/CO)				
IEEE/ANSI (C57.104-1991)				
COMMENTS				

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
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(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 6	MVA:	1.5
Transformer No.:	836002464	Gallons:	540
Manufacturer:	RTE	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.6

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/2000
Acetylene	0	0	0	0	0
Hydrogen	5	13	5	8	4
Ethylene	4	4	4	13	2
Methane	12	14	15	34	10
Ethane	4	4	4	16	0
Carbon Monoxide	315	353	377	620	363
Carbon Dioxide	1604	1849	1703	1809	1652
Oxygen	70	126	60	4814	2059
Nitrogen	70	44029	48969	42454	54285
Total Combustibles	340	388	405	691	379
Total Gas	42300	46392	51137	49768	58373
OIL QUALITY					
Dielectric Break (kV)	41.5	34.9	45.2	33	42
Water in Fluid (ppm)	22.1	16.3	21.3	18	7
Acid Number (mg KOH/g)	0.017	0.011	0.02	0.017	0.012
Interfacial Tens.(dynes/cm)	36.8	39.1	36.5	35	35
ASTM Color	L3.5	3	3	L3.5	L3.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.8725	0.872	0.872	0.882	0.88
OPERATING CONDITIONS					
AmbientTemp.	70F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	36C	40C	37C	40c	40c
Pressure	npg	npg	npg	npg	npg
Liquid Level	ok	ok	ok	ok	
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					
COMMENTS					

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Berth 308	MVA:	0.3
Transformer No.:	H425083M68	Gallons:	122
Manufacturer:	GE	PCB's	no data
Voltage:	13200/480	% Imp.	1.71

Lab Used	JACO	JACO	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	8/25/1999
Acetylene	0	0	0
Hydrogen	3	4	15
Ethylene	28	31	37
Methane	4	6	12
Ethane	3	3	2
Carbon Monoxide	72	106	510
Carbon Dioxide	2939	3180	3711
Oxygen	14010	12749	9215
Total Combustibles	110	150	576
Total Gas	6.48%	64984	82428
OIL QUALITY			
Dielectric Break (kV)	51.1	49.2	49
Water in Fluid (ppm)	6.3	6.3	13
Acid Number (mg KOH/g)	0.011	0.017	0.012
Interfacial Tens.(dynes/cm)	35.6	36.2	30
ASTM Color	L1.5	1.5	L1.5
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.8795	0.8805	0.887
OPERATING CONDITIONS			
AmbientTemp.	72F	80F	
Winding Temp.			
Liquid Temp.	20C	39C	
Pressure			
Liquid Level	ok	ok	
GAS DIAGNOSTICS			
Rogers Ratio			
Cellulose Ratio (CO2/CO)			
IEEE/ANSI (C57.104-1991)			
COMMENTS			

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Berth 307	MVA:	0.3
Transformer No.:	H425084M68	Gallons:	122
Manufacturer:	GE	PCB's	no data
Voltage:	12470/480	% Imp.	1.71

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0
Hydrogen	9	10	11	26	5
Ethylene	7	7	7	27	4
Methane	23	26	28	84	23
Ethane	5	5	5	27	1
Carbon Monoxide	636	745	812	1307	666
Carbon Dioxide	3050	3539	4614	4962	3833
Oxygen	85	81	106	5119	2245
Total Combustibles	680	793	863	1466	699
Total Gas	5.69%	67149	71820	73149	69390
OIL QUALITY					
Dielectric Break (kV)	53.4	52.2	44.7	43	53
Water in Fluid (ppm)	6.8	6.3	3.4	11	10
Acid Number (mg KOH/g)	0.008	0.011	0.014	0.011	0.009
Interfacial Tens.(dynes/cm)	38.5	38.5	37.2	31	32
ASTM Color	L1.5	1	L1.5	L1.5	L1.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.879	0.8804	0.88	0.885	0.885
OPERATING CONDITIONS					
AmbientTemp.	71F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	38C	46C	36C	40C	35C
Pressure			npg	npg	npg
Liquid Level	ok	ok	ok	ok	
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					
COMMENTS					

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Berth 306	MVA:	0.3
Transformer No.:	H425082M68	Gallons:	122
Manufacturer:	GE	PCB's	no data
Voltage:	13200/480	% Imp.	1.71

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0
Hydrogen	2	0	1	0	0
Ethylene	3	2	2	4	0
Methane	1	1	1	3	0
Ethane	0	0	0	0	0
Carbon Monoxide	35	30	33	133	46
Carbon Dioxide	990	884	884	1018	688
Oxygen	16303	15456	22095	18404	20235
Total Combustibles	41	33	37	140	46
Total Gas	6.34%	65542	74661	73320	73481
OIL QUALITY					
Dielectric Break (kV)	54.2	49.9	43.7	34	38
Water in Fluid (ppm)	29	35.8	25	26	29
Acid Number (mg KOH/g)	0.011	0.008	0.014	0.012	0.018
Interfacial Tens.(dynes/cm)	37.8	37.9	38.2	24	33
ASTM Color	L1.5	L1.5	L1.5	L1.0	L1.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.873	0.8735	0.874	0.878	0.877
OPERATING CONDITIONS					
AmbientTemp.	72F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	42C	51C	40C	45C	36C
Pressure			npg	npg	npg
Liquid Level	ok	high	high	high	
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					
COMMENTS					

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 7A	MVA:	2
Transformer No.:	PQH0715	Gallons:	415
Manufacturer:		PCB's	rtemp
Voltage:	12470/460	% Imp.	5.4

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0
Hydrogen	9	7	6	14	5
Ethylene	7	8	7	32	6
Methane	14	15	15	43	7
Ethane	6	6	5	27	2
Carbon Monoxide	767	777	856	1346	811
Carbon Dioxide	3076	3401	5619	7301	4227
Oxygen	85	55	81	4656	2748
Nitrogen	46969	47037	52630	51068	58570
Total Combustibles	803	813	889	1462	831
Total Gas	50933	51306	59219	64487	66375
OIL QUALITY					
Dielectric Break (kV)	43.5	39.5	39.2	32	43
Water in Fluid (ppm)	17.4	12.8	14.4	24	8
Acid Number (mg KOH/g)	0.023	0.02	0.014	0.033	0.022
Interfacial Tens.(dynes/cm)	37.1	37.7	37.6	38	36
ASTM Color	L3.0	L3.0	L3.0	L3.0	L3.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.873	0.873	0.8725	0.881	0.884
OPERATING CONDITIONS					
AmbientTemp.	79F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	45C	55C	44C	45c	42c
Pressure	npg	npg	npg	npg	npg
Liquid Level	ok	ok		high	
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					
COMMENTS					

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Crane #14	MVA:	0.75
Transformer No.:	L243297	Gallons:	142
Manufacturer:		PCB's	silicone
Voltage:	2400/480	% Imp.	5.7

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0
Hydrogen	163	168	174	208	501
Ethylene	1	1	1	4	0
Methane	52	51	56	122	41
Ethane	5	5	6	20	1
Carbon Monoxide	948	941	1054	1224	853
Carbon Dioxide	4550	4392	4861	3758	3068
Oxygen	1617	1018	1881	4803	4504
Total Combustibles	1169	1166	1291	1578	1396
Total Gas	10.75%	107320	118776	79103	115933
OIL QUALITY					
Dielectric Break (kV)	47.8	47.3	46.7	33	34
Water in Fluid (ppm)	9.4	21.6	11	11	26
Acid Number (mg KOH/g)	0.003	0.008	0.008	0.006	0.001
Interfacial Tens.(dynes/cm)					
ASTM Color	0	0	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.9696	0.9638	0.963	0.967	0.969
OPERATING CONDITIONS					
AmbientTemp.	78F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	39C	39C	40C	35C	35C
Pressure	-0.3	-0.3	-0.5	0	-0.5
Liquid Level	ok	ok	ok	ok	
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					

COMMENTS

needs pressure

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Crane #17	MVA:	0.5
Transformer No.:	L243299B	Gallons:	125
Manufacturer:		PCB's	silicone
Voltage:	2400/480	% Imp.	

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0
Hydrogen	119	126	170	203	198
Ethylene	0	0	0	3	1
Methane	71	72	78	166	51
Ethane	7	7	7	31	0
Carbon Monoxide	991	1009	1200	1473	889
Carbon Dioxide	5630	5743	7642	7095	5679
Oxygen	976	701	1228	6358	5654
Total Combustibles	1188	1214	1455	1876	1139
Total Gas	11.07%	111859	140295	94624	119876
OIL QUALITY					
Dielectric Break (kV)	39.6	49.6	43.8	36	36
Water in Fluid (ppm)	17.2	19.6	13	27	21
Acid Number (mg KOH/g)	0.008	0.008	0.008	0.008	0.001
Interfacial Tens.(dynes/cm)					
ASTM Color	0	0	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.969	0.9625	0.9615	0.969	0.971
OPERATING CONDITIONS					
AmbientTemp.	70F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	38C	41C	40C	35C	40C
Pressure	0.9	1.2	1	1	1.25
Liquid Level	ok	ok	ok	ok	
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	kh
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Crane #16	MVA:	0.5
Transformer No.:	L243299C	Gallons:	125
Manufacturer:	GE	PCB's	silicone
Voltage:	2400/480	% Imp.	

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/24/1999
Acetylene	0	0	1	9	0
Hydrogen	124	181	172	231	55
Ethylene	1	2	1	7	0
Methane	44	56	52	131	24
Ethane	4	6	5	21	0
Carbon Monoxide	923	1231	1288	1557	845
Carbon Dioxide	4756	5961	7054	6117	5087
Oxygen	2257	802	1381	6293	12063
Total Combustibles	1096	1476	1524	1956	924
Total Gas	9.8%	125501	130421	92128	129232
OIL QUALITY					
Dielectric Break (kV)	40.8	49.1	45	33	46
Water in Fluid (ppm)	9.9	14.4	11	25	20
Acid Number (mg KOH/g)	0.006	0.006	0.006	0.01	0.005
Interfacial Tens.(dynes/cm)					
ASTM Color	0	0	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.97	0.9625	0.9675	0.968	0.974
OPERATING CONDITIONS					
AmbientTemp.	72F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	39C	41C	30C	40C	45C
Pressure	-0.1	0.3	0	0	0.5
Liquid Level	ok	ok	ok	ok	
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					

COMMENTS

needs nitrogen

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Crane #15	MVA:	0.5
Transformer No.:	L243299A	Gallons:	125
Manufacturer:	GE	PCB's	silicone
Voltage:	2400/480	% Imp.	5.18

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0
Hydrogen	200	210	213	265	132
Ethylene	1	1	1	4	0
Methane	43	45	48	113	40
Ethane	6	7	7	27	1
Carbon Monoxide	1110	1177	1279	1473	1221
Carbon Dioxide	5104	5351	7016	5545	5493
Oxygen	1269	751	2297	4649	117171
Total Combustibles	1360	1440	1548	1882	129723
Total Gas	10.48%	109825	124508	79505	
OIL QUALITY					
Dielectric Break (kV)	43.8	51	47.9	37	35
Water in Fluid (ppm)	10.4	15.5	12	13	29
Acid Number (mg KOH/g)	0.003	0.008	0.008	0.007	0.001
Interfacial Tens.(dynes/cm)					
ASTM Color	0	0	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.9695	0.9635	0.9745	0.968	0.973
OPERATING CONDITIONS					
AmbientTemp.	73F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	39C	40C	40C	35C	
Pressure	-0.5	-0.5	0	0	0.5
Liquid Level	ok	ok	ok	ok	
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					

COMMENTS

needs pressure

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Crane #12	MVA:	0.75
Transformer No.:	L243298	Gallons:	125
Manufacturer:	GE	PCB's	silicone
Voltage:	2400/480	% Imp.	5.64

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0
Hydrogen	179	185	197	243	109
Ethylene	1	1	1	4	0
Methane	63	61	68	138	43
Ethane	6	6	6	22	2
Carbon Monoxide	1034	1019	1157	1309	995
Carbon Dioxide	4455	4351	4895	3751	3893
Oxygen	1979	1554	2323	6243	6584
Total Combustibles	1283	1272	1429	1716	1149
Total Gas	10.71%	107397	118691	78350	123954
OIL QUALITY					
Dielectric Break (kV)	46.4	43.9	47.3	33	37
Water in Fluid (ppm)	9.4	18.6	9.4	12	22
Acid Number (mg KOH/g)	0.003	0.006	0.006	0.005	0.002
Interfacial Tens.(dynes/cm)					
ASTM Color	0	0	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.9711	0.9625	0.9615	0.971	0.973
OPERATING CONDITIONS					
AmbientTemp.	70F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	36C	37C	34C	35C	
Pressure	-0.1	-0.2	0	0	0.5
Liquid Level	ok	ok	ok	ok	
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					

COMMENTS

needs pressure

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Building 73	MVA:	0.5
Transformer No.:	PCT83390101	Gallons:	141
Manufacturer:	West.	PCB's	cert.non
Voltage:	12470/480	% Imp.	5.86

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0
Hydrogen	13	16	17	37	9
Ethylene	0	1	0	2	9
Methane	16	16	16	51	5
Ethane	1	0	1	6	0
Carbon Monoxide	617	714	824	1347	680
Carbon Dioxide	3788	4455	6681	6940	4699
Oxygen	379	882	2328	3837	8862
Total Combustibles	647	747	858	1443	694
Total Gas	5.97%	76069	95351	71804	86182
OIL QUALITY					
Dielectric Break (kV)	49	42.1	42.2	43	49
Water in Fluid (ppm)	4	8.5	3.4	6	16
Acid Number (mg KOH/g)	0.028	0.028	0.039	0.033	0.038
Interfacial Tens.(dynes/cm)	40.4	41.6	32.1	27	27
ASTM Color	1	1	L1.0	L1.0	L1.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.867	0.868	0.8665	0.876	0.871
OPERATING CONDITIONS					
AmbientTemp.	70F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	39C	35C	25C	35C	40C
Pressure	4	4	4	0	0.5
Liquid Level	ok	ok	ok	ok	
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Building 73	MVA:	0.5
Transformer No.:	PAT80910101	Gallons:	141
Manufacturer:	West	PCB's	cert.non
Voltage:	12470/480	% Imp.	5.77

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0
Hydrogen	8	17	16	42	7
Ethylene	0	1	0	2	0
Methane	13	14	16	56	6
Ethane	0	0	1	8	0
Carbon Monoxide	509	640	759	1391	645
Carbon Dioxide	3027	3746	4828	6001	3473
Oxygen	956	1604	3059	3564	11258
Total Combustibles	531	672	792	1499	658
Total Gas	5.51%	76411	93274	76157	98744
OIL QUALITY					
Dielectric Break (kV)	45.5	42.4	43.6	35	47
Water in Fluid (ppm)	6.3	6.3	4.5	8	11
Acid Number (mg KOH/g)	0.023	0.023	0.031	0.027	0.028
Interfacial Tens.(dynes/cm)	35.1	33.2	35.7	28	28
ASTM Color	1	1	1	L1.5	L1.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.8675	0.868	0.8675	0.873	0.871
OPERATING CONDITIONS					
AmbientTemp.	70F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	39C	40C	35C	40C	40C
Pressure	4	5	4	0	0
Liquid Level	ok	ok	ok	ok	
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					
COMMENTS					

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	BWTP	MVA:	0.75
Transformer No.:	PCT786301	Gallons:	179
Manufacturer:	West.	PCB's	cert.non
Voltage:	12470/480	% Imp.	6.24

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0
Hydrogen	6	3	2	0	0
Ethylene	2	1	1	1	0
Methane	3	2	2	2	0
Ethane	0	0	0	0	0
Carbon Monoxide	161	109	73	38	0
Carbon Dioxide	2351	1688	1236	553	412
Oxygen	12764	12730	20698	17164	22184
Total Combustibles	172	115	78	41	0
Total Gas	6.68%	68553	89368	65417	68858
OIL QUALITY					
Dielectric Break (kV)	44.2	45.3	47.9	30	53
Water in Fluid (ppm)	7.4	9.7	5.1	8	24
Acid Number (mg KOH/g)	0.041	0.043	0.053	0.047	0.041
Interfacial Tens.(dynes/cm)	31	29.7	31.1	26	25
ASTM Color	L1.5	L1.5	L1.5	L1.5	L1.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.879	0.8796	0.88	0.885	0.887
OPERATING CONDITIONS					
AmbientTemp.	69F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	28C	34C	32C	30C	40C
Pressure	2.5	3.2	3.5	0	0
Liquid Level	ok	ok	ok	ok	
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
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(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 8A	MVA:	2
Transformer No.:	PQH-0714	Gallons:	451
Manufacturer:		PCB's	rtemp
Voltage:	12470/460	% Imp.	5.4

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/12/2002	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0
Hydrogen	5	6	5	5	3
Ethylene	6	6	6	19	1
Methane	13	13	14	30	2
Ethane	6	5	6	18	1
Carbon Monoxide	597	611	635	885	574
Carbon Dioxide	2995	3178	4654	4642	3431
Oxygen	67	106	62	4325	3520
Total Combustibles	627	641	666	957	581
Total Gas	52463	52986	59232	57139	71043
OIL QUALITY					
Dielectric Break (kV)	42.5	39	39.5	34	50
Water in Fluid (ppm)	23.3	27.3	20.1	5	16
Acid Number (mg KOH/g)	0.014	0.014	0.022	0.02	0.017
Interfacial Tens.(dynes/cm)	44.5	45.1	45	38	38
ASTM Color	L2.5	L2.5	L2.5	L2.5	L2.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.8745	0.875	0.8745	0.883	0.887
OPERATING CONDITIONS					
AmbientTemp.	71F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	48C	50C	45C	45C	46c
Pressure					0
Liquid Level	ok	ok	ok	ok	
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					

COMMENTS

Major leak at tap changer should be repaired quickly - see attached photos.

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
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(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Portable 32-5	MVA:	1
Transformer No.:	PO15676	Gallons:	240
Manufacturer:	GE	PCB's	silicone
Voltage:	12470/460	% Imp.	5.5

Lab Used	JACO	JACO	JACO
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	0
Hydrogen	21	47	52
Ethylene	0	0	0
Methane	29	42	42
Ethane	2	3	0
Carbon Monoxide	728	1236	1254
Carbon Dioxide	5225	5567	5849
Oxygen	14219	5220	3851
Total Combustibles	780	1328	1351
Total Gas	11.12%	114823	103110
OIL QUALITY			
Dielectric Break (kV)	38.4	46.7	43.5
Water in Fluid (ppm)	9.4	13.9	6.8
Acid Number (mg KOH/g)	0.008	0.006	0.011
Interfacial Tens.(dynes/cm)			
ASTM Color	0	0	0
Visual Inspection	Pass	Pass	Pass
Specific Gravity	0.9626	0.9644	0.9628
OPERATING CONDITIONS			
AmbientTemp.	66F	80f	70F
Winding Temp.			
Liquid Temp.	35C	48C	32C
Pressure			npg
Liquid Level	ok	ok	ok
GAS DIAGNOSTICS			
Rogers Ratio			
Cellulose Ratio (CO2/CO)			
IEEE/ANSI (C57.104-1991)			
COMMENTS			

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	*5555 N Channel Blvd. PDX*	Report by	*KH*
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Portable 32-3	MVA:	2
Transformer No.:	87V1243	Gallons:	600
Manufacturer:	Vantram	PCB's	rtemp
Voltage:	12470/460	% Imp.	5.7

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0
Hydrogen	16	16	7	18	6
Ethylene	14	1	18	75	14
Methane	13	16	16	48	10
Ethane	4	0	5	16	1
Carbon Monoxide	479	714	333	962	4501
Carbon Dioxide	3372	4455	4915	6055	596
Oxygen	81	882	82	4850	1900
Total Combustibles	526	747	319	1119	627
Total Gas	51075	76069	60933	61085	65369
OIL QUALITY					
Dielectric Break (kV)	39.2	32.5	39.1	33	49
Water in Fluid (ppm)	29.7	15.7	21.3	7	13
Acid Number (mg KOH/g)	0.011	0.008	0.014	0.015	0.008
Interfacial Tens.(dynes/cm)	45.7	46.2	46.5	39	42
ASTM Color	1.5	1.5	1.5	L2.0	L2.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.875	0.87	0.8705	0.88	0.883
OPERATING CONDITIONS					
AmbientTemp.	69F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	68C	48C	40c	40c	42c
Pressure	0	0	0	npg	
Liquid Level	ok	ok	ok	ok	
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					
COMMENTS					

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 5	MVA:	1
Transformer No.:	PO14476	Gallons:	240
Manufacturer:	GE	PCB's	silicone
Voltage:	12470/460	% Imp.	5.5

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0
Hydrogen	7	61	60	91	28
Ethylene	0	0	0	1	0
Methane	11	21	22	45	6
Ethane	1	2	2	6	0
Carbon Monoxide	267	861	903	1027	730
Carbon Dioxide	3355	3985	3935	2846	2858
Oxygen	23275	5442	10752	9121	15323
Total Combustibles	286	945	987	1170	764
Total Gas	11.39%	102305	122087	74431	114837
OIL QUALITY					
Dielectric Break (kV)	39.6	42	46.1	30	32
Water in Fluid (ppm)	25	14.4	5.7	12	26
Acid Number (mg KOH/g)	0.003	0.006	0.006	0.002	0.003
Interfacial Tens.(dynes/cm)					
ASTM Color	0	0	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.9712	0.9635	0.9622	0.971	0.976
OPERATING CONDITIONS					
AmbientTemp.	71F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	30C	40C	38C	40C	33C
Pressure			npg	npg	
Liquid Level	ok	ok	ok	ok	
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					
COMMENTS					

ENGINEERED SUBSTATION SERVICES INC.

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(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 5	MVA:	1.5
Transformer No.:	PO14490	Gallons:	315
Manufacturer:	GE	PCB's	silicone
Voltage:	12470/460	% Imp.	5.54

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/2000
Acetylene	0	0	0	0	0
Hydrogen	17	23	31	53	28
Ethylene	1	1	0	2	0
Methane	83	81	100	183	76
Ethane	4	4	4	16	1
Carbon Monoxide	360	367	452	659	458
Carbon Dioxide	2060	1691	1894	1306	1455
Oxygen	1419	10942	14571	9079	13837
Total Combustibles	465	476	587	913	563
Total Gas	11.12%	110157	124866	74179	126025
OIL QUALITY					
Dielectric Break (kV)	39.5	50.9	47.1	37	38
Water in Fluid (ppm)	12	9.8	6.3	19	9
Acid Number (mg KOH/g)	0.003	0.006	0.006	0.002	0.001
Interfacial Tens.(dynes/cm)					
ASTM Color	0	0	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.9672	0.9612	0.9632	0.969	0.973
OPERATING CONDITIONS					
AmbientTemp.	71F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	31C	39C	39C	35C	33C
Pressure	npg	npg	npg	npg	
Liquid Level	ok	ok	low	low	
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					
COMMENTS					

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4	MVA:	1
Transformer No.:	PCT2521-0101	Gallons:	200
Manufacturer:	West	PCB's	silicone
Voltage:	12470/460	% Imp.	5.94

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0		0
Hydrogen	30	32	46		21
Ethylene	0	0	0		0
Methane	79	78	82		53
Ethane	4	4	3		0
Carbon Monoxide	1655	1648	2037		1612
Carbon Dioxide	6794	7421	11838		9722
Oxygen	1245	2864	3384		10872
Total Combustibles	1768	1762	2168		1686
Total Gas	11.33%	125571	158357		125843
OIL QUALITY					
Dielectric Break (kV)	43.9	37.1	45.5		36
Water in Fluid (ppm)	8.3	12.4	7.8		14
Acid Number (mg KOH/g)	0.003	0.006	0.008		0.003
Interfacial Tens.(dynes/cm)					
ASTM Color	0	0	0		L0.5
Visual Inspection	Pass	Pass	Clear		Pass
Specific Gravity	0.969	0.963	0.962		0.974
OPERATING CONDITIONS					
AmbientTemp.	80F	80F			
Winding Temp.					
Liquid Temp.	50C	50C			50C
Pressure	4	4			-0.25
Liquid Level	ok	ok			
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					
COMMENTS					

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 3	MVA:	1.5
Transformer No.:	R277558	Gallons:	321
Manufacturer:		PCB's	silicone
Voltage:	12470/480	% Imp.	

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/25/2000	2/7/2000
Acetylene	0	0	0	19	0
Hydrogen	35	33	46	100	18
Ethylene	0	1	0	13	0
Methane	27	26	29	83	7
Ethane	3	3	2	13	0
Carbon Monoxide	583	563	681	1046	535
Carbon Dioxide	6355	6341	9382	8934	730
Oxygen	8771	8119	13861	13060	20371
Total Combustibles	648	626	758	1274	560
Total Gas	11.3%	114538	151671	101936	130420
OIL QUALITY					
Dielectric Break (kV)	39.7	47.7	46.1	36	37
Water in Fluid (ppm)	35.4	42.8	36.5	38	34
Acid Number (mg KOH/g)	0.003	0.006	0.006	0.005	0.003
Interfacial Tens.(dynes/cm)					
ASTM Color	0	0	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.9695	0.8638	0.9625	0.969	0.973
OPERATING CONDITIONS					
AmbientTemp.	75F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	43C	45C	44C	40C	42C
Pressure	1.8	2	3	1.5	1.5
Liquid Level	high	high	high	high	
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					
COMMENTS					

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 3	MVA:	1
Transformer No.:	R277557	Gallons:	268
Manufacturer:		PCB's	silicone
Voltage:	12470/480	% Imp.	6

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0
Hydrogen	19	13	10	0	0
Ethylene	0	0	0	0	0
Methane	5	4	3	0	0
Ethane	1	1	0	0	0
Carbon Monoxide	184	131	78	22	0
Carbon Dioxide	3503	2626	1671	580	460
Oxygen	21138	20870	32373	24101	43478
Total Combustibles	209	149	91	24	0
Total Gas	11.34%	117158	139818	91355	141319
OIL QUALITY					
Dielectric Break (kV)	39.7	50.9	43.6	29	31
Water in Fluid (ppm)	42.7	48.5	42.8	49	42
Acid Number (mg KOH/g)	0.003	0.006	0.008	0.005	0.002
Interfacial Tens.(dynes/cm)					
ASTM Color	0	0	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.969	0.9628	0.963	0.967	0.981
OPERATING CONDITIONS					
AmbientTemp.	75F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	42C	42C	41C	40C	42C
Pressure	0	0	0	0	-0.25
Liquid Level	high	high	high	high	
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					

COMMENTS

needs pressure

high moisture - although a silicone unit

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
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(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 1	MVA:	1.5
Transformer No.:	910396-A1	Gallons:	345
Manufacturer:	Square D	PCB's	rtemp
Voltage:	12470/480	% Imp.	6.3

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0
Hydrogen	4	5	4	7	3
Ethylene	15	18	19	81	5
Methane	14	16	17	46	3
Ethane	3	3	3	13	0
Carbon Monoxide	287	323	342	665	237
Carbon Dioxide	2159	2610	2584	3022	1378
Oxygen	68	131	63	1677	3503
Total Combustibles	323	365	385	812	248
Total Gas	54216	62288	67529	42953	57834
OIL QUALITY					
Dielectric Break (kV)	40.6	41.1	40.8	41	41
Water in Fluid (ppm)	4.7	9.9	5.2	8	7
Acid Number (mg KOH/g)	0.023	0.02	0.042	0.029	0.027
Interfacial Tens.(dynes/cm)	42.3	43.4	43.1	36	35
ASTM Color	L3.5	L3.5	L3.5	L3.5	L3.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.8781	0.879	0.8784	0.888	0.892
OPERATING CONDITIONS					
AmbientTemp.	71F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	39C	41C	40c	40c	42c
Pressure	2	2.9	2.5	0	0.25
Liquid Level	ok	ok	ok	ok	
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 1	MVA:	2
Transformer No.:	910396-B1	Gallons:	390
Manufacturer:	Square D	PCB's	rtemp
Voltage:	12470/480	% Imp.	6.05

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0
Hydrogen	3	6	4	5	3
Ethylene	2	2	2	9	0
Methane	12	14	15	36	3
Ethane	3	3	3	13	0
Carbon Monoxide	323	375	412	654	190
Carbon Dioxide	2419	3021	4192	4147	1703
Oxygen	68	73	74	1711	16668
Total Combustibles	343	400	436	717	196
Total Gas	45628	52232	58144	39997	103832
OIL QUALITY					
Dielectric Break (kV)	40.3	44.4	43	39	34
Water in Fluid (ppm)	5.8	19.8	5.2	5	11
Acid Number (mg KOH/g)	0.023	0.023	0.02	0.028	0.028
Interfacial Tens.(dynes/cm)	42	44.3	44.2	35	36
ASTM Color	3	3	3	L3.5	L3.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.877	0.877	0.8765	0.885	0.889
OPERATING CONDITIONS					
AmbientTemp.	71F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	38C	41C	38C	40c	42c
Pressure	-0.8	-0.2	0	0	-1
Liquid Level	ok	ok	ok	ok	
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					

COMMENTS

needs pressure

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 1	MVA:	2
Transformer No.:	910396-C1	Gallons:	390
Manufacturer:	Square D	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.75

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0
Hydrogen	21	27	26	44	17
Ethylene	1	2	1	6	0
Methane	9	10	12	24	6
Ethane	2	2	3	9	0
Carbon Monoxide	278	3005	310	550	296
Carbon Dioxide	2379	2853	3629	3540	3125
Oxygen	68	209	57	1640	1306
Total Combustibles	311	346	352	633	319
Total Gas	45310	50073	52887	36014	56537
OIL QUALITY					
Dielectric Break (kV)	46.1	42.7	42.8	34	45
Water in Fluid (ppm)	7	12.8	8.6	2	29
Acid Number (mg KOH/g)	0.023	0.025	0.025	0.027	0.028
Interfacial Tens.(dynes/cm)	42	42.2	42.3	36	37
ASTM Color	3	3	3	L3.5	L3.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.8776	0.879	0.8785	0.884	0.885
OPERATING CONDITIONS					
AmbientTemp.	81F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	39	43C	40c	40c	43c
Pressure	-0.5	0	0	-1	-1
Liquid Level	ok	ok	ok	ok	
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					

COMMENTS

need pressure

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 7	MVA:	0.75
Transformer No.:	M590624TLPA	Gallons:	230
Manufacturer:	GE	PCB's	no data
Voltage:	12470/480	% Imp.	5.75

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	1	0	0	0	0
Hydrogen	34	40	41	73	19
Ethylene	5	5	5	15	1
Methane	12	14	15	37	5
Ethane	3	3	3	13	1
Carbon Monoxide	517	604	656	917	531
Carbon Dioxide	2574	3089	4176	3797	3035
Oxygen	62	1080	166	3874	3583
Total Combustibles	572	688	720	1055	557
Total Gas	4.82%	58424	62867	46226	65891
OIL QUALITY					
Dielectric Break (kV)	51.3	48.4	45.6	46	37
Water in Fluid (ppm)	12.5	11.4	8.5	7	17
Acid Number (mg KOH/g)	0.011	0.011	0.014	0.02	0.014
Interfacial Tens.(dynes/cm)	36.9	37.1	37.1	31	32
ASTM Color	L0.5	L0.5	L0.5	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.8918	0.8924	0.8925	0.902	0.901
OPERATING CONDITIONS					
AmbientTemp.	75F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	25C	35C	26C	25C	32C
Pressure	-3	0	-1.5	0	0
Liquid Level	ok	ok	ok	ok	
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					

COMMENTS

needs pressure

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/22/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 8	MVA:	0.75
Transformer No.:	M590623TLPA	Gallons:	230
Manufacturer:	GE	PCB's	no data
Voltage:	12470/480	% Imp.	5.75

Lab Used	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0
Hydrogen	36	38	38	62	20
Ethylene	3	3	3	8	1
Methane	11	13	15	34	8
Ethane	2	3	3	11	0
Carbon Monoxide	477	538	609	836	502
Carbon Dioxide	2246	2529	3217	2748	2269
Oxygen	65	79	114	3386	3246
Total Combustibles	529	595	668	951	531
Total Gas	4.67%	53457	60959	44515	64744
OIL QUALITY					
Dielectric Break (kV)	50.9	46.9	41.5	36	39
Water in Fluid (ppm)	6.3	8	13	5	20
Acid Number (mg KOH/g)	0.011	0.014	0.017	0.02	0.014
Interfacial Tens.(dynes/cm)	41.1	43	38.7	30	31
ASTM Color	0.5	0.5	L0.5	L0.5	0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.8915	0.8919	0.8925	0.898	0.898
OPERATING CONDITIONS					
AmbientTemp.	69F	80F	70F	80F	
Winding Temp.					
Liquid Temp.	30C	35C	27C	25C	27C
Pressure	0	0	0		
Liquid Level	NO LG	NO LG	NA	ok	
GAS DIAGNOSTICS					
Rogers Ratio					
Cellulose Ratio (CO2/CO)					
IEEE/ANSI (C57.104-1991)					

COMMENTS

needs pressure

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/12/2008
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1609
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Dry Dock 3	MVA:	1
Transformer No.:	16121-1	Gallons:	415
Manufacturer/Date:	Sierra	PCB's	cert.non
Voltage:	12470/480	% Imp.	NP

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/12/2008	8/30/2007	11/17/2006	10/21/2005	6/16/2004	8/5/2003	8/12/2002
Acetylene (C2H2)	0	0	0	0	0	0	0
Hydrogen (H2)	0	5	4	6	4	5	5
Ethylene (C2H4)	8	4	4	1	2	3	3
Methane (CH4)	3	3	3	2	2	2	2
Ethane (C2H6)	2	1	1	1	0	0	0
Carbon Monoxide (CO)	225	356	288	265	196	241	236
Carbon Dioxide (CO2)	2753	2501	2373	2233	1849	2608	2634
Oxygen (O2)	10148	13257	8094	1773	3871	7647	8019
Total Combustibles	238	369	300	278	204	251	246
Total Gas%	6.11%	8.63%	7.16%	3.59%	4.23%	5.69%	6.02%
OIL QUALITY							
Dielectric D-1816	47.8	43.2	53	43.8	47	51.3	49.4
Water in Fluid (ppm) D-1533	6.8	6.3	5.7	7.4	4.5	9.7	11.4
Acid Number (mg KOH/g) D-974	0.01	0.02	0.008	0.005	0.006	0.003	0.003
Interfacial Tens.(dynes/cm) D-971	42	42	41.8	43.3	44.1	38.8	36.7
ASTM Color D-1500	L1.0	L1.0	L1.0	L1.0	L1.0	L1.0	1
Visual Inspection D-1524	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.875	0.876	0.878	0.878	0.876	0.877	0.877
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	6.03	6.25	8.38	8.91	5.42	9.26	8.41
OPERATING CONDITIONS							
Ambient Temp. °F.	85	80	47	60	75	79	80
Winding Temp °C.							
Liquid Temp °C.	38	35	25	30	30	36	43
Pressure	-1	-0.5	-1.5	-2	-1.5	-1	-0.2
Liquid Level	ok	ok	ok	ok	low	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	2 0 2 0	0-0-2-0	0-0-2-0	0-0-2-0	0-0-2-0		
Cellulose Ratio (CO2/CO)	12.23	7.03	9.43	8.43	9.43		
IEEE/ANSI (C57.104-1991)							

COMMENTS needs pressure

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/12/2008
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1609
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Dry Dock 3	MVA:	1.5
Transformer No.:	16745-1	Gallons:	327
Manufacturer/Date:	Sierra	PCB's	cert.non
Voltage:	12470/480	% Imp.	NP

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/12/2008	8/30/2007	11/17/2006	10/21/2005	6/19/2004	8/5/2003	8/12/2002
Acetylene (C2H2)	0	0	0	0	0	0	0
Hydrogen (H2)	5	2	7	10	12	2	8
Ethylene (C2H4)	27	16	20	18	16	13	16
Methane (CH4)	4	4	6	5	5	3	5
Ethane (C2H6)	2	1	1	1	1	1	1
Carbon Monoxide (CO)	285	274	577	562	520	149	499
Carbon Dioxide (CO2)	3646	2658	2437	2648	2850	2951	3524
Oxygen (O2)	11073	13866	2324	342	1019	11059	3753
Total Combustibles	324	279	611	596	544	168	529
Total Gas%	7.18%	8.32%	5.89%	3.78%	5.25%	5.74%	6.02%
OIL QUALITY							
Dielectric D-1816	64.1	36.6	48.2	45.7	49	50.8	46.8
Water in Fluid (ppm) D-1533	5.1	4.5	9.1	9	6.3	18.2	15.3
Acid Number (mg KOH/g) D-974	0.02	0.02	0.008	0.008	0.008	0.008	0.008
Interfacial Tens.(dynes/cm) D-971	40	43	37.9	44.8	46.2	39	39.2
ASTM Color D-1500	L1.5	L1.5	L1.5	L1.5	L1.5	1	1
Visual Inspection D-1524	pass	pass	pass	pass	pass	pass	pass
Specific Gravity D-1298	0.875	0.876	0.875	0.8775	0.876	0.876	0.8774
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	4.52	5.42	16.44	7.41	5.18	9.79	8.23
OPERATING CONDITIONS							
Ambient Temp. °F.	85	80	47	60	75	79	80
Winding Temp °C.							
Liquid Temp °C.	38	30	20	40	40	52	52
Pressure	0	0	0	0	-1	-0.5	-0.5
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0 0 2 0	1-0-2-0	0-0-2-0	0-0-2-0	0-0-2-0		
Cellulose Ratio (CO2/CO)	12.81	9.70	4.22	4.71	5.48		
IEEE/ANSI (C57.104-1991)							

COMMENTS Needs Pressure

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/12/2008
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1609
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Dry Dock 3	MVA:	1
Transformer No.:	16121-3	Gallons:	415
Manufacturer/Date:	Sierra	PCB's	cert.non
Voltage:	12470/480	% Imp.	5.7

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/12/2008	8/29/2007	11/11/2006	10/12/2005	6/19/2004	8/5/2003	11/14/2002
Acetylene (C2H2)	0	1	1	1	1	1	0
Hydrogen (H2)	1	2	3	3	0	2	2
Ethylene (C2H4)	12	9	11	11	11	9	0
Methane (CH4)	2	3	3	3	2	2	0
Ethane (C2H6)	3	1	2	1	1	1	1
Carbon Monoxide (CO)	47	111	83	66	33	16	2
Carbon Dioxide (CO2)	1707	1981	1933	1491	866	471	346
Oxygen (O2)	9433	18017	14693	3316	11042	10706	1989
Total Combustibles	66	127	103	85	48	31	5
Total Gas%	6.09%	10.21%	10.91%	4.8%	7.17%	5.80%	4.68%
OIL QUALITY							
Dielectric D-1816	44.9	39.3	43.9	39.3	45.2	48.2	42.5
Water in Fluid (ppm) D-1533	22.2	21.6	10.8	23.3	14.2	27.3	6
Acid Number (mg KOH/g) D-974	0.01	0.01	0.003	0.008	0.008	0.003	0.003
Interfacial Tens.(dynes/cm) D-971	46	47	43.4	43.5	49.4	39.8	49.2
ASTM Color D-1500	L0.5	L0.5	L0.5	L0.5	L0.5	L1.0	0
Visual Inspection D-1524	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.885	0.883	0.885	0.886	0.885	0.885	0.8938
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	18.27	17.77	19.51	28.04	18.49	22.46	4.94
OPERATING CONDITIONS							
Ambient Temp. °F.	85	85	47	60	75	79	60
Winding Temp °C.							
Liquid Temp °C.	40	40	20	30	28	40	40
Pressure	2	1	0	1.5	1.5	2.5	1
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	1 1 2 0	1-0-2-0	1-0-2-0	1-0-2-0	2-0-2-0		
Cellulose Ratio (CO2/CO)	36.27	17.85	23.29	22.59	26.24		
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/12/2008
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1609
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 4-5	MVA:	0.33
Transformer No.:	79F6705	Gallons:	176
Manufacturer/Date:	Sierra	PCB's	
Voltage:	12470/480	% Imp.	

	Lab Used	JACO	JACO
DISSOLVED GASES PPM		9/12/2008	6/16/2004
Acetylene (C2H2)		3	29
Hydrogen (H2)		10	71
Ethylene (C2H4)		2	16
Methane (CH4)		1	31
Ethane (C2H6)		1	23
Carbon Monoxide (CO)		19	54
Carbon Dioxide (CO2)		543	987
Oxygen (O2)		279	69
Total Combustibles		36	224
Total Gas%		2.42%	
OIL QUALITY			
Dielectric D-1816		52.4	43.1
Water in Fluid (ppm) D-1533		5.7	61.6
Acid Number (mg KOH/g) D-974		0.04	0.028
Interfacial Tens.(dynes/cm) D-971		37	39.2
ASTM Color D-1500		L6.0	<6.0
Visual Inspection D-1524		Pass	Pass
Specific Gravity D-1298		0.882	0.882
Power Factor @ 25 C			
Power Factor @ 100 C			
Relative Saturation		N/A	
OPERATING CONDITIONS			
Ambient Temp. °F.		75	
Winding Temp °C.		42	
Liquid Temp °C.			
Pressure		0.5	
Liquid Level		OK	
GAS DIAGNOSTICS			
Rogers Ratio		0 0 1 1	
Cellulose Ratio (CO2/CO)		27.91	
IEEE/ANSI (C57.104-1991)			

COMMENTS

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/12/2008
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1609
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 4-2	MVA:	0.33
Transformer No.:	7916702	Gallons:	176 Rtemp
Manufacturer/Date:	Elect. Tech	PCB's	
Voltage:	12470/480	% Imp.	5.1

Now 08 Blown up fuses

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/12/2008	8/29/2007	11/9/2006	10/12/2005	6/16/2004	8/5/2003	8/12/2002
Acetylene (C2H2)	0	0	0	0	6	0	0
Hydrogen (H2)	26	7	15	9	11	9	15
Ethylene (C2H4)	0	1	0	1	15	1	1
Methane (CH4)	1	3	2	4	1	5	5
Ethane (C2H6)	0	1	1	3	0	5	6
Carbon Monoxide (CO)	30	137	85	122	88	74	41
Carbon Dioxide (CO2)	495	1390	1016	1176	1062	967	638
Oxygen (O2)	3452	4726	3591	11	73	68	97
Total Combustibles	58	149	103	139	121	94	68
Total Gas%	2.01%	5.26%	3.52%	2.63%	3.83%	4.11%	4.17%
OIL QUALITY							
Dielectric D-1816	60.2	free water	41.8	39.9	41.5	42.7	44.8
Water in Fluid (ppm) D-1533	20.5	84.7	16.8	18	40.1	18	19.8
Acid Number (mg KOH/g) D-974	0.06	0.02	0.03	0.023	0.022	0.025	0.025
Interfacial Tens.(dynes/cm) D-971	31	39	31.9	32.6	32.6	32.1	32.7
ASTM Color D-1500	5.5	L5.5	L5.5	5.5	5.5	5.5	5.5
Visual Inspection D-1524	Pass	Fail	Pass	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.881	0.884	0.88	0.885	0.8825	0.883	0.884
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	19.58	75.05	58.95	17.86	48.26	15.95	24.79
OPERATING CONDITIONS							
Ambient Temp. °F.	85	80	55	55	75	79	80
Winding Temp °C.							
Liquid Temp °C.	36	38	5	35	30	38	29
Pressure	0	1.5	0	0	0	2	1
Liquid Level	ok	ok	ok	ok	low	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	5 0 2 0	0-0-1-0					
Cellulose Ratio (CO2/CO)	16.31	10.15	11.95	9.64	12.07		
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/12/2008
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1609
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 4-4	MVA:	0.33
Transformer No.:	79F6704	Gallons:	176 rtemp
Manufacturer/Date:	Elect. Tech	PCB's	no data
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/12/2008	8/29/2007	11/9/2006	10/11/2005	7/28/2004	6/16/2004	8/12/2002
Acetylene (C2H2)	0	0	0	1	<1	0	1
Hydrogen (H2)	12	16	11	7	<1	5	4
Ethylene (C2H4)	8	6	5	4	<1	17	22
Methane (CH4)	3	2	2	2	<1	3	3
Ethane (C2H6)	2	1	0	0	<1	3	3
Carbon Monoxide (CO)	87	128	96	76	<10	88	112
Carbon Dioxide (CO2)	1228	1201	1027	860	<100	1614	1853
Oxygen (O2)	605	972	2952	441	<100	64	122
Total Combustibles	112	153	114	90	*	116	117
Total Gas%	3.32%	5.56%	4.13%	2.89%	*	3.58%	3.8%
OIL QUALITY							
Dielectric D-1816	57.2	37.7	45.7	38.4	42	42.2	40
Water in Fluid (ppm) D-1533	5.7	18.8	1.2	76.7	4	93.6	18
Acid Number (mg KOH/g) D-974	0.04	0.04	0.065	0.026	0.022	0.025	0.025
Interfacial Tens.(dynes/cm) D-971	38	40	35	37	36.7	36.9	37
ASTM Color D-1500	L5.0	L5.0	L5.0	L5.5	L5.5	L5.5	5.5
Visual Inspection D-1524	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.881	0.882	0.878	0.88	0.8815	0.88	0.8828
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	5.87	16.66	1.76	76.09	1.94	112.64	15.95
OPERATING CONDITIONS							
Ambient Temp. °F.	85	80	52	52	80	75	78
Winding Temp °C.							
Liquid Temp °C.	34	38	25	35	55	30	38
Pressure	1.5	3	3	0	1.5	0	0.5
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0 0 2 0	0-0-2-0					
Cellulose Ratio (CO2/CO)	14.06	9.38	10.70	11.32		18.34	
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/17/2008	
Address:	5555 N Channel Blvd. PDX	Report by:	KH	
Phone:	503-247-1667	STR Job No:	1609	
Contact:	Ken Swingle	Class:	NP	
Substation/Site:	Sub 4-11	MVA:	0.33	
Transformer No.:	79F6701	Gallons:	176	rtemp
Manufacturer/Date:	Elect. Tech	PCB's	no data	
Voltage:	12470/480	% Imp.	5.1	

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/17/2008	8/29/2007	11/9/2006	10/11/2005	6/16/2004	8/5/2003	8/12/2002
Acetylene (C2H2)	0	0	0	0	0	0	0
Hydrogen (H2)	0	23	25	24	20	5	12
Ethylene (C2H4)	4	3	4	4	4	4	5
Methane (CH4)	3	4	6	5	14	7	10
Ethane (C2H6)	4	4	5	5	17	6	10
Carbon Monoxide (CO)	55	118	117	111	109	96	75
Carbon Dioxide (CO2)	1813	1436	1770	1529	1872	1965	2061
Oxygen (O2)	1753	3017	4750	19	51	69	62
Total Combustibles	65	152	157	149	164	118	112
Total Gas%	2.61%	4.44%	4.81%	2.51%	3.94%	4.08%	4.19%
OIL QUALITY							
Dielectric D-1816	35.1	33.3	47.1	34.9	40.6	26	33.8
Water in Fluid (ppm) D-1533	15.3	11.9	8.1	16.9	36	22.1	14.5
Acid Number (mg KOH/g) D-974	0.04	0.03	0.038	0.023	0.022	0.023	0.02
Interfacial Tens.(dynes/cm) D-971	35	38	33.8	33.3	33	32.2	33
ASTM Color D-1500	L6.0	L5.5	L6.0	L6.0	L6.0	L6.0	5.5
Visual Inspection D-1524	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.882	0.88	0.88	0.882	0.882	0.882	0.886
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	14.61	10.95	22.60	16.76	43.32	26.60	11.93
OPERATING CONDITIONS							
Ambient Temp. °F.	75	75	50	65	75	70	80
Winding Temp °C.							
Liquid Temp °C.	36	37	10	35	30	30	40
Pressure	0	0	0	0	0	0	1
Liquid Level	ok	low	low	low	low	low	low
GAS DIAGNOSTICS							
Rogers Ratio	2 1 1 0	0-1-0-0					
Cellulose Ratio (CO2/CO)	33.12	12.17	15.13	13.77	17.17		
IEEE/ANSI (C57.104-1991)							

COMMENTS needs pressure

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/12/2008
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1609
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 4-3	MVA:	0.33
Transformer No.:	79F6703	Gallons:	176 Rtemp
Manufacturer/Date:	Elect. Tech	PCB's	no data
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/12/2008	8/30/2007	11/9/2006	10/12/2005	6/16/2004	8/5/2003	8/12/2002
Acetylene (C2H2)	4	7	8	10	10	11	12
Hydrogen (H2)	20	19	18	14	11	11	13
Ethylene (C2H4)	15	18	20	25	26	30	32
Methane (CH4)	4	6	7	9	11	11	13
Ethane (C2H6)	3	2	2	2	5	4	5
Carbon Monoxide (CO)	97	186	188	202	165	156	146
Carbon Dioxide (CO2)	1571	1534	1409	1812	1643	1820	1840
Oxygen (O2)	4134	8543	3566	1454	67	118	200
Total Combustibles	142	238	243	262	228	223	221
Total Gas%	2.84%	5.07%	4.08%	3.23%	4.06%	4.23%	4.53%
OIL QUALITY							
Dielectric D-1816	52.3	29.9	39	40.2	41.5	45.6	41.8
Water in Fluid (ppm) D-1533	6.8	7.4	7.6	11.1	20.3	19.8	22.1
Acid Number (mg KOH/g) D-974	0.03	0.03	0.03	0.023	0.022	0.023	0.023
Interfacial Tens.(dynes/cm) D-971	35	39	31.9	32.8	32.7	32	32.8
ASTM Color D-1500	L5.0	L5.0	L5.0	5	5	5	5
Visual Inspection D-1524	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.875	0.882	0.878	0.882	0.882	0.889	0.881
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	6.49	6.56	11.17	13.36	21.74	20.41	16.30
OPERATING CONDITIONS							
Ambient Temp. °F.	80	80	53	50	75	69	80
Winding Temp °C.							
Liquid Temp °C.	36	38	25	30	33	34	43
Pressure	1	1	0	0	0.7	0.5	1.6
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0 0 2 0	0-0-2-0					
Cellulose Ratio (CO2/CO)	16.27	8.25	7.49	8.97	9.96		
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/12/2008
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1609
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 4-1	MVA:	0.33
Transformer No.:	79F9701	Gallons:	176 rtemp
Manufacturer/Date:	Elect. Tech	PCB's	no data
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/12/2008	8/30/2007	11/11/2006	10/11/2005	6/16/2004	8/5/2003	8/12/2002
Acetylene (C2H2)	0	0	0	0	0	0	0
Hydrogen (H2)	12	22	14	36	8	5	9
Ethylene (C2H4)	4	2	2	3	1	3	2
Methane (CH4)	1	1	1	1	2	2	2
Ethane (C2H6)	0	0	0	0	1	0	0
Carbon Monoxide (CO)	26	34	19	37	47	66	57
Carbon Dioxide (CO2)	626	461	400	454	429	571	463
Oxygen (O2)	12514	12350	8995	2189	98	42	56
Total Combustibles	42	59	36	77	59	76	70
Total Gas%	4.93%	5.54%	4.42%	2.45%	4.00%	4.04%	3.46%
OIL QUALITY							
Dielectric D-1816	56.1	33.5	43.2	39.7	41.5	46.7	42
Water in Fluid (ppm) D-1533	9.7	10.9	24.4	23.2	18.6	29.7	26.7
Acid Number (mg KOH/g) D-974	0.04	0.04	0.046	0.029	0.028	0.031	0.031
Interfacial Tens.(dynes/cm) D-971	36	36	30.7	33.1	33.2	33.5	33.5
ASTM Color D-1500	L6.0	L6.0	L5.5	6	6	6	6
Visual Inspection D-1524	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.88	0.885	0.88	0.8825	0.882	0.8815	0.881
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	9.62	8.97	35.85	23.01	22.38	35.74	20.42
OPERATING CONDITIONS							
Ambient Temp. °F.	85	80	50	65	75	65	80
Winding Temp °C.							
Liquid Temp °C.	35	40	25	35	30	30	42
Pressure	0	0.25	0	0	0	0	0
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	5 0 2 0	5-0-2-0					
Cellulose Ratio (CO2/CO)	24.42	13.56	21.05	12.27	9.13		
IEEE/ANSI (C57.104-1991)							

COMMENTS needs pressure

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/12/2008	
Address:	5555 N Channel Blvd. PDX	Report by:	KH	
Phone:	503-247-1667	STR Job No:	1609	
Contact:	Ken Swingle	Class:	NP	
Substation/Site:	Sub 4-12	MVA:	0.33	
Transformer No.:	79F67012	Gallons:	176	Rtemp
Manufacturer/Date:	Elect. Tech	PCB's	no data	
Voltage:	12470/480	% Imp.	5.1	

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/12/2008	8/29/2007	11/9/2006	10/12/2005	7/28/2004	6/16/2004	8/5/2003
Acetylene (C2H2)	0	0	0	0	<1	0	0
Hydrogen (H2)	0	5	6	10	<1	142	17
Ethylene (C2H4)	4	4	5	5	<1	12	8
Methane (CH4)	1	1	1	1	<1	15	4
Ethane (C2H6)	0	0	0	0	<1	12	2
Carbon Monoxide (CO)	21	41	37	60	<10	116	86
Carbon Dioxide (CO2)	766	899	874	719	<100	2117	1503
Oxygen (O2)	7693	11199	8532	1203	<100	74	122
Total Combustibles	27	51	49	76	*	297	117
Total Gas%	3.18%	5.48%	4.96%	2.98%	*	4.52%	3.8%
OIL QUALITY							
Dielectric D-1816	28.9	36.5	45	38.5	40	39.7	38
Water in Fluid (ppm) D-1533	32.4	21.9	23.8	26.2	8.7	107	69.7
Acid Number (mg KOH/g) D-974	0.03	0.03	0.03	0.023	0.022	0.022	0.023
Interfacial Tens.(dynes/cm) D-971	35	37	31.9	32.3	32.3	32.2	32.4
ASTM Color D-1500	L5.0	L5.0	l5.0	5.5	5.5	5.5	5.5
Visual Inspection D-1524	*Fail	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.882	0.883	0.88	0.8835	0.882	0.8815	0.8825
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	33.39	19.40	34.97	25.99	4.23	128.76	61.76
OPERATING CONDITIONS							
Ambient Temp. °F.	80	80	50	65	80	75	78
Winding Temp °C.							
Liquid Temp °C.	34	38	25	35	55	30	38
Pressure	0	0	0	0	1.5	0	0
Liquid Level	ok	ok	ok	ok	ok	low	low
GAS DIAGNOSTICS							
Rogers Ratio	2 0 2 0	0-0-2-0					
Cellulose Ratio (CO2/CO)	36.11	21.93	23.62	11.98		18.25	
IEEE/ANSI (C57.104-1991)							

COMMENTS needs pressure
slight moisture/low dielectric

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/12/2008	
Address:	5555 N Channel Blvd. PDX	Report by:	KH	
Phone:	503-247-1667	STR Job No:	1609	
Contact:	Ken Swingle	Class:	NP	
Substation/Site:	Sub 4-6	MVA:	0.33	
Transformer No.:	79F6706	Gallons:	176	rtemp
Manufacturer/Date:	Elect. Tech	PCB's		
Voltage:	12470/460	% Imp.	5.1	

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/12/2008	8/29/2007	11/9/2006	10/11/2005	6/16/2004	8/5/2003	8/12/2002
Acetylene (C2H2)	0	0	0	1	0	1	0
Hydrogen (H2)	31	27	21	21	11	7	8
Ethylene (C2H4)	6	2	2	2	2	2	1
Methane (CH4)	5	4	4	3	9	5	6
Ethane (C2H6)	3	1	1	1	11	4	6
Carbon Monoxide (CO)	204	212	160	128	109	71	103
Carbon Dioxide (CO2)	3015	1831	1422	1588	2123	1821	1711
Oxygen (O2)	561	4145	730	220	155	71	194
Total Combustibles	249	246	188	156	142	90	124
Total Gas%	4.59%	5.79%	3.93%	4.9%	5.36%	4.9%	4.5%
OIL QUALITY							
Dielectric D-1816	63.3	36.5	45.2	40	43	38.5	36.5
Water in Fluid (ppm) D-1533	12.5	11.4	11.6	19.8	26.2	25.6	27.3
Acid Number (mg KOH/g) D-974	0.04	0.04	0.041	0.023	0.025	0.025	0.023
Interfacial Tens.(dynes/cm) D-971	31	36.1	31.7	32.2	27.4	34.1	34.4
ASTM Color D-1500	L6.0	L5.5	L6.0	L6.0	5.5	5.5	5.5
Visual Inspection D-1524	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.88	0.883	0.875	0.883	0.881	0.884	0.882
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	11.08	9.38	19.28	19.64	31.53	30.81	20.88
OPERATING CONDITIONS							
Ambient Temp. °F.	75	80	55	65	70	70	80
Winding Temp °C.							
Liquid Temp °C.	38	40	22	35	30	30	42
Pressure	0.75	1	0	1.5	2.5	2.5	3.5
Liquid Level	ok	ok	ok	ok	low	low	low
GAS DIAGNOSTICS							
Rogers Ratio	0 0 1 0	0-0-1-0					
Cellulose Ratio (CO2/CO)	14.79	8.64	8.89	12.41	19.48		
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/17/2008	
Address:	5555 N Channel Blvd. PDX	Report by:	KH	
Phone:	503-247-1667	STR Job No:	1609	
Contact:	Ken Swingle	Class:	NP	
Substation/Site:	Sub 4-9	MVA:	0.33	
Transformer No.:	79F6709	Gallons:	176	rtemp
Manufacturer/Date:	Elect. Tech	PCB's		
Voltage:	12470/460	% Imp.	5.1	

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/17/2008	8/29/2007	11/9/2006	10/11/2005	6/16/2004	8/5/2003	8/12/2002
Acetylene (C2H2)	0	0	0	0	0	0	0
Hydrogen (H2)	5	14	75	40	9	20	13
Ethylene (C2H4)	4	3	3	3	3	3	3
Methane (CH4)	3	5	6	5	10	11	11
Ethane (C2H6)	3	3	3	3	7	8	7
Carbon Monoxide (CO)	61	146	134	119	116	145	149
Carbon Dioxide (CO2)	1917	1787	1603	1613	1903	2281	2358
Oxygen (O2)	788	5079	1876	18	52	59	119
Total Combustibles	77	171	221	170	145	187	183
Total Gas%	2.30%	5.31%	4.12%	2.53%	4.40%	4.4%	4.3%
OIL QUALITY							
Dielectric D-1816	41.7	43.1	46.1	37.4	37.7	41.7	40.8
Water in Fluid (ppm) D-1533	10.8	7.4	9.3	14	16.9	21.5	22.7
Acid Number (mg KOH/g) D-974	0.04	0.03	0.041	0.021	0.022	0.023	0.023
Interfacial Tens.(dynes/cm) D-971	36	40	31.9	36.9	37.1	37	37
ASTM Color D-1500	5.5	L6.0	L6.0	L6.0	5.5	5.5	5.5
Visual Inspection D-1524	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.883	0.883	0.88	0.882	0.882	0.882	0.881
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	9.57	6.09	11.19	13.89	20.34	20.54	13.07
OPERATING CONDITIONS							
Ambient Temp. °F.	75	80	55	65	75	60	80
Winding Temp °C.							
Liquid Temp °C.	38	40	30	35	30	36	50
Pressure	0	0	0	0	0	0	0
Liquid Level	ok	ok	low	ok	ok	Low	ok
GAS DIAGNOSTICS							
Rogers Ratio	0 1 1 0	0-0-1-0					
Cellulose Ratio (CO2/CO)	31.25	12.24	11.96	13.54	16.41	15.73	
IEEE/ANSI (C57.104-1991)							

COMMENTS needs pressure

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/12/2008	
Address:	5555 N Channel Blvd. PDX	Report by:	KH	
Phone:	503-247-1667	STR Job No:	1609	
Contact:	Ken Swingle	Class:	NP	
Substation/Site:	Sub 4-10	MVA:	0.33	
Transformer No.:	79F67010	Gallons:	176	rtemp
Manufacturer/Date:	Elect. Tech	PCB's		
Voltage:	12470/460	% Imp.	5.1	

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/12/2008	8/29/2007	11/9/2006	10/11/2005	7/28/2004	6/16/2004	8/5/2003
Acetylene (C2H2)	0	0	0	0	<1	0	0
Hydrogen (H2)	16	32	34	10	<1	382	23
Ethylene (C2H4)	2	2	1	1	<1	3	3
Methane (CH4)	2	2	2	2	<1	9	9
Ethane (C2H6)	1	1	1	1	<1	6	5
Carbon Monoxide (CO)	63	102	79	38	<10	113	118
Carbon Dioxide (CO2)	711	803	653	287	<100	1312	1152
Oxygen (O2)	548	1060	474	73	<100	68	91
Total Combustibles	85	139	117	52	*	513	158
Total Gas%	2.37%	4.17%	3.65%	2.22%	*	4.77%	5.04%
OIL QUALITY							
Dielectric D-1816	34.6	34.9	46	35.9	40.9	42.8	34.3
Water in Fluid (ppm) D-1533	5.1	4.2	8.7	21.5	4	68.6	11.6
Acid Number (mg KOH/g) D-974	0.02	0.03	0.022	0.021	0.025	0.02	0.02
Interfacial Tens.(dynes/cm) D-971	36	40	34.4	35.4	35	35.1	34
ASTM Color D-1500	L5.0	L5.0	L4.5	L5.0	L5.0	L5.0	L5.0
Visual Inspection D-1524	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.881	0.884	0.88	0.882	0.8815	0.881	0.881
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	4.52	4.50	12.78	38.84	1.94	68.05	9.54
OPERATING CONDITIONS							
Ambient Temp. °F.	75	80	56	65	80	75	78
Winding Temp °C.							
Liquid Temp °C.	38	33	25	20	55	35	40
Pressure	0.1	0	0	-1	1.5	0	0.1
Liquid Level	ok	ok	ok	ok	ok	low	ok
GAS DIAGNOSTICS							
Rogers Ratio	0 0 1 0	5-0-1-0					
Cellulose Ratio (CO2/CO)	11.28	7.87	8.27	7.55		11.61	
IEEE/ANSI (C57.104-1991)							

COMMENTS low pressure

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/12/2008	
Address:	5555 N Channel Blvd. PDX	Report by:	KH	
Phone:	503-247-1667	STR Job No:	1609	
Contact:	Ken Swingle	Class:	NP	
Substation/Site:	Sub 4-8	MVA:	0.33	
Transformer No.:	79F6708	Gallons:	176	rtemp
Manufacturer/Date:	Elect. Tech	PCB's		
Voltage:	12470/460	% Imp.	5.1	

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/12/2008	8/29/2007	11/8/2006	10/11/2005	6/16/2004	8/5/2003	8/12/2002
Acetylene (C2H2)	8	7	7	11	12	10	12
Hydrogen (H2)	16	20	41	54	497	44	34
Ethylene (C2H4)	240	240	252	366	385	365	385
Methane (CH4)	33	44	46	61	68	61	66
Ethane (C2H6)	54	33	33	49	43	39	45
Carbon Monoxide (CO)	119	169	159	203	187	177	183
Carbon Dioxide (CO2)	1544	1130	1113	1764	1925	1875	1852
Oxygen (O2)	187	85	33	15	136	71	178
Total Combustibles	471	613	538	744	1192	696	726
Total Gas%	2.64%	3.67%	3.32%	3.41%	5.00%	4.7%	5.1%
OIL QUALITY							
Dielectric D-1816	48.7	35.1	39.7	33	32.9	34.3	35
Water in Fluid (ppm) D-1533	4.5	5.2	15.1	20.9	36	20.9	29.7
Acid Number (mg KOH/g) D-974	0.04	0.03	0.035	0.031	0.031	0.031	0.028
Interfacial Tens.(dynes/cm) D-971	37	37	34.4	35	35.1	34.7	35.5
ASTM Color D-1500	L2.5	L2.5	L2.5	L2.0	L2.0	L2.0	2.5
Visual Inspection D-1524	Pass	Pass	Fail	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.883	0.882	0.88	0.8835	0.881	0.881	0.882
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	3.70	4.28	22.19	20.73	38.55	25.16	20.39
OPERATING CONDITIONS							
Ambient Temp. °F.	85	80	53	65	75	70	80
Winding Temp °C.							
Liquid Temp °C.	40	40	25	35	33	30	45
Pressure	0	0	-0.2	0	0	0	1.5
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	1 1 2 0	1-0-2-0					
Cellulose Ratio (CO2/CO)	12.96	4.20	7.00	8.69	10.29		
IEEE/ANSI (C57.104-1991)							

COMMENTS needs pressure

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.

Milwaukie, Oregon

(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/17/2008
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1609
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Dry Dock	MVA:	1
Transformer No.:	771382	Gallons:	310
Manufacturer/Date:	United Power	PCB's	cert-non
Voltage:	NP	% Imp.	

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/17/2008	8/30/2007	11/6/2006	10/18/2005	6/16/2004	8/5/2003	8/12/2002
Acetylene (C2H2)	18	21	20	22	23	23	25
Hydrogen (H2)	56	53	27	40	39	34	36
Ethylene (C2H4)	22	11	9	9	9	8	8
Methane (CH4)	26	26	22	22	23	21	21
Ethane (C2H6)	10	6	5	5	4	4	4
Carbon Monoxide (CO)	732	788	536	607	557	509	473
Carbon Dioxide (CO2)	5102	2784	2387	2933	3173	3489	3652
Oxygen (O2)	896	3132	3066	568	903	4328	4645
Total Combustibles	864	905	619	705	655	599	567
Total Gas%	6.42%	7.06%	5.57%	4.19%	6.07%	6.20%	6.59%
OIL QUALITY							
Dielectric D-1816	58.7	43	53.3	50.2	53.5	51.4	46.9
Water in Fluid (ppm) D-1533	11.9	10.8	6.8	9.7	7.4	13.1	20.5
Acid Number (mg KOH/g) D-974	0.02	0.01	0.003	0.005	0.006	0.003	0.003
Interfacial Tens.(dynes/cm) D-971	49	48	47.5	46.9	51.5	44.4	45.9
ASTM Color D-1500	L0.5	L0.5	L0.5	L0.5	L0.5	L0.5	0.5
Visual Inspection D-1524	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.8735	0.879	0.875	0.878	0.8765	0.8775	0.8785
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	5.98	7.41	4.67	7.98	6.09	8.99	10.30
OPERATING CONDITIONS							
Ambient Temp. °F.	85	85	64	65	75	70	80
Winding Temp °C.							
Liquid Temp °C.	54	45	45	40	40	45	54
Pressure	0	0.5	0	0	0	0.25	0
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0 0 1 1	0-0-1-1	0-0-1-1	0-0-1-1	0-0-1-1	0-0-1-1	
Cellulose Ratio (CO2/CO)	6.97	3.53	4.45	4.83	5.70	6.85	
IEEE/ANSI (C57.104-1991)							

COMMENTS needs pressure

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
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(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/12/2008
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1609
Contact:	Ken Swingle	Class:	NP
Substation/Site:	C.U.S.	MVA:	1.5
Transformer No.:	SBV567601	Gallons:	259
Manufacturer/Date:	West.	PCB's	cert-non
Voltage:	12470/240	% Imp.	5.5

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/12/2008	8/30/2007	11/8/2006	10/18/2005	6/19/2004	8/5/2003	8/12/2002
Acetylene (C2H2)	0	0	0	0	0	0	0
Hydrogen (H2)	6	9	7	14	11	8	8
Ethylene (C2H4)	27	17	17	17	18	18	17
Methane (CH4)	13	12	12	11	12	10	10
Ethane (C2H6)	5	2	2	2	2	2	1
Carbon Monoxide (CO)	417	552	473	487	481	326	381
Carbon Dioxide (CO2)	3537	2970	3039	3159	3467	2764	3077
Oxygen (O2)	972	2040	3135	148	141	266	613
Total Combustibles	469	592	511	531	524	364	417
Total Gas%	7.34%	10.85%	10.57%	6.5%	9.25%	5.72%	7.4%
OIL QUALITY							
Dielectric D-1816	44.7	36	44.1	45.6	43.7	50.4	43.2
Water In Fluid (ppm) D-1533	2.3	1.1	2.3	4.5	6	8.5	7.4
Acid Number (mg KOH/g) D-974	0.03	0.03	0.016	0.021	0.022	0.014	0.017
Interfacial Tens.(dynes/cm) D-971	38	38	32.2	38.8	38.9	36.1	35.9
ASTM Color D-1500	L2.0	L2.0	L2.0	L2.0	L2.0	1.5	1.5
Visual Inspection D-1524	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.871	0.875	0.872	0.874	0.871	0.872	0.8725
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	1.89	1.83	6.42	6.61	13.42	9.46	5.08
OPERATING CONDITIONS							
Ambient Temp. °F.	85	80	50	65	75	70	80
Winding Temp °C.							
Liquid Temp °C.	40	22	10	25	15	32	45
Pressure	4	4	2.5	3	3.5	4.5	5
Liquid Level	ok	ok	ok	ok	low	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	1 0 2 0	1-0-2-0	1-0-2-0	0-0-2-0	1-0-2-0	1-0-2-0	
Cellulose Ratio (CO2/CO)	8.47	5.38	6.42	6.49	7.21	8.48	
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/12/2008
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1609
Contact:	Ken Swingle	Class:	NP
Substation/Site:	C.U.S.	MVA:	1.5
Transformer No.:	SBV567602	Gallons:	259
Manufacturer/Date:	West.	PCB's	cert-non
Voltage:	12470/240	% Imp.	5.47

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/12/2008	8/30/2007	11/8/2006	10/18/2005	6/16/2004	8/5/2003	8/12/2002
Acetylene (C2H2)	0	0	0	0	0	0	0
Hydrogen (H2)	12	10	9	10	11	11	9
Ethylene (C2H4)	42	29	31	26	31	33	28
Methane (CH4)	7	9	9	8	10	10	9
Ethane (C2H6)	4	2	2	2	2	2	1
Carbon Monoxide (CO)	525	740	667	589	678	678	555
Carbon Dioxide (CO2)	5634	3041	3112	3166	3955	4472	4150
Oxygen (O2)	5503	6402	4299	911	2349	3730	4461
Total Combustibles	591	790	718	635	732	734	602
Total Gas%	6.00%	7.45%	6.97%	4.00%	6.81%	6.93%	6.4%
OIL QUALITY							
Dielectric D-1816	59.6	40.2	4.44	44.6	47.6	52.3	43.6
Water in Fluid (ppm) D-1533	1.1	1.7	5.7	4.5	0.6	7.4	8.5
Acid Number (mg KOH/g) D-974	0.03	0.03	0.03	0.018	0.23	0.011	0.014
Interfacial Tens.(dynes/cm) D-971	35	34	33.6	35.3	38.3	34.4	34.3
ASTM Color D-1500	L2.0	L2.0	L2.0	L2.0	L2.0	1.5	1.5
Visual Inspection D-1524	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.874	0.872	0.875	0.8735	0.8715	0.872	0.8725
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	0.84	1.40	6.86	4.46	0.69	6.09	5.84
OPERATING CONDITIONS							
Ambient Temp. °F.	85	80	50	65	75	70	80
Winding Temp °C.							
Liquid Temp °C.	42	40	30	35	31	40	45
Pressure	0.75	0.5	-0.5	0	0	0	1
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0 0 2 0	0-0-2-0	1-0-2-0	0-0-2-0	0-0-2-0	0-0-2-0	
Cellulose Ratio (CO2/CO)	10.73	4.11	4.67	5.38	5.83	6.60	
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.

Milwaukie, Oregon

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/12/2008
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1609
Contact:	Ken Swingle	Class:	NP
Substation/Site:	C.U.S.	MVA:	1.5
Transformer No.:	SBV567604	Gallons:	259
Manufacturer/Date:	West.	PCB's	cert-non
Voltage:	12470/240	% Imp.	5.47

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/12/2008	8/30/2007	11/8/2006	10/11/2005	6/15/2004	8/5/2003	8/12/2002
Acetylene (C2H2)	0	0	0	0	0	0	0
Hydrogen (H2)	6	8	8	12	13	8	10
Ethylene (C2H4)	30	21	23	25	25	26	21
Methane (CH4)	10	10	10	11	12	11	10
Ethane (C2H6)	4	2	2	2	2	2	2
Carbon Monoxide (CO)	444	599	549	566	616	477	559
Carbon Dioxide (CO2)	3372	2594	2731	3145	3647	3274	3659
Oxygen (O2)	1254	1580	1894	229	247	572	540
Total Combustibles	493	640	592	616	668	524	602
Total Gas%	6.14%	8.25%	8.21%	5.47%	8.64%	6.24%	7.4%
OIL QUALITY							
Dielectric D-1816	44.2	38.2	41	42.6	40.9	45.9	44.6
Water in Fluid (ppm) D-1533	6.3	3.4	2.8	9.7	11.9	9.1	5.1
Acid Number (mg KOH/g) D-974	0.03	0.03	0.019	0.021	0.022	0.02	0.023
Interfacial Tens.(dynes/cm) D-971	35	38	32.9	39.7	38.2	44	44.6
ASTM Color D-1500	L2.0	L2.0	L2.0	L2.0	L2.0	L1.5	1.5
Visual Inspection D-1524	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.872	0.871	0.873	0.875	0.871	0.871	0.8725
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	4.82	3.01	3.37	11.67	14.32	7.77	3.50
OPERATING CONDITIONS							
Ambient Temp. °F.	85	80	50	65	75	70	80
Winding Temp °C.							
Liquid Temp °C.	42	38	30	30	30	39	45
Pressure	2	2	1.2	2	2	3	4.2
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	1 0 2 0	1-0-2-0	1-0-2-0	0-0-2-0	0-0-2-0	1-0-2-0	
Cellulose Ratio (CO2/CO)	7.60	4.33	4.97	5.56	5.92	6.86	
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

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Milwaukie, Oregon
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/12/2008
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1609
Contact:	Ken Swingle	Class:	NP
Substation/Site:	C.U.S.	MVA:	1.5
Transformer No.:	SBV567603	Gallons:	259
Manufacturer/Date:	West.	PCB's	cert-non
Voltage:	12470/240	% Imp.	5.51

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/12/2008	8/30/2007	11/8/2006	10/18/2005	6/16/2004	8/5/2003	8/12/2002
Acetylene (C2H2)	0	0	0	0	0	0	0
Hydrogen (H2)	2	13	9	12	13	8	11
Ethylene (C2H4)	28	19	21	21	21	22	24
Methane (CH4)	9	11	11	11	11	10	11
Ethane (C2H6)	4	2	2	2	2	2	2
Carbon Monoxide (CO)	445	773	661	681	685	486	542
Carbon Dioxide (CO2)	3464	3127	3403	3500	3864	3221	3609
Oxygen (O2)	1065	1691	3853	164	206	501	556
Total Combustibles	488	818	704	727	732	528	590
Total Gas%	5.98%	10.65%	10.90%	6.47%	9.53%	6.15%	7.30%
OIL QUALITY							
Dielectric D-1816	61.4	42.3	44.8	46.5	43	46.6	49.4
Water in Fluid (ppm) D-1533	2.8	2.3	3.4	3.4	2.3	8	5.7
Acid Number (mg KOH/g) D-974	0.03	0.02	0.024	0.023	0.031	0.02	0.023
Interfacial Tens.(dynes/cm) D-971	37	35	35.4	39.3	39.4	35.8	35.7
ASTM Color D-1500	L2.0	L2.0	L2.0	L2.0	L2.0	L1.5	1.5
Visual Inspection D-1524	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.872	0.872	0.875	0.8735	0.871	0.871	0.8732
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	2.30	3.00	5.00	5.00	5.14	9.26	4.36
OPERATING CONDITIONS							
Ambient Temp. °F.	85	80	65	65	75	70	80
Winding Temp °C.							
Liquid Temp °C.	40	28	25	25	15	31	42
Pressure	4.5	4	4	4	4	4.5	5.2
Liquid Level	ok	ok			low	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	2 0 2 0	0-0-2-0	1-0-2-0	0-0-2-0	0-0-2-0	1-0-2-0	
Cellulose Ratio (CO2/CO)	7.78	4.05	5.15	5.14	5.64	6.63	
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/12/2008
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1609
Contact:	Ken Swingle	Class:	NP
Substation/Site:	C.U.S.	MVA:	1
Transformer No.:	PAT716001	Gallons:	224
Manufacturer/Date:	West.	PCB's	cert-non
Voltage:	12470/480	% Imp.	5.81

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/12/2008	8/30/2007	11/8/2006	10/18/2005	6/19/2004	8/5/2003	8/12/2002
Acetylene (C2H2)	0	0	0	0	0	0	0
Hydrogen (H2)	8	11	7	13	18	10	15
Ethylene (C2H4)	15	11	10	11	15	16	15
Methane (CH4)	14	15	13	13	15	12	11
Ethane (C2H6)	12	9	8	6	5	4	2
Carbon Monoxide (CO)	375	553	405	495	579	448	488
Carbon Dioxide (CO2)	3224	2584	2066	2867	3672	3185	3315
Oxygen (O2)	423	515	78	29	150	158	182
Total Combustibles	424	599	443	538	632	490	531
Total Gas%	5.79%	8.30%	5.71%	5.32%	8.98%	6.39%	7.30%
OIL QUALITY							
Dielectric D-1816	61.2	36.7	42.4	48.3	45.6	50.2	45.6
Water in Fluid (ppm) D-1533	4	1.1	3.4	6.8	2	2.8	6.8
Acid Number (mg KOH/g) D-974	0.04	0.03	0.027	0.026	0.037	0.02	0.023
Interfacial Tens.(dynes/cm) D-971	34	34	33	38.9	38.6	34.5	34.3
ASTM Color D-1500	L2.0	L2.0	L2.0	L2.0	L2.0	L1.5	1.5
Visual Inspection D-1524	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.873	0.873	0.875	0.875	0.872	0.872	0.8725
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	4.45	1.62	9.49	9.99	4.47	4.85	6.49
OPERATING CONDITIONS							
Ambient Temp. °F.	85	80	50	65	75	70	80
Winding Temp °C.							
Liquid Temp °C.	32	25	10	25	15	21	36
Pressure	2	2	1	2	2.8	3	4
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	1 0 1 0	1-0-1-0	1-0-1-0	1-0-1-0	1-0-2-0	1-0-2-0	
Cellulose Ratio (CO2/CO)	8.59	4.67	5.10	5.79	6.34	7.11	
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/12/2008
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1609
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 4-7	MVA:	0.33
Transformer No.:	79F670-71	Gallons:	176 rtemp
Manufacturer/Date:	Elect. Tech.	PCB's	
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/12/2008	8/29/2007	11/8/2006	10/12/2005	6/16/2004	8/5/2003	8/12/2002
Acetylene (C2H2)	0	0	0	0	0	0	0
Hydrogen (H2)	13	14	35	14	22	23	31
Ethylene (C2H4)	1	0	0	0	0	1	1
Methane (CH4)	1	1	1	1	5	5	4
Ethane (C2H6)	1	0	0	0	6	5	3
Carbon Monoxide (CO)	27	319	496	393	395	492	605
Carbon Dioxide (CO2)	472	33	19	31	37	54	62
Oxygen (O2)	4900	4618	9747	2215	56	59	81
Total Combustibles	42	48	55	46	70	88	101
Total Gas%	2.97%	3.64%	4.84%	2.88%	3.05%	3.30%	3.80%
OIL QUALITY							
Dielectric D-1816	40	33.8	36.7	42	47.5	42.7	41.8
Water in Fluid (ppm) D-1533	30.1	23.4	66.3	20.9	33.1	29.7	36.6
Acid Number (mg KOH/g) D-974	0.03	0.04	0.038	0.023	0.022	0.023	0.023
Interfacial Tens.(dynes/cm) D-971	33	36	31.3	34.5	34.6	34.7	34.9
ASTM Color D-1500	L6.0	L6.0	L6.0	L5.5	L5.5	5.5	5.5
Visual Inspection D-1524	*Fail	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.88	0.883	0.88	0.884	0.882	0.882	0.883
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	28.75	20.73	79.79	20.73	39.83	28.37	30.11
OPERATING CONDITIONS							
Ambient Temp. °F.	85	80	50	50	75	79	90
Winding Temp °C.							
Liquid Temp °C.	36	38	30	35	30	36	40
Pressure	0	0	0	0	0	0	0
Liquid Level	ok	ok	ok	Low	Low		
GAS DIAGNOSTICS							
Rogers Ratio	5 0 0 0	5-0-2-2					
Cellulose Ratio (CO2/CO)	17.57	0.10	0.26	0.13	0.11		
IEEE/ANSI (C57.104-1991)							

COMMENTS needs pressure
slight moisture - particules in oil

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/16/2008
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1609
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 4	MVA:	1.5
Transformer No.:	P008188	Gallons:	295 silicone
Manufacturer/Date:	GE	PCB's	
Voltage:	12470/480	% Imp.	

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/16/2008	8/30/2007	11/6/2006	10/18/2005	6/19/2004	8/5/2003	8/12/2002
Acetylene (C2H2)	0	0	0	0	0	0	0
Hydrogen (H2)	32	44	40	57	53	52	56
Ethylene (C2H4)	0	1	1	1	1	1	1
Methane (CH4)	28	30	29	29	31	30	30
Ethane (C2H6)	4	3	3	3	2	2	2
Carbon Monoxide (CO)	860	1006	921	932	886	852	879
Carbon Dioxide (CO2)	3601	3479	3292	3944	4163	4339	4254
Oxygen (O2)	3669	4120	2360	932	2264	2510	1409
Total Combustibles	924	1084	994	1022	973	937	968
Total Gas%	11.03%	12.71%	11.15%	8.41%	10.63%	10.57%	10.54%
OIL QUALITY							
Dielectric D-1816	52.9	45	47.3	45.4	46.8	38.7	50.4
Water in Fluid (ppm) D-1533	3.7	6.3	5.2	7.8	8.3	15.1	13.4
Acid Number (mg KOH/g) D-974	0.02	0.01	0.003	0.005	0.006	0.003	0.006
Interfacial Tens.(dynes/cm) D-971							43.7
ASTM Color D-1500	0	0	0	0	0	0	0
Visual Inspection D-1524	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.965	0.972	0.97	0.965	0.963	0.972	0.9618
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	2.28	5.18	5.16	6.42	6.83	11.55	9.20
OPERATING CONDITIONS							
Ambient Temp. °F.	85	85	65	65	75	80	80
Winding Temp °C.							
Liquid Temp °C.	48	40	35	40	40	42	45
Pressure	npg	npg	0	0	0	0	0
Liquid Level	ok	ok	ok	ok	ok	high	high
GAS DIAGNOSTICS							
Rogers Ratio	0 0 0 0	0-0-0-0	0-0-0-0	0-0-0-0	0-0-0-0	0-0-0-0	
Cellulose Ratio (CO2/CO)	4.19	4.23	3.57	4.23	4.69	5.09	
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/16/2008
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1609
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 6	MVA:	1
Transformer No.:	836002311	Gallons:	392 rtemp
Manufacturer/Date:	RTE	PCB's	no data
Voltage:	12470/460	% Imp.	5.6

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/16/2008	8/30/2007	11/17/2006	10/18/2005	6/16/2004	8/5/2003	8/12/2002
Acetylene (C2H2)	0	0	0	0	0	0	0
Hydrogen (H2)	2	5	4	8	7	7	9
Ethylene (C2H4)	3	2	2	3	2	3	3
Methane (CH4)	5	9	9	9	10	11	12
Ethane (C2H6)	4	6	6	6	6	6	6
Carbon Monoxide (CO)	157	322	338	331	314	383	394
Carbon Dioxide (CO2)	1477	1419	1443	1700	1972	2269	2522
Oxygen (O2)	213	238	164	21	97	78	64
Total Combustibles	171	344	359	357	339	410	424
Total Gas%	2.25%	4.51%	4.17%	3.22%	4.30%	4.98%	5.02%
OIL QUALITY							
Dielectric D-1816	53.2	36.4	41.9	42	48.3	43.7	34.9
Water in Fluid (ppm) D-1533	11.9	7.4	14.5	19.2	27.9	29.1	15.1
Acid Number (mg KOH/g) D-974	0.02	0.02	0.011	0.021	0.022	0.02	0.02
Interfacial Tens.(dynes/cm) D-971	39	43	35.3	34.6	34.8	37.7	40.5
ASTM Color D-1500	L3.0	L3.0	3	3	3	3	3
Visual Inspection D-1524	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.87	0.875	0.873	0.8745	0.873	0.8715	0.873
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	7.88	6.09	14.38	13.18	27.68	19.28	8.70
OPERATING CONDITIONS							
Ambient Temp. °F.	85	85	45	65	75	70	80
Winding Temp °C.							
Liquid Temp °C.	46	40	35	45	35	46	50
Pressure	0	0	0	0	0	0	0
Liquid Level	ok	OK	OK	OK	OK	OK	OK
GAS DIAGNOSTICS							
Rogers Ratio	1 0 0 0	1-0-0-0					
Cellulose Ratio (CO2/CO)	9.43	4.41	4.27	5.14	6.28		
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/16/2008	
Address:	5555 N Channel Blvd. PDX	Report by:	KH	
Phone:	503-247-1667	STR Job No:	1609	
Contact:	Ken Swingle	Class:	NP	
Substation/Site:	Sub 6	MVA:	1.5	
Transformer No.:	836002464	Gallons:	540	rtemp
Manufacturer/Date:	RTE	PCB's	no data	
Voltage:	12470/480	% Imp.	5.6	

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/16/2008	8/30/2007	11/17/2006	10/18/2005	6/16/2004	8/5/2003	8/12/2002
Acetylene (C2H2)	0	0	0	0	0	0	0
Hydrogen (H2)	0	4	4	5	5	5	13
Ethylene (C2H4)	4	3	4	3	3	4	4
Methane (CH4)	6	10	12	10	12	12	14
Ethane (C2H6)	4	3	4	3	4	4	4
Carbon Monoxide (CO)	170	353	356	289	326	315	353
Carbon Dioxide (CO2)	1209	1394	1361	1298	1655	1604	1849
Oxygen (O2)	216	1210	207	13	189	70	126
Total Combustibles	183	373	380	310	350	340	388
Total Gas%	2.58%	5.25%	4.45%	2.75%	4.71%	4.23%	4.63%
OIL QUALITY							
Dielectric D-1816	60.6	36.3	48.4	38.9	44.8	41.5	34.9
Water in Fluid (ppm) D-1533	11.4	17.6	12.8	27.9	29.1	22.1	16.3
Acid Number (mg KOH/g) D-974	0.02	0.03	0.016	0.018	0.017	0.017	0.011
Interfacial Tens.(dynes/cm) D-971	41	42	35.8	36.4	36.5	36.8	39.1
ASTM Color D-1500	L3.0	L3.5	L3.0	L3.0	L3.0	L3.5	3
Visual Inspection D-1524	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.87	0.878	0.87	0.874	0.8718	0.8725	0.872
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	9.38	14.48	21.27	33.57	35.02	21.11	13.41
OPERATING CONDITIONS							
Ambient Temp. °F.	85	85	45	65	75	70	80
Winding Temp °C.							
Liquid Temp °C.	40	40	22	30	30	36	40
Pressure	npg	npg	npg	npg	npg	npg	npg
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	2 0 1 0	1-0-1-0					
Cellulose Ratio (CO2/CO)	7.12	3.95	3.82	4.49	5.08		
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/12/2008
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1609
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 7A	MVA:	2
Transformer No.:	PQH0715	Gallons:	415 rtemp
Manufacturer/Date:	NP	PCB's	no data
Voltage:	12470/460	% Imp.	5.4

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/12/2008	8/29/2007	11/9/2006	10/11/2005	6/16/2004	8/5/2003	8/12/2002
Acetylene (C2H2)	0	0	0	0	0	0	0
Hydrogen (H2)	2	5	6	7	7	9	7
Ethylene (C2H4)	6	6	7	7	8	7	8
Methane (CH4)	5	12	14	12	15	14	15
Ethane (C2H6)	5	6	7	6	6	6	6
Carbon Monoxide (CO)	272	660	796	685	739	767	777
Carbon Dioxide (CO2)	2383	1969	2905	2313	2783	3076	3401
Oxygen (O2)	205	325	3810	13	59	85	55
Total Combustibles	291	689	830	717	775	803	813
Total Gas%	2.06%	5.13%	7.57%	3.21%	5.00%	5.09%	5.13%
OIL QUALITY							
Dielectric D-1816	37	36.4	39.8	39.1	40.8	43.5	39.5
Water in Fluid (ppm) D-1533	8.5	2.3	13.4	11.4	16.3	17.4	12.8
Acid Number (mg KOH/g) D-974	0.03	0.03	0.033	0.023	0.022	0.023	0.02
Interfacial Tens.(dynes/cm) D-971	43	47	39.6	37.2	37.5	37.1	37.7
ASTM Color D-1500	L3.0	L3.0	L2.5	L3.0	L3.0	L3.0	L3.0
Visual Inspection D-1524	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.871	0.873	0.87	0.8745	0.873	0.873	0.873
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	6.99	1.89	16.13	9.38	16.17	11.94	6.22
OPERATING CONDITIONS							
Ambient Temp. °F.	80	80	55	65	75	79	80
Winding Temp °C.							
Liquid Temp °C.	40	40	30	40	35	45	55
Pressure	npg	npg	npg	npg	npg	npg	npg
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	2 0 1 0	1-0-1-0					
Cellulose Ratio (CO2/CO)	8.75	2.98	3.65	3.38	3.77		
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/12/2008
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1609
Contact:	Ken Swingle	Class:	OA
Substation/Site:	Crane #14	MVA:	0.75
Transformer No.:	L243297	Gallons:	142 silicone
Manufacturer/Date:	NP	PCB's	no data
Voltage:	2.4/0.5kV	% Imp.	5.7

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/12/2008	8/30/2007	11/8/2006	10/12/2005	6/19/2004	8/5/2003	8/12/2002
Acetylene (C2H2)	0	0	0	0	0	0	0
Hydrogen (H2)	144	178	146	152	170	163	168
Ethylene (C2H4)	0	0	1	1	0	1	1
Methane (CH4)	51	50	48	47	56	52	51
Ethane (C2H6)	9	6	6	6	5	5	5
Carbon Monoxide (CO)	982	1047	919	902	1019	948	941
Carbon Dioxide (CO2)	3724	3328	3157	3592	4434	4550	4392
Oxygen (O2)	1380	1698	1116	349	969	1617	1018
Total Combustibles	1186	1281	1120	1108	1250	1169	1166
Total Gas%	11.12%	11.63%	10.20%	7.05%	11.09%	10.75%	1.07%
OIL QUALITY							
Dielectric D-1816	50.8	37.6	44.1	44.9	42.4	47.8	47.3
Water in Fluid (ppm) D-1533	3.1	5.2	5.7	7.8	7.3	9.4	21.6
Acid Number (mg KOH/g) D-974	0.02	0.01	0.003	0.005	0.006	0.003	0.008
Interfacial Tens.(dynes/cm) D-971							
ASTM Color D-1500	0	0	0	0	0	0	0
Visual Inspection D-1524	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.965	0.962	0.968	0.965	0.9625	0.9696	0.9638
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	2.55	4.28	6.86	9.39	8.78	8.03	96.11
OPERATING CONDITIONS							
Ambient Temp. °F.	85	80	55	65	75	78	80
Winding Temp °C.							
Liquid Temp °C.	40	40	30	30	30	39	
Pressure	0.1	0	-0.5	-1	-0.5	-0.3	-0.3
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0 0 0 0	0-0-0-2	0-0-0-0	0-0-0-0	0-0-0-2	0-0-0-0	
Cellulose Ratio (CO2/CO)	3.79	3.18	3.44	3.98	4.35	4.80	
IEEE/ANSI (C57.104-1991)							

COMMENTS low pressure

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/12/2008
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1609
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Crane #17	MVA:	0.5
Transformer No.:	L243299B	Gallons:	125 silicone
Manufacturer/Date:	NP	PCB's	no data
Voltage:	2400/480	% Imp.	NP

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/12/2008	8/29/2007	11/6/2006	10/11/2005	6/16/2004	8/5/2003	8/12/2002
Acetylene (C2H2)	0	0	0	0	0	0	0
Hydrogen (H2)	118	177	100	193	152	119	126
Ethylene (C2H4)	0	8	0	0	0	0	0
Methane (CH4)	72	68	63	78	81	71	72
Ethane (C2H6)	12	0	7	9	7	7	7
Carbon Monoxide (CO)	1070	1250	902	1328	1168	991	1009
Carbon Dioxide (CO2)	5892	4590	3507	6085	6030	5630	5743
Oxygen (O2)	1340	1984	697	516	1001	976	701
Total Combustibles	1272	1503	1072	1608	1408	1188	1214
Total Gas%	12.06%	14.80%	9.86%	11.11%	13.00%	11.07%	1.12%
OIL QUALITY							
Dielectric D-1816	48.7	40.4	43.1	41.9	38.1	39.6	49.6
Water in Fluid (ppm) D-1533	3.7	9.4	9.4	10.9	11.5	17.2	19.6
Acid Number (mg KOH/g) D-974	0.01	0	0.003	0.005	0.006	0.008	0.008
Interfacial Tens.(dynes/cm) D-971							
ASTM Color D-1500	0	0	0	0	0	0	0
Visual Inspection D-1524	Pass	Pass	Fail	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.965	0.963	0.97	0.962	0.962	0.969	0.9625
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	3.28	8.33	9.32	13.12	11.41	15.24	15.55
OPERATING CONDITIONS							
Ambient Temp. °F.	70	75	60	65	75	70	80
Winding Temp °C.							
Liquid Temp °C.	38	38	35	30	35	38	41
Pressure	0.9	1	1	0.5	0.2	0.9	1.2
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0 0 0 0	0-0-2-0	0-0-0-2	0-0-0-2	0-0-0-2	0-0-0-2	
Cellulose Ratio (CO2/CO)	5.51	0.04	3.89	4.58	6.02	5.68	
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/12/2008
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1609
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Crane #16	MVA:	0.5
Transformer No.:	L243299C	Gallons:	125 silicone
Manufacturer/Date:	GE	PCB's	no data
Voltage:	2400/480	% Imp.	NP

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/12/2008	8/29/2007	11/8/2006	10/11/2005	6/19/2004	8/5/2003	8/12/2002
Acetylene (C2H2)	0	0	0	0	0	0	0
Hydrogen (H2)	133	97	130	97	137	124	181
Ethylene (C2H4)	0	1	1	1	1	1	2
Methane (CH4)	53	44	47	33	56	44	56
Ethane (C2H6)	9	6	5	4	6	4	6
Carbon Monoxide (CO)	1169	1053	1034	742	1165	923	1231
Carbon Dioxide (CO2)	5201	3748	3611	3023	5484	4756	5961
Oxygen (O2)	2087	5807	1254	248	2600	2257	802
Total Combustibles	1364	1234	1217	877	1365	1096	1476
Total Gas%	12.16%	12.21%	10.46%	5.31%	12.20%	9.80%	1.25
OIL QUALITY							
Dielectric D-1816	56.5	42	47.6	45	40.6	40.8	49.1
Water in Fluid (ppm) D-1533	8.9	10.9	4.2	13	8.3	9.9	14.4
Acid Number (mg KOH/g) D-974	0.01	0.01	0.005	0.005	0.008	0.006	0.006
Interfacial Tens.(dynes/cm) D-971							
ASTM Color D-1500	0	0	0	0	0	0	0
Visual Inspection D-1524	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.965	0.962	0.9685	0.965	0.963	0.97	0.9625
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	7.89	9.31	5.05	10.70	8.23	8.45	11.42
OPERATING CONDITIONS							
Ambient Temp. °F.	70	80	55	65	75	72	80
Winding Temp °C.							
Liquid Temp °C.	38	39	30	40	35	39	41
Pressure	0.5	0	-0.3	0	0	-0.1	0.3
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0 0 0 0	0-0-0-0	0-0-0-0	0-0-0-0	0-0-0-0	0-0-0-0	
Cellulose Ratio (CO2/CO)	4.45	3.56	3.49	4.07	4.7	5.15	
IEEE/ANSI (C57.104-1991)							

COMMENTS Low Pressure

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/12/2008		
Address:	5555 N Channel Blvd. PDX	Report by:	KH		
Phone:	503-247-1667	STR Job No:	1609		
Contact:	Ken Swingle	Class:	NP		
Substation/Site:	Crane #15	MVA:	0.5		
Transformer No.:	L243299A	Gallons:	125	silicone	
Manufacturer/Date:	GE	PCB's	no data		
Voltage:	2.4/0.6kV	% Imp.	5.18		

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/12/2008	8/29/2007	11/8/2006	10/12/2005	6/19/2004	8/5/2003	8/12/2002
Acetylene (C2H2)	0	0	0	0	0	0	0
Hydrogen (H2)	177	180	171	184	207	200	210
Ethylene (C2H4)	0	0	0	1	0	1	1
Methane (CH4)	44	40	40	42	47	43	45
Ethane (C2H6)	12	7	7	8	7	6	7
Carbon Monoxide (CO)	1195	1145	1051	1117	1205	1110	1177
Carbon Dioxide (CO2)	4989	3547	3447	4229	5083	5104	5351
Oxygen (O2)	2422	3045	1731	320	1022	1269	751
Total Combustibles	1428	1372	1269	1352	1466	1360	1440
Total Gas%	11.80%	11.19%	10.08%	7.29%	11.02%	10.48%	1.10%
OIL QUALITY							
Dielectric D-1816	45.4	44.3	47.4	44.3	43.1	43.8	51
Water in Fluid (ppm) D-1533	10.4	5.7	4.7	8.9	7.8	10.4	15.5
Acid Number (mg KOH/g) D-974	0.02	0.01	0.003	0.005	0.006	0.003	0.008
Interfacial Tens.(dynes/cm) D-971							
ASTM Color D-1500	0	0	0	0	0	0	0
Visual Inspection D-1524	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.9635	0.967	0.9685	0.965	0.9625	0.9695	0.9635
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	8.56	5.24	5.66	13.08	7.74	8.88	12.75
OPERATING CONDITIONS							
Ambient Temp. °F.	85	80	53	65	75	73	80
Winding Temp °C.							
Liquid Temp °C.	40	37	30	25	35	39	40
Pressure	0	0	0	-1	-1	-0.5	-0.5
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0 0 0 0	0-0-0-2	0-0-0-2	0-0-0-0	0-0-0-2	0-0-0-0	
Cellulose Ratio (CO2/CO)	4.17	3.10	3.28	3.79	4.21	4.60	
IEEE/ANSI (C57.104-1991)							

COMMENTS needs pressure

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/12/2008		
Address:	5555 N Channel Blvd. PDX	Report by:	KH		
Phone:	503-247-1667	STR Job No:	1609		
Contact:	Ken Swingle	Class:	NP		
Substation/Site:	Crane #12	MVA:	0.75		
Transformer No.:	L243298	Gallons:	125	silicone	
Manufacturer/Date:	GE	PCB's	no data		
Voltage:	2.1/0.5kV	% Imp.	5.64		

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/12/2008	8/29/2007	11/17/2006	10/12/2005	6/16/2004	8/5/2003	8/12/2002
Acetylene (C2H2)	0	0	0	0	0	0	0
Hydrogen (H2)	129	167	156	172	183	173	185
Ethylene (C2H4)	0	0	0	1	1	1	1
Methane (CH4)	59	55	60	60	63	66	61
Ethane (C2H6)	10	6	6	7	6	6	6
Carbon Monoxide (CO)	990	1040	996	1025	1015	1056	1019
Carbon Dioxide (CO2)	3697	3205	3063	3721	4050	4219	4361
Oxygen (O2)	4522	4673	1496	1025	1685	1511	1554
Total Combustibles	1188	1268	1218	1265	1268	1302	1272
Total Gas%	11.22%	11.53%	10.11%	7.26%	10.56%	10.57%	10.74%
OIL QUALITY							
Dielectric D-1816	47.7	43.5	40.8	47.3	42	46.4	43.9
Water In Fluid (ppm) D-1533	4.7	6.8	4.7	7.3	7.3	9.4	18.6
Acid Number (mg KOH/g) D-974	0.01	0.02	0.005	0.003	0.003	0.003	0.006
Interfacial Tens.(dynes/cm) D-971							
ASTM Color D-1500	0	0	0	0	0	0	0
Visual Inspection D-1524	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.965	0.963	0.965	0.965	0.9615	0.9711	0.9625
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	4.16	5.59	8.49	8.78	8.78	8.98	17.11
OPERATING CONDITIONS							
Ambient Temp. °F.	80	80	40	65	75	70	80
Winding Temp °C.							
Liquid Temp °C.	38	40	20	30	30	36	37
Pressure	0.1	1	0	-1	-1	-0.1	-0.2
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0 0 0 0	0-0-0-2	0-0-0-2	0-0-0-0	0-0-0-0	0-0-0-0	
Cellulose Ratio (CO2/CO)	3.73	3.08	3.08	3.63	3.99	3.99	
IEEE/ANSI (C57.104-1991)							

COMMENTS low pressure

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/17/2008
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1609
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Building 73	MVA:	0.5
Transformer No.:	PCT83390101	Gallons:	141
Manufacturer/Date:	Westinghouse	PCB's	cert.non
Voltage:	12.5/0.5kV	% Imp.	5.86

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/17/2008	8/30/2007	11/8/2006	10/18/2005	6/16/2004	8/5/2003	8/12/2002
Acetylene (C2H2)	0	0	0	0	0	0	0
Hydrogen (H2)	16	22	10	16	21	13	16
Ethylene (C2H4)	0	3	0	0	0	0	1
Methane (CH4)	17	19	16	17	18	16	16
Ethane (C2H6)	6	0	3	3	2	1	0
Carbon Monoxide (CO)	635	1079	687	805	815	617	714
Carbon Dioxide (CO2)	6569	4385	2869	4136	4524	3788	4455
Oxygen (O2)	641	3522	131	288	210	379	882
Total Combustibles	673	1123	716	841	856	647	747
Total Gas%	6.79%	12.96%	6.58%	6.09%	8.41%	5.97%	7.61%
OIL QUALITY							
Dielectric D-1816	52.3	37.8	38.6	45	44.1	49	42.1
Water in Fluid (ppm) D-1533	1.7	5.1	3.4	12.5	1.7	4	8.5
Acid Number (mg KOH/g) D-974	0.03	0.03	0.035	0.031	0.04	0.028	0.028
Interfacial Tens.(dynes/cm) D-971	33	28	30.4	36.7	33.5	40.4	41.6
ASTM Color D-1500	L1.5	L1.0	L1.5	L1.5	1	1	1
Visual Inspection D-1524	Pass	Pass	Fail	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.8685	0.867	0.87	0.869	0.8605	0.867	0.868
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	2.21	6.14	4.09	15.04	2.50	3.41	8.43
OPERATING CONDITIONS							
Ambient Temp. °F.	80	80	50	65	75	70	80
Winding Temp °C.							
Liquid Temp °C.	28	30	30	30	25	39	35
Pressure	3.5	4	3	4	4	4	4
Liquid Level	low	ok	low	low	low	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	1 0 0 0	0-0-2-0	1-0-0-2	1-0-0-2	1-0-0-2	1-0-0-2	
Cellulose Ratio (CO2/CO)	10.36	4.06	4.18	5.14	5.55	6.14	
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/17/2008
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1609
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Building 73	MVA:	0.5
Transformer No.:	PAT80910101	Gallons:	141
Manufacturer/Date:	Westinghouse	PCB's	cert.non
Voltage:	12470/480	% Imp.	5.77

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/17/2008	8/30/2007	11/8/2006	10/18/2005	6/29/2004	8/5/2003	8/12/2002
Acetylene (C2H2)	0	0	0	0	0	0	0
Hydrogen (H2)	9	15	11	16	13	8	17
Ethylene (C2H4)	0	2	0	0	0	0	1
Methane (CH4)	13	17	17	15	17	13	14
Ethane (C2H6)	4	0	2	2	1	0	0
Carbon Monoxide (CO)	502	919	822	800	732	509	640
Carbon Dioxide (CO2)	4025	3373	3239	3666	3833	3027	3746
Oxygen (O2)	1803	2336	595	199	923	956	1604
Total Combustibles	528	953	852	833	763	531	672
Total Gas%	6.07%	10.75%	8.89%	6.29%	8.36%	5.51%	7.64%
OIL QUALITY							
Dielectric D-1816	66.3	37.7	48.3	46.9	39.9	45.5	42.4
Water in Fluid (ppm) D-1533	6.3	5.7	1.7	3.4	6	6.3	6.3
Acid Number (mg KOH/g) D-974	0.03	0.03	0.027	0.031	0.037	0.023	0.023
Interfacial Tens.(dynes/cm) D-971	37	32	32.4	36.6	37	35.1	33.2
ASTM Color D-1500	L1.5	L1.5	L1.5	L1.5	L1.5	1	1
Visual Inspection D-1524	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.87	0.869	0.87	0.8695	0.8665	0.8675	0.868
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	8.21	7.42	2.05	4.09	6.94	5.38	5.18
OPERATING CONDITIONS							
Ambient Temp. °F.	80	80	55	65	75	70	80
Winding Temp °C.							
Liquid Temp °C.	28	28	30	30	31	39	40
Pressure	4	4	3	4	4	4	5
Liquid Level	low	ok	low	low	low	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	1 0 0 0	1-0-2-0	1-0-0-2	0-0-0-2	1-0-0-2	1-0-0-2	
Cellulose Ratio (CO2/CO)	8.01	3.67	3.94	4.58	5.24	5.95	
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/17/2008
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1609
Contact:	Ken Swingle	Class:	OA
Substation/Site:	BWTP	MVA:	0.75
Transformer No.:	PCT786301	Gallons:	179
Manufacturer/Date:	Westinghouse	PCB's	cert.non
Voltage:	12.5/0.5kV	% Imp.	6.24

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/17/2008	8/30/2007	11/9/2006	10/18/2005	6/16/2004	8/5/2003	8/12/2002
Acetylene (C2H2)	0	0	0	0	0	0	0
Hydrogen (H2)	12	12	6	8	6	6	3
Ethylene (C2H4)	7	3	3	2	2	2	1
Methane (CH4)	4	6	4	3	3	3	2
Ethane (C2H6)	0	1	0	0	0	0	0
Carbon Monoxide (CO)	312	469	345	243	205	161	109
Carbon Dioxide (CO2)	3315	2917	2556	2172	2449	2351	1688
Oxygen (O2)	10949	15675	9449	2782	11070	12764	12730
Total Combustibles	335	491	358	256	216	172	115
Total Gas%	6.35%	9.79%	7.37%	4.13%	7.06%	6.68%	6.85%
OIL QUALITY							
Dielectric D-1816	55.3	39.4	44	42.5	44.9	44.2	45.3
Water in Fluid (ppm) D-1533	3.4	2.8	2.8	6.3	4	7.4	9.7
Acid Number (mg KOH/g) D-974	0.04	0.05	0.038	0.042	0.054	0.041	0.043
Interfacial Tens.(dynes/cm) D-971	33	31	28.9	35.3	35.3	31	29.7
ASTM Color D-1500	L2.0	L1.5	L1.5	L1.5	L1.5	L1.5	L1.5
Visual Inspection D-1524	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.88	0.88	0.88	0.8805	0.879	0.879	0.8796
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	3.50	2.30	4.11	7.58	4.81	9.64	10.00
OPERATING CONDITIONS							
Ambient Temp. °F.	75	89	55	65	75	69	80
Winding Temp °C.							
Liquid Temp °C.	34	40	25	30	30	28	34
Pressure	2.5	3	2.5	2.5	2.5	2.5	3.2
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0 0 2 0	0-0-2-0	0-0-2-0	0-0-2-0	0-0-2-0	0-0-2-0	
Cellulose Ratio (CO2/CO)	10.63	6.22	7.41	8.94	11.95	14.60	
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/12/2008	
Address:	5555 N Channel Blvd. PDX	Report by:	KH	
Phone:	503-247-1667	STR Job No:	1609	
Contact:	Ken Swingle	Class:	NP	
Substation/Site:	Sub 8A	MVA:	2	
Transformer No.:	PQH-0714	Gallons:	451	rtemp
Manufacturer/Date:	NP	PCB's	no data	
Voltage:	12470/460	% Imp.	5.4	

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/12/2008	8/29/2007	11/8/2006	10/11/2005	6/16/2004	8/12/2002	8/12/2002
Acetylene (C2H2)	0	0	0	0	0	0	0
Hydrogen (H2)	2	3	2	51	4	5	6
Ethylene (C2H4)	7	6	4	5	5	6	6
Methane (CH4)	7	10	9	9	12	13	13
Ethane (C2H6)	7	5	4	7	8	6	5
Carbon Monoxide (CO)	304	581	440	415	336	597	611
Carbon Dioxide (CO2)	3204	2288	1722	2136	2340	2995	3178
Oxygen (O2)	292	3613	1572	62	113	67	106
Total Combustibles	327	605	459	438	365	627	641
Total Gas%	2.84%	6.19%	3.91%	3.01%	5.30%	5.25%	5.30%
OIL QUALITY							
Dielectric D-1816	55.1	34.4	47.1	43.9	43.7	42.5	39
Water in Fluid (ppm) D-1533	7.4	3.4	11	19.8	20.3	23.3	27.3
Acid Number (mg KOH/g) D-974	0.03	0.04	0.033	0.016	0.014	0.014	0.014
Interfacial Tens.(dynes/cm) D-971	44	45	41.1	44.2	44	44.5	45.1
ASTM Color D-1500	L3.0	L3.0	L2.5	L2.5	L2.5	L2.5	L2.5
Visual Inspection D-1524	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.875	0.875	0.865	0.874	0.875	0.8745	0.875
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	3.48	2.25	9.75	15.14	20.14	14.39	15.72
OPERATING CONDITIONS							
Ambient Temp. °F.	85	80	50	65	75	71	80
Winding Temp °C.							
Liquid Temp °C.	56	46	38	42	35	48	50
Pressure	0	0	0	0			
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	2 0 1 0	2-0-1-0					
Cellulose Ratio (CO2/CO)	10.53	3.94	3.91	5.15	6.96		
IEEE/ANSI (C57.104-1991)							

COMMENTS needs pressure

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/16/2008		
Address:	5555 N Channel Blvd. PDX	Report by:	KH		
Phone:	503-247-1667	STR Job No:	1609		
Contact:	Ken Swingle	Class:	NP		
Substation/Site:	Sub 5	MVA:	1		
Transformer No.:	PO14476	Gallons:	240	silicone	
Manufacturer/Date:	GE	PCB's	no data		
Voltage:	12470/460	% Imp.	5.5		

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/16/2008	8/30/2007	11/9/2006	10/12/2005	6/16/2004	8/5/2003	8/12/2002
Acetylene (C2H2)	0	0	0	0	0	0	0
Hydrogen (H2)	13	31	27	58	60	7	61
Ethylene (C2H4)	0	0	0	0	0	0	0
Methane (CH4)	13	17	18	23	23	11	21
Ethane (C2H6)	3	2	2	2	2	1	2
Carbon Monoxide (CO)	468	680	676	981	984	267	861
Carbon Dioxide (CO2)	3364	3522	3265	4274	4490	3355	3985
Oxygen (O2)	22340	19727	11026	4210	8032	23275	5442
Total Combustibles	499	730	723	1064	1069	286	945
Total Gas%	12.17%	12.87%	10.72%	9.82%	11.78%	11.39%	10.23%
OIL QUALITY							
Dielectric D-1816	41.5	40.9	37.7	40.8	48.5	39.6	42
Water in Fluid (ppm) D-1533	12	10.4	4.7	6.8	7.8	25	14.4
Acid Number (mg KOH/g) D-974	0.02	0.01	0.005	0.003	0.003	0.003	0.006
Interfacial Tens.(dynes/cm) D-971							
ASTM Color D-1500	0	0	0	0	0	0	0
Visual Inspection D-1524	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.966	0.965	0.9665	0.9625	0.963	0.9712	0.9635
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	7.41	8.56	5.66	8.86	8.35	30.09	11.85
OPERATING CONDITIONS							
Ambient Temp. °F.	85	85	70	65	75	71	80
Winding Temp °C.							
Liquid Temp °C.	48	40	30	28	33	30	40
Pressure	npg	npg	0	0	0	0	0
Liquid Level	ok	ok	low	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	1 0 0 0	0-0-0-2	0-0-0-2	0-0-0-2	0-0-0-2	1-0-0-2	
Cellulose Ratio (CO2/CO)	7.18	5.18	4.83	4.82	4.56	12.57	
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/16/2008		
Address:	5555 N Channel Blvd. PDX	Report by:	KH		
Phone:	503-247-1667	STR Job No:	1609		
Contact:	Ken Swingle	Class:	NP		
Substation/Site:	Sub 5	MVA:	1.5		
Transformer No.:	PO14490	Gallons:	315	silicone	
Manufacturer/Date:	GE	PCB's	no data		
Voltage:	12470/460	% Imp.	5.54		

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/16/2008	8/30/2007	11/9/2007	10/18/2005	6/16/2004	8/5/2003	8/12/2002
Acetylene (C2H2)	0	0	0	0	0	0	0
Hydrogen (H2)	8	14	7	14	19	17	23
Ethylene (C2H4)	0	0	0	1	0	1	1
Methane (CH4)	43	52	52	67	81	83	81
Ethane (C2H6)	6	4	4	5	4	4	4
Carbon Monoxide (CO)	221	302	250	340	367	360	367
Carbon Dioxide (CO2)	1920	2273	1757	2042	2048	2060	1691
Oxygen (O2)	25770	25922	14830	5669	15938	1419	10942
Total Combustibles	278	372	313	427	471	465	476
Total Gas%	11.93%	13.14%	10.03%	8.03%	11.89%	11.12%	11.02%
OIL QUALITY							
Dielectric D-1816	32	40.5	45.4	44.8	37.9	39.5	50.9
Water in Fluid (ppm) D-1533	8.9	7.3	4.2	6.8	6.8	12	9.8
Acid Number (mg KOH/g) D-974	0.01	0.01	0.008	0.003	0.003	0.003	0.006
Interfacial Tens.(dynes/cm) D-971							
ASTM Color D-1500	0	0	0	0	0	0	0
Visual Inspection D-1524	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.965	0.966	0.964	0.965	0.963	0.9672	0.9612
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	6.81	6.01	8.26	8.18	8.51	13.89	8.37
OPERATING CONDITIONS							
Ambient Temp. °F.	85	85	40	65	75	71	80
Winding Temp °C.							
Liquid Temp °C.	42	40	18	30	29	31	39
Pressure	npg	npg	npg		npg	npg	npg
Liquid Level	ok	ok	ok	low	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	2 0 0 0	2-0-0-2	2-0-0-2	2-0-0-0	2-0-0-2	2-0-0-0	
Cellulose Ratio (CO2/CO)	8.67	7.53	7.03	6.01	5.58	5.72	
IEEE/ANSI (C57.104-1991)							
COMMENTS							

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(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/16/2008		
Address:	5555 N Channel Blvd. PDX	Report by:	KH		
Phone:	503-247-1667	STR Job No:	1609		
Contact:	Ken Swingle	Class:	NP		
Substation/Site:	Sub 4	MVA:	1		
Transformer No.:	PCT2521-0101	Gallons:	200	silicone	
Manufacturer/Date:	Westinghouse	PCB's	no data		
Voltage:	12.5/0.5kV	% Imp.	5.94		

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/16/2008	8/30/2007	11/6/2006	10/18/2005	6/16/2004	8/5/2003	8/12/2002
Acetylene (C2H2)	0	0	0	0	0	0	0
Hydrogen (H2)	28	53	27	51	6	30	32
Ethylene (C2H4)	0	0	0	0	0	0	0
Methane (CH4)	70	83	73	86	42	79	78
Ethane (C2H6)	8	4	4	5	4	4	4
Carbon Monoxide (CO)	1674	2227	1637	2328	496	1655	1648
Carbon Dioxide (CO2)	8508	6113	4709	7609	6951	6794	7421
Oxygen (O2)	1372	1345	946	510	25599	1245	2864
Total Combustibles	1780	2367	1741	2470	548	1768	1762
Total Gas%	11.52%	17.70%	11.13%	11.78%	13.68%	11.33%	12.50%
OIL QUALITY							
Dielectric D-1816	50.7	38.6	39.3	36.6	36.3	43.9	37.1
Water in Fluid (ppm) D-1533	12.5	4.7	5.7	12.5	27.1	8.3	12.4
Acid Number (mg KOH/g) D-974	0.02	0.02	0.005	0.005	0.006	0.003	0.006
Interfacial Tens.(dynes/cm) D-971							
ASTM Color D-1500	0	0	0	0	0	0	0
Visual Inspection D-1524	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.964	0.964	0.967	0.9655	0.962	0.969	0.963
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	2.79	2.71	3.91	7.20	14.08	4.78	7.14
OPERATING CONDITIONS							
Ambient Temp. °F.	85	85	65	65	75	80	80
Winding Temp °C.							
Liquid Temp °C.	80	50	45	50	53	50	50
Pressure	5.5	3	3	4	4	4	4
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	1 0 0 0	1-0-0-2	1-0-0-2	1-0-0-2	2-0-0-2	1-0-0-2	
Cellulose Ratio (CO2/CO)	5.08	2.47	2.88	3.27	14.02	4.11	
IEEE/ANSI (C57.104-1991)							

COMMENTS

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/16/2008		
Address:	5555 N Channel Blvd. PDX	Report by:	KH		
Phone:	503-247-1667	STR Job No:	1609		
Contact:	Ken Swingle	Class:	NP		
Substation/Site:	Sub 3	MVA:	1.5		
Transformer No.:	R277558	Gallons:	321	silicone	
Manufacturer/Date:	GE	PCB's	no data		
Voltage:	12470/480	% Imp.	NP		

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/16/2008	8/30/2007	11/6/2006	10/18/2005	6/16/2004	8/5/2003	8/12/2002
Acetylene (C2H2)	0	0	0	0	0	0	0
Hydrogen (H2)	34	49	42	50	40	35	33
Ethylene (C2H4)	0	0	0	0	0	0	1
Methane (CH4)	27	27	27	27	27	27	26
Ethane (C2H6)	7	3	3	3	3	3	3
Carbon Monoxide (CO)	705	847	730	742	613	583	563
Carbon Dioxide (CO2)	7790	5396	4721	6157	6108	6355	6341
Oxygen (O2)	7731	1444	7699	2640	8673	8771	8119
Total Combustibles	773	926	802	822	883	648	626
Total Gas%	11.60%	16.08%	11.80%	9.20%	11.42%	11.30%	11.50%
OIL QUALITY							
Dielectric D-1816	51.5	42.2	41.8	40.6	39.3	39.7	47.7
Water in Fluid (ppm) D-1533	30.2	35.9	22.4	30.2	30.2	35.4	42.8
Acid Number (mg KOH/g) D-974	0.01	0.02	0.005	0.003	0.003	0.003	0.006
Interfacial Tens.(dynes/cm) D-971							
ASTM Color D-1500	0	0	0	0	0	0	0
Visual Inspection D-1524	Pass	Pass	Fail	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.965	0.965	0.968	0.9655	0.9625	0.9695	0.8638
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	21.49	23.78	22.22	24.85	24.85	26.11	29.38
OPERATING CONDITIONS							
Ambient Temp. °F.	80	85	64	65	75	75	80
Winding Temp °C.							
Liquid Temp °C.	44	46	35	40	40	43	45
Pressure	1.6	1.5	1	1	1.2	1.8	2
Liquid Level	ok	ok	ok	ok	ok	high	high
GAS DIAGNOSTICS							
Rogers Ratio	0 0 0 0	0-0-0-2	0-0-0-2	0-0-0-2	0-0-0-2	0-0-0-2	
Cellulose Ratio (CO2/CO)	11.06	6.37	6.47	8.30	9.96	10.90	
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/16/2008		
Address:	5555 N Channel Blvd. PDX	Report by:	KH		
Phone:	503-247-1667	STR Job No:	1609		
Contact:	Ken Swingle	Class:	NP		
Substation/Site:	Sub 3	MVA:	1		
Transformer No.:	R277557	Gallons:	268	silicone	
Manufacturer/Date:	GE	PCB's	no data		
Voltage:	12.5/0.5kV	% Imp.	6		

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/16/2008	8/30/2007	11/6/2006	10/18/2005	6/16/2004	8/5/2003	8/12/2002
Acetylene (C2H2)	0	0	0	0	0	0	0
Hydrogen (H2)	54	33	37	30	26	19	13
Ethylene (C2H4)	0	0	0	0	0	0	0
Methane (CH4)	12	7	10	9	7	5	4
Ethane (C2H6)	4	1	1	2	1	1	1
Carbon Monoxide (CO)	497	332	385	333	240	184	131
Carbon Dioxide (CO2)	5676	2881	4141	4635	4423	3503	2626
Oxygen (O2)	19205	15838	16101	6105	22150	21138	20870
Total Combustibles	567	373	433	374	274	209	149
Total Gas%	12.07%	9.30%	12.09%	7.90%	12.32%	11.34%	11.70%
OIL QUALITY							
Dielectric D-1816	57.5	44.9	45.8	45.7	50.2	39.7	50.9
Water in Fluid (ppm) D-1533	37.5	36.5	28.1	36.5	37	42.7	48.5
Acid Number (mg KOH/g) D-974	0.02	0.02	0.005	0.003	0.003	0.003	0.006
Interfacial Tens.(dynes/cm) D-971							
ASTM Color D-1500	0	0	0	0	0	0	0
Visual Inspection D-1524	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.965	0.962	0.97	0.965	0.962	0.969	0.9628
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	28.68	23.34	27.88	36.21	32.78	32.66	37.09
OPERATING CONDITIONS							
Ambient Temp. °F.	80	85	64	65	75	75	80
Winding Temp °C.							
Liquid Temp °C.	42	47	35	35	38	42	42
Pressure	-0.5	0	-0.75	0.5	-0.5	0	0
Liquid Level	ok	ok	ok	ok	ok	high	high
GAS DIAGNOSTICS							
Rogers Ratio	0 0 0 0	0-0-0-2	0-0-0-2	0-0-0-2	0-0-0-2	0-0-0-2	
Cellulose Ratio (CO2/CO)	11.42	8.68	10.76	13.92	18.43	19.04	
IEEE/ANSI (C57.104-1991)							

COMMENTS needs pressure

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/16/2008	
Address:	5555 N Channel Blvd. PDX	Report by:	KH	
Phone:	503-247-1667	STR Job No:	1609	
Contact:	Ken Swingle	Class:	NP	
Substation/Site:	Sub 1	MVA:	1.5	
Transformer No.:	910396-A1	Gallons:	345	rtemp
Manufacturer/Date:	Square D	PCB's	no data	
Voltage:	12470/480	% Imp.	6.3	

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/16/2008	08/30/207	11/9/2006	10/18/2005	6/16/2004	8/5/2003	8/12/2002
Acetylene (C2H2)	0	0	0	0	0	0	0
Hydrogen (H2)	5	2	1	4	4	4	5
Ethylene (C2H4)	11	11	12	14	14	15	18
Methane (CH4)	9	12	13	14	14	14	16
Ethane (C2H6)	3	2	2	3	2	3	3
Carbon Monoxide (CO)	181	345	314	321	290	287	323
Carbon Dioxide (CO2)	1718	1634	1557	1949	2025	2159	2610
Oxygen (O2)	378	773	52	33	53	68	131
Total Combustibles	209	372	342	356	324	323	365
Total Gas%	3.22%	5.85%	4.92%	4.06%	5.40%	5.42%	6.23%
OIL QUALITY							
Dielectric D-1816	58.1	38.1	46.3	39.9	40.5	40.6	41.1
Water in Fluid (ppm) D-1533	2.3	1.5	4.1	4.7	13.4	4.7	9.9
Acid Number (mg KOH/g) D-974	0.03	0.04	0.033	0.026	0.025	0.023	0.02
Interfacial Tens.(dynes/cm) D-971	44	47	40.2	41.8	42.4	42.3	43.4
ASTM Color D-1500	3.5	L4.0	L3.5	L3.5	L3.5	L3.5	L3.5
Visual Inspection D-1524	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.875	0.879	0.872	0.879	0.879	0.8781	0.879
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	1.89	1.23	4.93	3.87	11.03	4.01	7.85
OPERATING CONDITIONS							
Ambient Temp. °F.	75	85	53	65	75	71	80
Winding Temp °C.							
Liquid Temp °C.	40	40	30	40	40	39	41
Pressure	2	2.5	1.5	2	2.5	2	2.9
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	1 0 2 0	2-0-2-0					
Cellulose Ratio (CO2/CO)	9.49	4.74	4.96	6.07	6.98		
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.

Milwaukie, Oregon

(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/16/2008
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1609
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 1	MVA:	2
Transformer No.:	910396-B1	Gallons:	390 rtemp
Manufacturer/Date:	Square D	PCB's	no data
Voltage:	12470/480	% Imp.	6.05

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/16/2008	8/30/2007	11/9/2006	10/18/2005	6/16/2004	8/5/2003	8/12/2002
Acetylene (C2H2)	0	0	0	0	0	0	0
Hydrogen (H2)	0	2	0	4	2	3	6
Ethylene (C2H4)	5	2	2	2	2	2	2
Methane (CH4)	10	12	12	15	15	12	14
Ethane (C2H6)	5	4	3	4	4	3	3
Carbon Monoxide (CO)	252	337	333	411	337	323	375
Carbon Dioxide (CO2)	2921	1647	1669	2552	2379	2419	3021
Oxygen (O2)	267	226	37	19	57	68	73
Total Combustibles	272	357	350	436	360	343	400
Total Gas%	3.87%	4.81%	4.30%	4.04%	4.60%	4.57%	5.22%
OIL QUALITY							
Dielectric D-1816	49.6	31.3	44.3	42.1	39.4	40.3	44.4
Water in Fluid (ppm) D-1533	4	14.2	5.8	3.5	10.5	5.8	19.8
Acid Number (mg KOH/g) D-974	0.03	0.03	0.035	0.023	0.022	0.023	0.023
Interfacial Tens.(dynes/cm) D-971	38	48	42.3	44.3	48.4	42	44.3
ASTM Color D-1500	3.5	L3.5	L3.5	3	3	3	3
Visual Inspection D-1524	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.873	0.879	0.872	0.87	0.877	0.877	0.877
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	3.29	11.68	6.98	2.88	8.64	5.14	15.70
OPERATING CONDITIONS							
Ambient Temp. °F.	76	85	50	65	75	71	80
Winding Temp °C.							
Liquid Temp °C.	40	40	30	40	40	38	41
Pressure	0.2	0.5	0	0	0	-0.8	-0.2
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	2 0 1 0	2-0-0-0					
Cellulose Ratio (CO2/CO)	11.58	4.89	5.01	6.21	7.06		
IEEE/ANSI (C57.104-1991)							

COMMENTS low pressure

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/16/2008	
Address:	5555 N Channel Blvd. PDX	Report by:	KH	
Phone:	503-247-1667	STR Job No:	1609	
Contact:	Ken Swingle	Class:	NP	
Substation/Site:	Sub 1	MVA:	2	
Transformer No.:	910396-C1	Gallons:	390	rtemp
Manufacturer/Date:	Square D	PCB's	no data	
Voltage:	12470/480	% Imp.	5.75	

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/16/2008	8/30/2007	11/9/2006	10/18/2005	6/16/2004	8/5/2003	8/12/2002
Acetylene (C2H2)	0	0	0	0	0	0	0
Hydrogen (H2)	32	11	17	16	19	21	27
Ethylene (C2H4)	4	1	1	2	1	1	2
Methane (CH4)	8	8	10	10	11	9	10
Ethane (C2H6)	3	2	2	2	2	2	2
Carbon Monoxide (CO)	231	281	275	278	285	278	3005
Carbon Dioxide (CO2)	2934	1622	1620	2007	2263	2379	2853
Oxygen (O2)	142	1008	50	14	36	68	209
Total Combustibles	279	303	305	308	318	311	346
Total Gas%	4.07%	4.78%	4.25%	3.22%	4.50%	4.53%	5.01%
OIL QUALITY							
Dielectric D-1816	60.9	44.1	48.1	40.1	41	46.1	42.7
Water in Fluid (ppm) D-1533	4	2.6	4.1	4.7	14	7	12.8
Acid Number (mg KOH/g) D-974	0.03	0.03	0.03	0.023	0.022	0.023	0.025
Interfacial Tens.(dynes/cm) D-971	45	49	41.4	41.6	42.3	42	42.2
ASTM Color D-1500	L3.5	L3.5	L3.5	3	3	3	3
Visual Inspection D-1524	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.873	0.877	0.871	0.878	0.878	0.8776	0.879
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	3.29	2.14	4.93	3.87	11.52	5.98	9.44
OPERATING CONDITIONS							
Ambient Temp. °F.	75	85	55	65	75	81	80
Winding Temp °C.							
Liquid Temp °C.	40	40	30	40	40	39	43
Pressure	0.5	1	0	0	0	-0.5	0
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0 0 1 0	0-0-0-0					
Cellulose Ratio (CO2/CO)	12.70	6.77	6.89	7.22	7.94		
IEEE/ANSI (C57.104-1991)							

COMMENTS low pressure

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/16/2008
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1687	STR Job No:	1609
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 7	MVA:	0.75
Transformer No.:	M590624TLPA	Gallons:	230
Manufacturer/Date:	GE	PCB's	ND
Voltage:	12470/480	% Imp.	5.75

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/16/2008	8/29/2007	11/9/2006	10/12/2005	6/16/2004	8/5/2003	8/12/2002
Acetylene (C2H2)	0	0	0	0	0	1	0
Hydrogen (H2)	39	48	32	29	36	34	40
Ethylene (C2H4)	10	5	4	5	4	5	5
Methane (CH4)	13	14	12	13	12	12	14
Ethane (C2H6)	5	4	3	4	3	3	3
Carbon Monoxide (CO)	601	751	563	611	478	517	604
Carbon Dioxide (CO2)	3411	2630	2091	2430	2136	2574	3089
Oxygen (O2)	269	5837	2689	10	81	62	1080
Total Combustibles	668	822	614	672	533	572	688
Total Gas%	5.65%	8.39%	5.71%	3.98%	4.38%	4.82%	5.84%
OIL QUALITY							
Dielectric D-1816	52.9	42.7	44.3	46.1	47.3	51.3	48.4
Water in Fluid (ppm) D-1533	1.7	2.8	3.4	5.1	11.7	12.5	11.4
Acid Number (mg KOH/g) D-974	0.03	0.02	0.022	0.013	0.017	0.011	0.011
Interfacial Tens.(dynes/cm) D-971	40	39	36.1	42.7	44.2	36.9	37.1
ASTM Color D-1500	L0.5	L0.5	L0.5	0.5	0.5	L0.5	L0.5
Visual Inspection D-1524	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.892	0.892	0.891	0.884	0.891	0.8918	0.8924
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	2.21	2.14	4.93	3.87	11.52	5.98	9.44
OPERATING CONDITIONS							
Ambient Temp. °F.	75	80	70	65F	75F	75F	80F
Winding Temp °C.							
Liquid Temp °C.	28	30C	25C	30C	25C	25C	35C
Pressure	0	0	-2	0	-2	-3	0
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0 0 1 0	0-0-1-0	0-0-1-0	0-0-1-0	0-0-1-0	0-0-1-0	
Cellulose Ratio (CO2/CO)	5.73	3.50	3.71	3.98	4.47	4.98	
IEEE/ANSI (C57.104-1991)							

COMMENTS needs pressure

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/17/2008
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1609
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 8	MVA:	0.75
Transformer No.:	M590623TLPA	Gallons:	230
Manufacturer/Date:	GE	PCB's	no data
Voltage:	12.5/0.46kV	% Imp.	5.75

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	9/17/2008	8/29/2007	11/10/2006	10/11/2005	6/16/2004	8/5/2003	8/12/2002
Acetylene (C2H2)	0	0	0	0	0	0	0
Hydrogen (H2)	36	46	27	35	42	36	38
Ethylene (C2H4)	8	3	3	3	3	3	3
Methane (CH4)	14	14	13	12	16	11	13
Ethane (C2H6)	6	4	3	3	4	2	3
Carbon Monoxide (CO)	605	731	539	516	614	477	538
Carbon Dioxide (CO2)	3009	2648	1983	1976	2616	2246	2529
Oxygen (O2)	249	4637	693	11	73	65	79
Total Combustibles	668	798	585	569	679	529	595
Total Gas%	6.23%	9.64%	5.93%	5.91%	5.91%	4.67%	5.36%
OIL QUALITY							
Dielectric D-1816	58.8	43.5	47.3	43.5	53.2	50.9	46.9
Water in Fluid (ppm) D-1533	1.7	3.4	4	4	7	6.3	8
Acid Number (mg KOH/g) D-974	0.03	0.02	0.014	0.013	0.011	0.011	0.014
Interfacial Tens.(dynes/cm) D-971	37	37	34.2	42.1	42.1	41.1	43
ASTM Color D-1500	L0.5	L0.5	L0.5	0.5	0.5	0.5	0.5
Visual Inspection D-1524	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity D-1298	0.89	0.892	0.891	0.8945	0.89	0.8915	0.8919
Power Factor @ 25 C							
Power Factor @ 100 C							
Relative Saturation	2.21	2.14	4.93	3.87	11.52	5.98	9.44
OPERATING CONDITIONS							
Ambient Temp. °F.	85	80	55	65	75	69	80
Winding Temp °C.							
Liquid Temp °C.	28	26	18	24	35	30	35
Pressure	0	0	0	0	-0.5	0	0
Liquid Level	NO LG	ok	ok			NO LG	NO LG
GAS DIAGNOSTICS							
Rogers Ratio	0 0 1 0	0-0-0-0	0-0-1-0	0-0-1-0	0-0-0-0	0-0-1-0	
Cellulose Ratio (CO2/CO)	4.97	3.62	3.68	3.83	4.24	4.71	
IEEE/ANSI (C57.104-1991)							

COMMENTS needs pressure

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	9/17/2008
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1609
Contact:	Ken Swingle	Class:	
Substation/Site:		MVA:	1
Transformer No.:	070922-2	Gallons:	515
Manufacturer/Date:	T & R Electric	PCB's	2 ppm
Voltage:	12.47kV/0.48	% Imp.	5.5

Lab Used	JACO
DISSOLVED GASES PPM	9/17/2008
Acetylene (C2H2)	1
Hydrogen (H2)	4
Ethylene (C2H4)	2
Methane (CH4)	1
Ethane (C2H6)	1
Carbon Monoxide (CO)	48
Carbon Dioxide (CO2)	1158
Oxygen (O2)	19848
Total Combustibles	57
Total Gas%	7.15%
OIL QUALITY	
Dielectric D-1816	47.2
Water in Fluid (ppm) D-1533	10.2
Acid Number (mg KOH/g) D-974	0.02
Interfacial Tens.(dynes/cm) D-971	48
ASTM Color D-1500	0
Visual Inspection D-1524	Pass
Specific Gravity D-1298	0.877
Power Factor @ 25 C	
Power Factor @ 100 C	
Relative Saturation	8.39
OPERATING CONDITIONS	
Ambient Temp. °F.	85
Winding Temp °C.	
Liquid Temp °C.	40
Pressure	npg
Liquid Level	ok
GAS DIAGNOSTICS	
Rogers Ratio	0 0 1 0
Cellulose Ratio (CO2/CO)	23.88
IEEE/ANSI (C57.104-1991)	
COMMENTS	

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	**Date:**	8/30/2007
Address:	5555 N Channel Blvd. PDX	**Report by:**	KH
Phone:	503-247-1667	**STR Job No:**	1419
Contact:	Ken Swingle	**Class:**	NP
Substation/Site:	Dry Dock 3	**MVA:**	1
Transformer No.:	16121-1	**Gallons:**	415
Manufacturer:	Sierra	**PCB's**	cert.non
Voltage:	12470/480	**% Imp.**	NP

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/30/2007	11/17/2006	10/21/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	0	0	0	0	0
Hydrogen	5	4	6	4	5	5	6
Ethylene	4	4	1	2	3	3	3
Methane	3	3	2	2	2	2	2
Ethane	1	1	1	0	0	0	1
Carbon Monoxide	356	288	265	196	241	236	271
Carbon Dioxide	2501	2373	2233	1849	2608	2634	3000
Oxygen	13257	8094	1773	3871	7647	8019	14222
Total Combustibles	369	300	278	204	251	246	283
Total Gas	8.53%	7.16%	3.59%	4.23%	5.69	6.02	8.09
OIL QUALITY							
Dielectric Break (kV)	43.2	53	43.8	47	51.3	49.4	43.8
Water in Fluid (ppm)	6.3	5.7	7.4	4.5	9.7	11.4	10.3
Acid Number (mg KOH/g)	0.02	0.008	0.005	0.006	0.003	0.003	0.006
Interfacial Tens.(dynes/cm)	42	41.8	43.3	44.1	38.8	36.7	42.3
ASTM Color	L1.0	L1.0	L1.0	L1.0	L1.0	1	1
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.876	0.878	0.878	0.876	0.877	0.877	0.0876
Relative Saturation	6.25	8.38	8.91	5.42	9.26	8.41	9.84
OPERATING CONDITIONS							
Ambient Temp. F:	80	47	60	75	79	80	70
Winding Temp. C:							
Liquid Temp. C:	35	25	30	30	36	43	36
Pressure	-0.5	-1.5	-2	-1.5	-1	-0.2	0
Liquid Level	ok	ok	ok	low	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0-0-2-0	0-0-2-0	0-0-2-0	0-0-2-0			
Cellulose Ratio (CO2/CO)	7.03	9.43	8.43	9.43			
IEEE/ANSI (C57.104-1991)							

COMMENTS needs pressure

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/31/2007
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667	STR Job No:	1419
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Dry Dock 3	MVA:	1.5
Transformer No.:	16745-1	Gallons:	327
Manufacturer:	Sierra	PCB's	cert.non
Voltage:	12470/480	% Imp.	NP

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/30/2007	11/17/2006	10/21/2005	6/19/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	0	0	0	0	0
Hydrogen	2	7	10	12	2	8	11
Ethylene	16	20	18	16	13	16	59
Methane	4	6	5	5	3	5	5
Ethane	1	1	1	1	1	1	1
Carbon Monoxide	274	577	562	520	149	499	606
Carbon Dioxide	2658	2437	2648	2850	2951	3524	5669
Oxygen	13866	2324	342	1019	11059	3753	3488
Total Combustibles	279	611	596	544	168	529	682
Total Gas	8.32%	5.89%	3.78%	5.25%	5.74	6.02	6.81
OIL QUALITY							
Dielectric Break (kV)	36.6	48.2	45.7	49	50.8	46.8	44.5
Water in Fluid (ppm)	4.5	9.1	9	6.3	18.2	15.3	15.3
Acid Number (mg KOH/g)	0.02	0.008	0.008	0.008	0.008	0.008	0.008
Interfacial Tens.(dynes/cm)	43	37.9	44.8	46.2	39	39.2	37.6
ASTM Color	L1.5	L1.5	L1.5	L1.5	1	1	1
Visual Inspection	pass	pass	pass	pass	pass	pass	pass
Specific Gravity	0.876	0.875	0.8775	0.876	0.876	0.8774	0.08755
Relative Saturation	5.42	16.44	7.41	5.18	9.79	8.23	7.69
OPERATING CONDITIONS							
Ambient Temp. F:	80	47	60	75	79	80	70
Winding Temp. C:							
Liquid Temp. C:	30	20	40	40	52	52	54
Pressure	0	0	0	-1	-0.5	-0.5	-1
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	1-0-2-0	0-0-2-0	0-0-2-0	0-0-2-0			
Cellulose Ratio (CO2/CO)	9.7	4.22	4.71	5.48			
IEEE/ANSI (C57.104-1991)							

COMMENTS needs pressure

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	**Date:**	8/29/2007
Address:	5555 N Channel Blvd. PDX	**Report by**	KH
Phone:	503-247-1667	**STR Job No:**	1419
Contact:	Ken Swingle	**Class:**	NP
Substation/Site:	Dry Dock 3	**MVA:**	1
Transformer No.:	16121-3	**Gallons:**	415
Manufacturer:	Sierra	**PCB's**	cert.non
Voltage:	12470/480	**% Imp.**	5.7

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/29/2007	11/11/2006	10/12/2005	6/19/2004	8/5/2003	11/14/2002	8/12/2002
Acetylene	1	1	1	1	1	0	35
Hydrogen	2	3	3	0	2	2	86
Ethylene	9	11	11	11	9	0	758
Methane	3	3	3	2	2	0	284
Ethane	1	2	1	1	1	1	93
Carbon Monoxide	111	83	66	33	16	2	274
Carbon Dioxide	1981	1933	1491	866	471	346	2815
Oxygen	18017	14693	3316	11042	10706	1989	7615
Total Combustibles	127	103	85	48	31	5	1530
Total Gas	10.21%	10.91%	4.8%	7.17%	5.80	4.68	6.70
OIL QUALITY							
Dielectric Break (kV)	39.3	43.9	39.3	45.2	48.2	42.5	30
Water in Fluid (ppm)	21.6	10.8	23.3	14.2	27.3	6	39.8
Acid Number (mg KOH/g)	0.01	0.003	0.008	0.008	0.003	0.003	0.006
Interfacial Tens.(dynes/cm)	47	43.4	43.5	49.4	39.8	49.2	41.7
ASTM Color	L0.5	L0.5	L0.5	L0.5	L1.0	0	1
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.883	0.885	0.886	0.885	0.885	0.8938	0.876
Relative Saturation	17.77	19.51	28.04	18.49	22.46	4.94	32.75
OPERATING CONDITIONS							
Ambient Temp. F:	85	47	60	75	79	60	80
Winding Temp. C:							
Liquid Temp. C:	40	20	30	28	40	40	40
Pressure	1		1.5	1.5	2.5	1	0.5
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	1-0-2-0	1-0-2-0	1-0-2-0	2-0-2-0			
Cellulose Ratio (CO2/CO)	17.85	23.29	22.59	26.24			
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/29/2007
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1419
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 4-2	MVA:	0.33
Transformer No.:	7916702	Gallons:	176 Rtemp
Manufacturer:	Elect. Tech	PCB's	
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/29/2007	11/9/2006	10/12/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	0	6	0	0	0
Hydrogen	7	15	9	11	9	15	2
Ethylene	1	0	1	15	1	1	1
Methane	3	2	4	1	5	5	7
Ethane	1	1	3	0	5	6	9
Carbon Monoxide	137	85	122	88	74	41	42
Carbon Dioxide	1390	1016	1176	1062	967	638	577
Oxygen	4726	3591	11	73	68	97	77
Total Combustibles	149	103	139	121	94	68	61
Total Gas	5.26%	3.52%	2.63%	0.041	41103	41682	32969
OIL QUALITY							
Dielectric Break (kV)	free water	41.8	39.9	41.5	42.7	44.8	44.9
Water in Fluid (ppm)	84.7	16.8	18	40.1	18	19.8	17.8
Acid Number (mg KOH/g)	0.02	0.03	0.023	0.022	0.025	0.025	0.025
Interfacial Tens.(dynes/cm)	39	31.9	32.5	32.6	32.1	32.7	32.6
ASTM Color	L5.5	L5.5	5.5	5.5	5.5	5.5	5.5
Visual Inspection	Fail	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.884	0.88	0.885	0.8825	0.883	0.884	0.8835
Relative Saturation	75.05	58.95	17.86	48.26	15.95	24.79	#VALUE!
OPERATING CONDITIONS							
Ambient Temp. F:	80	55	55	75	79	80	70
Winding Temp. C:							
Liquid Temp. C:	38	5	35	30	38	29	18C
Pressure	1.5	0	0	0	2	1	0
Liquid Level	ok	ok	ok	low	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0-0-1-0						
Cellulose Ratio (CO2/CO)	10.15	11.95	9.64	12.07			
IEEE/ANSI (C57.104-1991)							

COMMENTS unit has free water - needs to be filtered ASAP

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/29/2007	
Address:	5555 N Channel Blvd. PDX	Report by	KH	
Phone:	503-247-1667	STR Job No:	1419	
Contact:	Ken Swingle	Class:	NP	
Substation/Site:	Sub 4-4	MVA:	0.33	
Transformer No.:	79F6704	Gallons:	176	rtemp
Manufacturer:	Elect. Tech	PCB's	no data	
Voltage:	12470/480	% Imp.	5.1	

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/29/2007	11/9/2006	10/11/2005	7/28/2004	6/16/2004	8/12/2002	8/12/2002
Acetylene	0	0	1	<1	0	1	1
Hydrogen	16	11	7	<1	5	4	7
Ethylene	6	5	4	<1	17	22	21
Methane	2	2	2	<1	3	3	4
Ethane	1	0	0	<1	3	3	3
Carbon Monoxide	128	96	76	<10	88	112	111
Carbon Dioxide	1201	1027	860	<100	1614	1853	1931
Oxygen	972	2952	441	<100	64	122	97
Total Combustibles	153	114	90	*	116	117	147
Total Gas	5.56%	4.13%	2.89%	*	3.58%	3.8%	3.9%
OIL QUALITY							
Dielectric Break (kV)	37.7	45.7	38.4	42	42.2	40	34.8
Water in Fluid (ppm)	18.8	1.2	76.7	4	93.6	18	22.7
Acid Number (mg KOH/g)	0.04	0.065	0.026	0.022	0.025	0.025	0.02
Interfacial Tens.(dynes/cm)	40	35	37	36.7	36.9	37	37.7
ASTM Color	L5.0	L5.0	L5.5	L5.5	L5.5	5.5	5.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.882	0.878	0.88	0.8815	0.88	0.8828	0.883
Relative Saturation	16.66	1.76	76.09	1.94	112.64	15.95	21.68
OPERATING CONDITIONS							
Ambient Temp. F:	80	52	52	80	75	78	80
Winding Temp. C:							
Liquid Temp. C:	38	25	35	55	30	38	36
Pressure	3	3	0	1.5	0	0.5	0
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0-0-2-0						
Cellulose Ratio (CO2/CO)	9.38	10.7	11.32		18.34		
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/29/2007	
Address:	5555 N Channel Blvd. PDX	Report by	KH	
Phone:	503-247-1667	STR Job No:	1419	
Contact:	Ken Swingle	Class:	NP	
Substation/Site:	Sub 4-11	MVA:	0.33	
Transformer No.:	79F6701	Gallons:	176	rtemp
Manufacturer:	Elect. Tech	PCB's	no data	
Voltage:	12470/480	% Imp.	5.1	

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/29/2007	11/9/2006	10/11/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	0	0	0	0	0
Hydrogen	23	25	24	20	5	12	15
Ethylene	3	4	4	4	4	5	5
Methane	4	6	5	14	7	10	16
Ethane	4	5	5	17	6	10	14
Carbon Monoxide	118	117	111	109	96	75	113
Carbon Dioxide	1436	1770	1529	1872	1965	2061	2727
Oxygen	3017	4750	19	51	69	62	70
Total Combustibles	152	157	149	164	118	112	163
Total Gas	4.44%	4.81	2.51%	3.94	4.08	4.19	5.08
OIL QUALITY							
Dielectric Break (kV)	33.3	47.1	34.9	40.6	26	33.8	30
Water in Fluid (ppm)	11.9	8.1	16.9	36	22.1	14.5	22.4
Acid Number (mg KOH/g)	0.03	0.038	0.023	0.022	0.023	0.02	0.02
Interfacial Tens.(dynes/cm)	38	33.8	33.3	33	32.2	33	33.9
ASTM Color	L5.5	L6.0	L6.0	L6.0	L6.0	5.5	5.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.88	0.88	0.882	0.882	0.882	0.886	0.886
Relative Saturation	10.95	22.60	16.76	43.32	26.60	11.93	18.43
OPERATING CONDITIONS							
Ambient Temp. F:	75	50	65	75	70	80	70
Winding Temp. C:							
Liquid Temp. C:	37	10	35	30	30	40	40
Pressure	0	0	0	0	0	1	0
Liquid Level	low	low	low	low	low	low	ok
GAS DIAGNOSTICS							
Rogers Ratio	0-1-0-0						
Cellulose Ratio (CO2/CO)	12.17	15.13	13.77	17.17			
IEEE/ANSI (C57.104-1991)							

COMMENTS needs pressure - low liquid level - add rtemp

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/30/2007
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1419
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 12-2	MVA:	1
Transformer No.:	79F67112	Gallons:	316 rtemp
Manufacturer:	Elect. Tech	PCB's	no data
Voltage:	12470/480	% Imp.	5.5

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/30/2007	11/17/2006	10/21/2005	6/16/2004	6/16/2004	8/5/2003	8/12/2002
Acetylene	0	0	0	<1	0	0	0
Hydrogen	4	5	7	<1	5	5	3
Ethylene	4	3	4	<1	2	4	1
Methane	1	1	1	<1	3	1	0
Ethane	0	0	0	<1	1	0	3
Carbon Monoxide	64	29	65	<10	68	71	56
Carbon Dioxide	591	432	486	<100	560	633	496
Oxygen	11915	9479	2003	<100	86	96	1051
Total Combustibles	73	38	77	*	79	81	63
Total Gas	5.31%	4.44%	2.73%	*	3.69%	3.28%	3.66
OIL QUALITY							
Dielectric Break (kV)	26.2	33.6	37	41	42.5	35.8	40.9
Water in Fluid (ppm)	15.3	9.8	19.2	4.1	80.8	30.2	43.6
Acid Number (mg KOH/g)	0.06	0.049	0.023	0.022	0.022	0.023	0.023
Interfacial Tens.(dynes/cm)	47	31.9	32	32.9	32	32.2	32
ASTM Color	6	L6.0	L6.0	L6.0	L6.0	L6.0	L6.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.878	0.88	0.883	0.88	0.88	0.882	0.882
Relative Saturation	31.39	11.79	19.05	1.99	89.94	36.34	35.87
OPERATING CONDITIONS							
Ambient Temp. F:	70	40	65	80	75	70	70
Winding Temp. C:							
Liquid Temp. C:	17	30	35	55	32	30	40
Pressure	0	0	0	1.5	0	0	0
Liquid Level	ok	ok	ok	ok	High	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0-0-2-0						
Cellulose Ratio (CO2/CO)	9.23	14.9	7.48		8.24		
IEEE/ANSI (C57.104-1991)							

COMMENTS needs pressure - lowering dielectric

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/30/2007
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1419
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 4-3	MVA:	0.33
Transformer No.:	79F9703	Gallons:	176 Rtemp
Manufacturer:	Elect. Tech	PCB's	no data
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/30/2007	11/9/2006	10/12/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	7	8	10	10	11	12	15
Hydrogen	19	18	14	11	11	13	24
Ethylene	18	20	25	26	30	32	40
Methane	6	7	9	11	11	13	16
Ethane	2	2	2	5	4	5	7
Carbon Monoxide	186	188	202	165	156	146	139
Carbon Dioxide	1534	1409	1812	1643	1820	1840	1982
Oxygen	8543	3566	1454	67	118	200	71
Total Combustibles	238	243	262	228	223	221	241
Total Gas	5.07%	4.08%	3.23%	4.06%	4.23%	4.53%	5.07
OIL QUALITY							
Dielectric Break (kV)	29.9	39	40.2	41.5	45.6	41.8	42.7
Water in Fluid (ppm)	7.4	7.6	11.1	20.3	19.8	22.1	20.1
Acid Number (mg KOH/g)	0.03	0.03	0.023	0.022	0.023	0.023	0.022
Interfacial Tens.(dynes/cm)	39	31.9	32.8	32.7	32	32.8	32.9
ASTM Color	L5.0	L5.0	5	5	5	5	5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.882	0.878	0.882	0.882	0.889	0.881	0.881
Relative Saturation	6.56	11.17	13.36	21.74	20.41	16.30	15.37
OPERATING CONDITIONS							
Ambient Temp. F:	80	53	50	75	69	80	70
Winding Temp. C:							
Liquid Temp. C:	38	25	30	33	34	43	42
Pressure	1	0	0	0.7	0.5	1.6	1.5
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0-0-2-0						
Cellulose Ratio (CO2/CO)	8.25	7.49	8.97	9.96			
IEEE/ANSI (C57.104-1991)							

COMMENTS

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/29/2007	
Address:	5555 N Channel Blvd. PDX	Report by:	KH	
Phone:	503-247-1667	STR Job No:	1419	
Contact:	Ken Swingle	Class:	NP	
Substation/Site:	Sub 4-1	MVA:	0.33	
Transformer No.:	79F9701	Gallons:	176	rtemp
Manufacturer:	Elect. Tech	PCB's	*no data*	
Voltage:	12470/480	% Imp.	5.1	

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/30/2007	11/11/2006	10/11/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	0	0	0	0	0
Hydrogen	22	14	36	8	5	9	33
Ethylene	2	2	3	1	3	2	3
Methane	1	1	1	2	2	2	3
Ethane	0	0	0	1	0	0	2
Carbon Monoxide	34	19	37	47	66	57	75
Carbon Dioxide	461	400	454	429	571	463	733
Oxygen	12350	8995	2189	98	42	56	105
Total Combustibles	59	36	77	59	76	70	116
Total Gas	5.54%	4.42%	2.45%	4.00%	4.04%	3.46%	4.26
OIL QUALITY							
Dielectric Break (kV)	33.5	43.2	39.7	41.5	46.7	42	42.5
Water in Fluid (ppm)	10.9	24.4	23.2	18.6	29.7	26.7	25.9
Acid Number (mg KOH/g)	0.04	0.046	0.029	0.028	0.031	0.031	0.028
Interfacial Tens.(dynes/cm)	36	30.7	33.1	33.2	33.5	33.5	33.4
ASTM Color	L6.0	L5.5	6	6	6	6	6
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.885	0.88	0.8825	0.882	0.8815	0.881	0.8808
Relative Saturation	8.97	35.85	23.01	22.38	35.74	20.42	21.31
OPERATING CONDITIONS							
Ambient Temp. F:	80	50	65	75	65	80	70
Winding Temp. C:							
Liquid Temp. C:	40	25	35	30	30	42	40
Pressure	0.25	0	0	0	0	0	0
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	5-0-2-0						
Cellulose Ratio (CO2/CO)	13.56	21.05	12.27	9.13			
IEEE/ANSI (C57.104-1991)							

COMMENTS

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	**Date:**	8/29/2007	
Address:	5555 N Channel Blvd. PDX	**Report by:**	KH	
Phone:	503-247-1667	**STR Job No:**	1419	
Contact:	Ken Swingle	**Class:**	NP	
Substation/Site:	Sub 4-12	**MVA:**	0.33	
Transformer No.:	79F97012	**Gallons:**	176	Rtemp
Manufacturer:	Elect. Tech	**PCB's**	no data	
Voltage:	12470/480	**% Imp.**	5.1	

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/29/2007	11/9/2006	10/12/2005	7/28/2004	6/16/2004	8/5/2003	8/12/2002
Acetylene	0	0	0	<1	0	0	0
Hydrogen	5	6	10	<1	142	17	7
Ethylene	4	5	5	<1	12	8	6
Methane	1	1	1	<1	15	4	3
Ethane	0	0	0	<1	12	2	1
Carbon Monoxide	41	37	60	<10	116	86	85
Carbon Dioxide	899	874	719	<100	2117	1503	1173
Oxygen	11199	8532	1203	<100	74	122	233
Total Combustibles	51	49	76	*	297	117	102
Total Gas	5.48%	4.96%	2.98%	*	4.52%	3.8%	4.1%
OIL QUALITY							
Dielectric Break (kV)	36.5	45	38.5	40	39.7	38	38.5
Water in Fluid (ppm)	21.9	23.8	26.2	8.7	107	69.7	38.4
Acid Number (mg KOH/g)	0.03	0.03	0.023	0.022	0.022	0.023	0.023
Interfacial Tens.(dynes/cm)	37	31.9	32.3	32.3	32.2	32.4	32
ASTM Color	L5.0	l5.0	5.5	5.5	5.5	5.5	5.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.883	0.88	0.8835	0.882	0.8815	0.8825	0.883
Relative Saturation	19.40	34.97	25.99	4.23	128.76	61.76	31.60
OPERATING CONDITIONS							
Ambient Temp. F:	80	50	65	80	75	78	80
Winding Temp. C:							
Liquid Temp. C:	38	25	35	55	30	38	40
Pressure	0	0	0	1.5	0	0	0
Liquid Level	ok	ok	ok	ok	low	low	low
GAS DIAGNOSTICS							
Rogers Ratio	0-0-2-0						
Cellulose Ratio (CO2/CO)	21.93	23.62	11.98		18.25		
IEEE/ANSI (C57.104-1991)							

COMMENTS needs pressure

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/29/2007	
Address:	5555 N Channel Blvd. PDX	Report by	KH	
Phone:	503-247-1667	STR Job No:	1419	
Contact:	Ken Swingle	Class:		
Substation/Site:	Sub 12-4	MVA:	1	
Transformer No.:	79F6714	Gallons:	316	rtemp
Manufacturer:	Elect. Tech	PCB's		
Voltage:	12470/460	% Imp.	5.5	

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/29/2007	11/9/2006	7/28/2004	6/16/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	1	<1	1	1	1	1
Hydrogen	2	3	<1	6	5	6	5
Ethylene	10	10	<1	40	42	45	39
Methane	3	3	<1	27	24	30	28
Ethane	2	2	<1	28	29	35	31
Carbon Monoxide	137	115	<10	389	345	388	373
Carbon Dioxide	1380	1120	<100	2337	2381	2763	3506
Oxygen	3332	1329	<100	95	79	109	61
Total Combustibles	154	134	*	491	446	505	477
Total Gas	5.61%	3.37	*	0.043	42413	46588	46289
OIL QUALITY							
Dielectric Break (kV)	30.1	41	43.1	44.1	34	39.2	38.8
Water in Fluid (ppm)	12.5	7	7.6	84.9	18.6	21.5	23.1
Acid Number (mg KOH/g)	0.03	0.044	0.022	0.02	0.02	0.017	0.022
Interfacial Tens.(dynes/cm)	41	33.7	35.1	35.6	31.1	37.5	37.6
ASTM Color	L5.5	L5.5	L6.0	5.5	5.5	5.5	5.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.884	0.878	0.881	0.88	0.881	0.881	0.8805
Relative Saturation	10.28	10.29	3.69	67.34	17.77	13.28	17.67
OPERATING CONDITIONS							
AmbientTemp.F:	80	70	80	75	65	80	70
Winding Temp.C:							
Liquid Temp.C:	40	25	55	41	36	48	42
Pressure	2	1.5	1.5	0.5	1	2	1
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	1-0-2-0						
Cellulose Ratio (CO2/CO)	10.07	9.74					
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

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Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/29/2007	
Address:	5555 N Channel Blvd. PDX	Report by	KH	
Phone:	503-247-1667	STR Job No:	1419	
Contact:	Ken Swingle	Class:	NP	
Substation/Site:	Sub 4-6	MVA:	0.33	
Transformer No.:	79F6706	Gallons:	176	rtemp
Manufacturer:	Elect. Tech	PCB's		
Voltage:	12470/460	% Imp.	5.1	

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/29/2007	11/9/2006	10/11/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	1	0	1	0	0
Hydrogen	27	21	21	11	7	8	6
Ethylene	2	2	2	2	2	1	2
Methane	4	4	3	9	5	6	10
Ethane	1	1	1	11	4	6	11
Carbon Monoxide	212	160	128	109	71	103	79
Carbon Dioxide	1831	1422	1588	2123	1821	1711	1555
Oxygen	4145	730	220	155	71	194	115
Total Combustibles	246	188	156	142	90	124	108
Total Gas	5.79%	3.93%	4.9%	5.36%	4.9%	4.5%	5.8%
OIL QUALITY							
Dielectric Break (kV)	36.5	45.2	40	43	38.5	36.5	35.5
Water in Fluid (ppm)	11.4	11.6	19.8	26.2	25.6	27.3	26.4
Acid Number (mg KOH/g)	0.04	0.041	0.023	0.025	0.025	0.023	0.028
Interfacial Tens.(dynes/cm)	36.1	31.7	32.2	27.4	34.1	34.4	34.5
ASTM Color	L5.5	L6.0	L6.0	5.5	5.5	5.5	5.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.883	0.875	0.883	0.881	0.884	0.882	0.8815
Relative Saturation	9.38	19.28	19.64	31.53	30.81	20.88	21.72
OPERATING CONDITIONS							
AmbientTemp.F:	80	55	65	70	70	80	70
Winding Temp.C:							
Liquid Temp.C:	40	22	35	30	30	42	40
Pressure	1	0	1.5	2.5	2.5	3.5	0.5
Liquid Level	ok	ok	ok	low	low	low	low
GAS DIAGNOSTICS							
Rogers Ratio	0-0-1-0						
Cellulose Ratio (CO2/CO)	8.64	8.89	12.41	19.48			
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/29/2007	
Address:	5555 N Channel Blvd. PDX	Report by	KH	
Phone:	503-247-1667	STR Job No:	1419	
Contact:	Ken Swingle	Class:	NP	
Substation/Site:	Sub 4-9	MVA:	0.33	
Transformer No.:	79F6709	Gallons:	176	rtemp
Manufacturer:	Elect. Tech	PCB's		
Voltage:	12470/460	% Imp.	5.1	

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/29/2007	11/9/2006	10/11/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	0	0	0	0	0
Hydrogen	14	75	40	9	20	13	21
Ethylene	3	3	3	3	3	3	3
Methane	5	6	5	10	11	11	14
Ethane	3	3	3	7	8	7	7
Carbon Monoxide	146	134	119	116	145	149	193
Carbon Dioxide	1787	1603	1613	1903	2281	2358	3430
Oxygen	5079	1876	18	52	59	119	80
Total Combustibles	171	221	170	145	187	183	238
Total Gas	5.31%	4.12%	2.53%	4.40%	4.4%	4.3%	54048
OIL QUALITY							
Dielectric Break (kV)	43.1	46.1	37.4	37.7	41.7	40.8	40.4
Water in Fluid (ppm)	7.4	9.3	14	16.9	21.5	22.7	17.2
Acid Number (mg KOH/g)	0.03	0.041	0.021	0.022	0.023	0.023	0.02
Interfacial Tens.(dynes/cm)	40	31.9	36.9	37.1	37	37	37.1
ASTM Color	L6.0	L6.0	L6.0	5.5	5.5	5.5	5.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.883	0.88	0.882	0.882	0.882	0.881	0.881
Relative Saturation	6.09	11.19	13.89	20.34	20.54	13.07	14.15
OPERATING CONDITIONS							
AmbientTemp.F:	80	55	65	75	60	80	70
Winding Temp.C:							
Liquid Temp.C:	40	30	35	30	36	50	40
Pressure	0	0	0	0	0	0	0.5
Liquid Level	ok	low	ok	ok	Low	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0-0-1-0						
Cellulose Ratio (CO2/CO)	12.24	11.96	13.54	16.41	15.73		
IEEE/ANSI (C57.104-1991)							

COMMENTS needs pressure

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/29/2007
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667	STR Job No:	1419
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 4-10	MVA:	0.33
Transformer No.:	79F67010	Gallons:	176 rtemp
Manufacturer:	Elect. Tech	PCB's	
Voltage:	12470/460	% Imp.	5.1

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/29/2007	11/9/2006	10/11/2005	7/28/2004	6/16/2004	8/5/2003	8/12/2002
Acetylene	0	0	0	<1	0	0	0
Hydrogen	32	34	10	<1	382	23	23
Ethylene	2	1	1	<1	3	3	3
Methane	2	2	2	<1	9	9	9
Ethane	1	1	1	<1	6	5	5
Carbon Monoxide	102	79	38	<10	113	118	119
Carbon Dioxide	803	653	287	<100	1312	1152	1188
Oxygen	1060	474	73	<100	68	91	83
Total Combustibles	139	117	52	*	513	158	159
Total Gas	4.17	3.65	2.22%	*	4.77%	50412	51019
OIL QUALITY							
Dielectric Break (kV)	34.9	46	35.9	40.9	42.8	34.3	34.9
Water in Fluid (ppm)	4.2	8.7	21.5	4	68.6	11.6	10.5
Acid Number (mg KOH/g)	0.03	0.022	0.021	0.025	0.02	0.02	0.011
Interfacial Tens.(dynes/cm)	40	34.4	35.4	35	35.1	34	36
ASTM Color	L5.0	L4.5	L5.0	L5.0	L5.0	L5.0	L5.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.884	0.88	0.882	0.8815	0.881	0.881	0.883
Relative Saturation	4.50	12.78	38.84	1.94	68.05	9.54	8.64
OPERATING CONDITIONS							
Ambient Temp.F:	80	56	65	80	75	78	80
Winding Temp.C:							
Liquid Temp.C:	33	25	20	55	35	40	40
Pressure	0	0	-1	1.5	0	0.1	1
Liquid Level	ok	ok	ok	ok	low	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	5-0-1-0						
Cellulose Ratio (CO2/CO)	7.87	8.27	7.55		11.61		
IEEE/ANSI (C57.104-1991)							

COMMENTS needs pressure

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/29/2007	
Address:	5555 N Channel Blvd. PDX	Report by	KH	
Phone:	503-247-1667	STR Job No:	1419	
Contact:	Ken Swingle	Class:	NP	
Substation/Site:	Sub 4-8	MVA:	0.33	
Transformer No.:	79F6708	Gallons:	176	rtemp
Manufacturer:	Elect. Tech	PCB's		
Voltage:	12470/460	% Imp.	5.1	

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/29/2007	11/8/2006	10/11/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	7	7	11	12	10	12	13
Hydrogen	20	41	54	497	44	34	44
Ethylene	240	252	366	385	365	385	435
Methane	44	46	61	68	61	66	75
Ethane	33	33	49	43	39	45	49
Carbon Monoxide	169	159	203	187	177	183	207
Carbon Dioxide	1130	1113	1764	1925	1875	1852	1995
Oxygen	85	33	15	136	71	178	81
Total Combustibles	613	538	744	1192	696	725	823
Total Gas	3.67%	3.32%	3.41%	5.00%	4.7%	5.1%	63741
OIL QUALITY							
Dielectric Break (kV)	35.1	39.7	33	32.9	34.3	35	35.5
Water In Fluid (ppm)	5.2	15.1	20.9	36	20.9	29.7	15.5
Acid Number (mg KOH/g)	0.03	0.035	0.031	0.031	0.031	0.028	0.036
Interfacial Tens.(dynes/cm)	37	34.4	35	35.1	34.7	35.5	35.7
ASTM Color	L2.5	L2.5	L2.0	L2.0	L2.0	2.5	2.5
Visual Inspection	Pass	Fail	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.882	0.88	0.8835	0.881	0.881	0.882	0.8815
Relative Saturation	4.28	22.19	20.73	38.55	25.15	20.39	12.75
OPERATING CONDITIONS							
Ambient Temp.F:	80	53	65	75	70	80	70
Winding Temp.C:							
Liquid Temp.C:	40	25	35	33	30	45	40
Pressure	0	-0.2	0	0	0	1.5	1.5
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	1-0-2-0						
Cellulose Ratio (CO2/CO)	4.2	7	8.69	10.29			
IEEE/ANSI (C57.104-1991)							

COMMENTS needs pressure

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/29/2007
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667	STR Job No:	1419
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 12-1	MVA:	1
Transformer No.:	79F6711	Gallons:	316
Manufacturer:	Elect. Tech.	PCB's	
Voltage:	12470/480	% Imp.	5.5

rtemp

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/29/2007	11/8/2006	10/12/2005	7/28/2004	6/16/2004	8/5/2003	8/12/2002
Acetylene	2	2	0	0	36	0	0
Hydrogen	2	3	5	1	3	6	9
Ethylene	7	8	1	0	0	1	1
Methane	3	3	1	1	1	1	2
Ethane	1	1	0	1	0	0	0
Carbon Dioxide	97	63	777	65	1390	589	575
Carbon Monoxide	1444	1045	62	15	67	55	57
Oxygen	12693	4475	2214	222	35310	3968	708
Total Combustibles	110	80	69	18	108	63	69
Total Gas	6.62%	4.94%	3.44%	1.00%	4.00%	4.26%	36986
OIL QUALITY TESTS							
Dielectric Break	46.6	42.2	39	38.8	39.4	37	32.2
Water in Fluid	13.6	19.2	23.8	14.8	99.4	41.3	43
Acid Number	0.03	0.027	0.023	0.025	0.022	0.025	0.025
Interfacial Tens.	41	35.3	40.4	40.4	41.1	40	41.5
ASTM Color	L2.5	L2.5	L3.0	L3.0	L3.0	L3.0	L3.0
Visual Inspection	PASS	PASS	PASS	PASS	PASS	PASS	PASS
Specific Gravity	0.878	0.872	0.8765	0.875	0.874	0.8725	0.874
Relative Saturation	12.05	25.01	23.61	7.19	98.60	32.76	34.11
OPERATING CONDITIONS							
Ambient Temp.F:	80	53	55	80	75	78	80
Winding Temp.C:							
Liquid Temp.C:	38	28	35	55	35	41	41
Pressure	0.5	0	0.5	1.5	0	0	0
Liquid Level	ok	ok	ok	ok	low	OK	OK
GAS DIAGNOSTICS							
Rogers Ratio	1-0-2-0						
Cellulose Ratio (CO2/CO)	14.89	16.59	10.22		20.75		
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
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(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/30/2007
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667	STR Job No:	1419
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Dry Dock	MVA:	1
Transformer No.:	771382	Gallons:	310
Manufacturer:	United Power	PCB's	cert-non
Voltage:	NP	% Imp.	

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/30/2007	11/6/2006	10/18/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	21	20	22	23	23	25	25
Hydrogen	53	27	40	39	34	36	34
Ethylene	11	9	9	9	8	8	7
Methane	26	22	22	23	21	21	20
Ethane	6	5	5	4	4	4	4
Carbon Monoxide	788	536	607	557	509	473	437
Carbon Dioxide	2784	2387	2933	3173	3489	3652	4637
Oxygen	3132	3066	568	903	4328	4645	8500
Total Combustibles	905	619	705	655	599	567	527
Total Gas	7.06%	5.57%	4.19%	6.07%	6.2	65953	74225
OIL QUALITY							
Dielectric Break (kV)	43	53.3	50.2	53.5	51.4	46.9	45.4
Water in Fluid (ppm)	10.8	6.8	9.7	7.4	13.1	20.5	12.5
Acid Number (mg KOH/g)	0.01	0.003	0.005	0.006	0.003	0.003	0.011
Interfacial Tens.(dynes/cm)	48	47.5	46.9	51.5	44.4	45.9	48.6
ASTM Color	L0.5	L0.5	L0.5	L0.5	L0.5	0.5	0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.879	0.875	0.878	0.8765	0.8775	0.8785	0.8785
Relative Saturation	7.41	4.67	7.98	6.09	8.99	10.30	7.99
OPERATING CONDITIONS							
Ambient Temp.F:	85	64	65	75	70	80	70
Winding Temp.C:							
Liquid Temp.C:	45	45	40	40	45	54	47
Pressure	0.5	0	0	0	0.25	0	0
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0-0-1-1	0-0-1-1	0-0-1-1	0-0-1-1	0-0-1-1		
Cellulose Ratio (CO2/CO)	3.53	4.45	4.83	5.7	6.85		
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	**Date:**	8/30/2007
Address:	5555 N Channel Blvd. PDX	**Report by**	KH
Phone:	503-247-1667	**STR Job No:**	1419
Contact:	Ken Swingle	**Class:**	NP
Substation/Site:	C.U.S.	**MVA:**	1.5
Transformer No.:	SBV567601	**Gallons:**	259
Manufacturer:	West.	**PCB's**	cert-non
Voltage:	12470/240	**% Imp.**	5.5

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/30/2007	11/8/2006	10/18/2005	6/19/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	0	0	0	0	0
Hydrogen	9	7	14	11	8	8	11
Ethylene	17	17	17	18	18	17	19
Methane	12	12	11	12	10	10	11
Ethane	2	2	2	2	2	1	2
Carbon Monoxide	552	473	487	481	326	381	492
Carbon Dioxide	2970	3039	3159	3467	2764	3077	3569
Oxygen	2040	3135	148	141	266	613	517
Total Combustibles	592	511	531	524	364	417	535
Total Gas	10.85%	10.57%	6.5%	9.25%	5.72%	7.4%	9.3%
OIL QUALITY							
Dielectric Break (kV)	36	44.1	45.6	43.7	50.4	43.2	45.1
Water in Fluid (ppm)	1.1	2.3	4.5	6	8.5	7.4	4
Acid Number (mg KOH/g)	0.03	0.016	0.021	0.022	0.014	0.017	0.025
Interfacial Tens.(dynes/cm)	38	32.2	38.8	38.9	36.1	35.9	37.1
ASTM Color	L2.0	L2.0	L2.0	L2.0	1.5	1.5	L2.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.875	0.872	0.874	0.871	0.872	0.8725	0.8715
Relative Saturation	1.83	6.42	6.61	13.42	9.46	5.08	3.97
OPERATING CONDITIONS							
Ambient Temp.F:	80	50	65	75	70	80	70
Winding Temp.C:							
Liquid Temp.C:	22	10	25	15	32	45	35
Pressure	4	2.5	3	3.5	4.5	5	4.5
Liquid Level	ok	ok	ok	low	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	1-0-2-0	1-0-2-0	0-0-2-0	1-0-2-0	1-0-2-0		
Cellulose Ratio (CO2/CO)	5.38%	6.42%	6.49%	7.21%	8.48%		
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/30/2007
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667	STR Job No:	1419
Contact:	Ken Swingle	Class:	NP
Substation/Site:	C.U.S.	MVA:	1.5
Transformer No.:	SBV567602	Gallons:	259
Manufacturer:	West.	PCB's	cert-non
Voltage:	12470/240	% Imp.	5.47

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/30/2007	11/8/2006	10/18/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	0	0	0	0	0
Hydrogen	10	9	10	11	11	9	11
Ethylene	29	31	26	31	33	28	33
Methane	9	9	8	10	10	9	11
Ethane	2	2	2	2	2	1	2
Carbon Monoxide	740	667	589	678	678	555	750
Carbon Dioxide	3041	3112	3166	3955	4472	4150	8100
Oxygen	6402	4299	911	2349	3730	4461	4819
Total Combustibles	790	718	635	732	734	602	807
Total Gas	7.45%	6.97%	4.00%	6.81%	6.93%	6.4%	8.1%
OIL QUALITY							
Dielectric Break (kV)	40.2	4.44	44.6	47.6	52.3	43.6	45.6
Water in Fluid (ppm)	1.7	5.7	4.5	0.6	7.4	8.5	2.3
Acid Number (mg KOH/g)	0.03	0.03	0.018	0.23	0.011	0.014	0.008
Interfacial Tens.(dynes/cm)	34	33.6	35.3	38.3	34.4	34.3	34.3
ASTM Color	L2.0	L2.0	L2.0	L2.0	1.5	1.5	L1.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.872	0.875	0.8735	0.8715	0.872	0.8725	0.8715
Relative Saturation	1.40	6.86	4.46	0.69	6.09	5.84	
OPERATING CONDITIONS							
Ambient Temp.F:	80	50	65	75	70	80	70
Winding Temp.C:							
Liquid Temp.C:	40	30	35	31	40	45	40
Pressure	0.5	-0.5	0	0	0	1	0.5
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0-0-2-0	1-0-2-0	0-0-2-0	0-0-2-0	0-0-2-0		
Cellulose Ratio (CO2/CO)	4.11%	4.67%	5.38%	5.83%	6.60%		
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/30/2007
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667	STR Job No:	1419
Contact:	Ken Swingle	Class:	NP
Substation/Site:	C.U.S.	MVA:	1.5
Transformer No.:	SBV567604	Gallons:	259
Manufacturer:	West.	PCB's	cert-non
Voltage:	12470/240	% Imp.	5.47

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/30/2007	11/8/2006	10/11/2005	6/15/2004	8/5/2003	8/12/2002
Acetylene	0	0	0	0	0	0
Hydrogen	8	8	12	13	8	10
Ethylene	21	23	25	25	26	21
Methane	10	10	11	12	11	10
Ethane	2	2	2	2	2	2
Carbon Monoxide	599	549	566	616	477	559
Carbon Dioxide	2594	2731	3145	3647	3274	3659
Oxygen	1580	1894	229	247	572	540
Total Combustibles	640	592	616	668	524	602
Total Gas	8.25%	8.21%	5.47%	8.64%	6.24%	7.4%
OIL QUALITY						
Dielectric Break (kV)	38.2	41	42.6	40.9	45.9	44.6
Water in Fluid (ppm)	3.4	2.8	9.7	11.9	9.1	5.1
Acid Number (mg KOH/g)	0.03	0.019	0.021	0.022	0.02	0.023
Interfacial Tens.(dynes/cm)	38	32.9	39.7	38.2	44	44.6
ASTM Color	L2.0	L2.0	L2.0	L2.0	L1.5	1.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.871	0.873	0.875	0.871	0.871	0.8725
Relative Saturation	3.01	3.37	11.67	14.32	7.77	3.50
OPERATING CONDITIONS						
Ambient Temp.F:	80	50	65	75	70	80
Winding Temp.C:						
Liquid Temp.C:	38	30	30	30	39	45
Pressure	2	1.2	2	2	3	4.2
Liquid Level	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS						
Rogers Ratio	1-0-2-0	1-0-2-0	0-0-2-0	0-0-2-0	1-0-2-0	
Cellulose Ratio (CO2/CO)	4.33%	4.97%	5.56	5.92%	6.86%	
IEEE/ANSI (C57.104-1991)						
COMMENTS						

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/30/2007
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667	STR Job No:	1419
Contact:	Ken Swingle	Class:	NP
Substation/Site:	C.U.S.	MVA:	1.5
Transformer No.:	SBV567603	Gallons:	259
Manufacturer:	West.	PCB's	cert-non
Voltage:	12470/240	% Imp.	5.51

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/30/2007	11/8/2006	10/18/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	0	0	0	0	0
Hydrogen	13	9	12	13	8	11	13
Ethylene	19	21	21	21	22	24	22
Methane	11	11	11	11	10	11	11
Ethane	2	2	2	2	2	2	2
Carbon Monoxide	773	661	681	685	486	542	673
Carbon Dioxide	3127	3403	3500	3864	3221	3609	4435
Oxygen	1691	3853	164	206	501	556	853
Total Combustibles	818	704	727	732	528	590	721
Total Gas	10.65%	10.90%	6.47%	9.53%	6.15%	7.30%	9.30%
OIL QUALITY							
Dielectric Break (kV)	42.3	44.8	46.5	43	46.6	49.4	40.4
Water in Fluid (ppm)	2.3	3.4	3.4	2.3	8	5.7	8
Acid Number (mg KOH/g)	0.02	0.024	0.023	0.031	0.02	0.023	0.022
Interfacial Tens.(dynes/cm)	35	35.4	39.3	39.4	35.8	35.7	36.9
ASTM Color	L2.0	L2.0	L2.0	L2.0	L1.5	1.5	L2.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.872	0.875	0.8735	0.871	0.871	0.8732	0.8725
Relative Saturation	3.00	5.00	5.00	5.14	9.26	4.36	8.57
OPERATING CONDITIONS							
Ambient Temp.F:	80	65	65	75	70	80	70
Winding Temp.C:							
Liquid Temp.C:	28	25	25	15	31	42	33
Pressure	4	4	4	4	4.5	5.2	5
Liquid Level	ok			low	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0-0-2-0	1-0-2-0	0-0-2-0	0-0-2-0	1-0-2-0		
Cellulose Ratio (CO2/CO)	4.05%	5.15%	5.14%	5.64%	6.63%		
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/30/2007
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667	STR Job No:	1419
Contact:	Ken Swingle	Class:	NP
Substation/Site:	C.U.S.	MVA:	1
Transformer No.:	PAT716001	Gallons:	224
Manufacturer:	West.	PCB's	cert-non
Voltage:	12470/480	% Imp.	5.81

Lab Used	*JACO*	*JACO*	*JACO*	*JACO*	*JACO*	*JACO*	*JACO*
DISSOLVED GASES PPM	8/30/2007	11/8/2006	10/18/2005	6/19/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	0	0	0	0	0
Hydrogen	11	7	13	18	10	15	12
Ethylene	11	10	11	15	16	15	17
Methane	15	13	13	15	12	11	11
Ethane	9	8	6	5	4	2	2
Carbon Monoxide	553	405	495	579	448	488	536
Carbon Dioxide	2584	2066	2867	3672	3185	3315	3834
Oxygen	515	78	29	150	158	182	230
Total Combustibles	599	443	538	632	490	531	578
Total Gas	8.30%	5.71%	5.32%	8.98%	6.39%	7.30%	7.99%
OIL QUALITY							
Dielectric Break (kV)	36.7	42.4	48.3	45.6	50.2	45.6	39.4
Water in Fluid (ppm)	1.1	3.4	6.8	2	2.8	6.8	3.4
Acid Number (mg KOH/g)	0.03	0.027	0.026	0.037	0.02	0.023	0.034
Interfacial Tens.(dynes/cm)	34	33	38.9	38.6	34.5	34.3	35.4
ASTM Color	L2.0	L2.0	L2.0	L2.0	L1.5	1.5	2
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	2
Specific Gravity	0.873	0.875	0.875	0.872	0.872	0.8725	0.873
Relative Saturation	1.62	9.49	9.99	4.47	4.85	6.49	6.14
OPERATING CONDITIONS							
Ambient Temp.F:	80	50	65	75	70	80	70
Winding Temp.C:							
Liquid Temp.C:	25	10	25	15	21	36	20
Pressure	2	1	2	2.8	3	4	3
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	1-0-1-0	1-0-1-0	1-0-1-0	1-0-2-0	1-0-2-0		
Cellulose Ratio (CO2/CO)	4.67%	5.10%	5.79%	6.34%	7.11%		
IEEE/ANSI (C57.104-1991)							

COMMENTS

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/29/2007	
Address:	5555 N Channel Blvd. PDX	Report by	KH	
Phone:	503-247-1667	STR Job No:	1419	
Contact:	Ken Swingle	Class:	NP	
Substation/Site:	Sub 4-7	MVA:	0.33	
Transformer No.:	79F670-71	Gallons:	176	rtemp
Manufacturer:	Elect. Tech.	PCB's		
Voltage:	12470/480	% Imp.	5.1	

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/29/2007	11/8/2006	10/12/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	0	0	0	0	0
Hydrogen	14	35	14	22	23	31	6
Ethylene	0	0	0	0	1	1	1
Methane	1	1	1	5	5	4	11
Ethane	0	0	0	6	5	3	13
Carbon Dioxide	319	496	393	395	492	605	513
Carbon Monoxide	33	19	31	37	54	62	56
Oxygen	4618	9747	2215	56	59	81	113
Total Combustibles	48	55	46	70	88	101	87
Total Gas	3.64%	4.84%	2.88%	3.05%	3.30%	3.80%	4.10%
OIL QUALITY TESTS							
Dielectric Break	33.8	36.7	42	47.5	42.7	41.8	41.6
Water in Fluid	23.4	66.3	20.9	33.1	29.7	36.6	29.9
Acid Number	0.04	0.038	0.023	0.022	0.023	0.023	0.036
Interfacial Tens.	36	31.3	34.5	34.6	34.7	34.9	34.6
ASTM Color	L6.0	L6.0	L5.5	L5.5	5.5	5.5	5.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.883	0.88	0.884	0.882	0.882	0.883	0.883
Relative Saturation	20.73	79.79	20.73	39.83	28.37	30.11	29.66
OPERATING CONDITIONS							
Ambient Temp.F:	80	50	50	75	79	90	70
Winding Temp.C:							
Liquid Temp.C:	38	30	35	30	36	40	35
Pressure	0	0	0	0	0	0	0
Liquid Level	ok	ok	Low	Low			OK
GAS DIAGNOSTICS							
Rogers Ratio	5-0-2-2						
Cellulose Ratio (CO2/CO)	9.67%	26.11%	12.68%	10.68%			
IEEE/ANSI (C57.104-1991)							

COMMENTS needs pressure

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/30/2007		
Address:	5555 N Channel Blvd. PDX	Report by	KH		
Phone:	503-247-1667	STR Job No:	1419		
Contact:	Ken Swingle	Class:	NP		
Substation/Site:	Sub 4	MVA:	1.5		
Transformer No.:	P008188	Gallons:	295	silicone	
Manufacturer:	GE	PCB's			
Voltage:	12470/480	% Imp.			

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/30/2007	11/6/2006	10/18/2005	6/19/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	0	0	0	0	0
Hydrogen	44	40	57	53	52	56	65
Ethylene	1	1	1	1	1	1	1
Methane	30	29	29	31	30	30	32
Ethane	3	3	3	2	2	2	2
Carbon Monoxide	1006	921	932	886	852	879	980
Carbon Dioxide	3479	3292	3944	4163	4339	4254	4672
Oxygen	4120	2360	932	2264	2510	1409	4772
Total Combustibles	1084	994	1022	973	937	968	1080
Total Gas	12.71%	11.15%	8.41%	10.63%	10.57%	105420	128402
OIL QUALITY							
Dielectric Break (kV)	45	47.3	45.4	46.8	38.7	50.4	44.2
Water in Fluid (ppm)	6.3	5.2	7.8	8.3	15.1	13.4	10.9
Acid Number (mg KOH/g)	0.01	0.003	0.005	0.006	0.003	0.006	0.008
Interfacial Tens.(dynes/cm)						43.7	43.7
ASTM Color	0	0	0	0	0	0	0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.972	0.97	0.965	0.963	0.972	0.9618	0.9615
Relative Saturation	5.18	5.16	6.42	6.83	11.55	9.20	8.34
OPERATING CONDITIONS							
Ambient Temp.F:	85	65	65	75	80	80	70
Winding Temp.C:							
Liquid Temp.C:	40	35	40	40	42	45	42
Pressure	npg						npg
Liquid Level	ok	ok	ok	ok	high	high	high
GAS DIAGNOSTICS							
Rogers Ratio	0-0-0-0	0-0-0-0	0-0-0-0	0-0-0-0	0-0-0-0		
Cellulose Ratio (CO2/CO)	4.23	3.57	4.23	4.69	5.09		
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/30/2007		
Address:	5555 N Channel Blvd. PDX	Report by	KH		
Phone:	503-247-1667	STR Job No:	1419		
Contact:	Ken Swingle	Class:	NP		
Substation/Site:	Sub 6	MVA:	1		
Transformer No.:	836002311	Gallons:	392	rtemp	
Manufacturer:	RTE	PCB's	no data		
Voltage:	12470/460	% Imp.	5.6		

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/30/2007	11/17/2006	10/18/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	0	0	0	0	0
Hydrogen	5	4	8	7	7	9	7
Ethylene	2	2	3	2	3	3	3
Methane	9	9	9	10	11	12	12
Ethane	6	6	6	6	6	6	6
Carbon Monoxide	322	338	331	314	383	394	421
Carbon Dioxide	1419	1443	1700	1972	2269	2522	2676
Oxygen	238	164	21	97	78	64	71
Total Combustibles	344	359	357	339	410	424	449
Total Gas	4.51%	4.17%	3.22%	4.30%	4.98%	5.02%	54662
OIL QUALITY							
Dielectric Break (kV)	36.4	41.9	42	48.3	43.7	34.9	41
Water in Fluid (ppm)	7.4	14.5	19.2	27.9	29.1	15.1	21.3
Acid Number (mg KOH/g)	0.02	0.011	0.021	0.022	0.02	0.02	0.018
Interfacial Tens.(dynes/cm)	43	35.3	34.6	34.8	37.7	40.5	37.2
ASTM Color	L3.0	3	3	3	3	3	3
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.875	0.873	0.8745	0.873	0.8715	0.873	0.873
Relative Saturation	6.09	14.38	13.18	27.68	19.28	8.70	11.45
OPERATING CONDITIONS							
Ambient Temp. F:	85	45	65	75	70	80	70
Winding Temp. C:							
Liquid Temp. C:	40	35	45	35	46	50	52
Pressure	0	0	0				NG
Liquid Level	OK	OK	OK	OK	OK	OK	
GAS DIAGNOSTICS							
Rogers Ratio	1-0-0-0						
Cellulose Ratio (CO2/CO)	4.41	4.27	5.14	6.28			
IEEE/ANSI (C57.104-1991)							

COMMENTS needs pressure

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/30/2007	
Address:	5555 N Channel Blvd. PDX	Report by	KH	
Phone:	503-247-1667	STR Job No:	1419	
Contact:	Ken Swingle	Class:	NP	
Substation/Site:	Sub 6	MVA:	1.5	
Transformer No.:	836002464	Gallons:	540	rtemp
Manufacturer:	RTE	PCB's	no data	
Voltage:	12470/480	% Imp.	5.6	

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/30/2007	11/17/2006	10/18/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	0	0	0	0	0
Hydrogen	4	4	5	5	5	13	5
Ethylene	3	4	3	3	4	4	4
Methane	10	12	10	12	12	14	15
Ethane	3	4	3	4	4	4	4
Carbon Monoxide	353	356	289	326	315	353	377
Carbon Dioxide	1394	1361	1298	1655	1604	1849	1703
Oxygen	1210	207	13	189	70	126	60
Total Combustibles	373	380	310	350	340	388	405
Total Gas	5.25%	4.45%	2.75%	4.71%	4.23%	46392	51137
OIL QUALITY							
Dielectric Break (kV)	36.3	48.4	38.9	44.8	41.5	34.9	45.2
Water In Fluid (ppm)	17.6	12.8	27.9	29.1	22.1	16.3	21.3
Acid Number (mg KOH/g)	0.03	0.016	0.018	0.017	0.017	0.011	0.02
Interfacial Tens.(dynes/cm)	42	35.8	36.4	36.5	36.8	39.1	36.5
ASTM Color	L3.5	L3.0	L3.0	L3.0	L3.5	3	3
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.878	0.87	0.874	0.8718	0.8725	0.872	0.872
Relative Saturation	14.48	21.27	33.57	35.02	21.11	13.41	19.59
OPERATING CONDITIONS							
Ambient Temp. F:	85	45	65	75	70	80	70
Winding Temp. C:							
Liquid Temp. C:	40	22	30	30	36	40	37
Pressure	npg	npg	npg	npg	npg	npg	npg
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	1-0-1-0						
Cellulose Ratio (CO2/CO)	3.95	3.82	4.49	5.08			
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/30/2007
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667	STR Job No:	1419
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Berth 307	MVA:	0.3
Transformer No.:	H425084M68	Gallons:	122
Manufacturer:	GE	PCB's	no data
Voltage:	12470/480	% Imp.	1.71

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/30/2007	11/17/2006	10/21/2005	6/19/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	0	0	0	0	0
Hydrogen	7	5	7	7	9	10	11
Ethylene	6	5	6	6	7	7	7
Methane	22	20	21	26	23	26	28
Ethane	6	5	6	6	5	5	5
Carbon Monoxide	705	584	587	663	636	745	812
Carbon Dioxide	2295	1943	2223	2791	3050	3539	4614
Oxygen	964	535	13	139	85	81	106
Total Combustibles	746	619	627	708	680	793	863
Total Gas	6.72%	5.24%	3.62%	5.91%	5.69%	6.71%	7.18%
OIL QUALITY							
Dielectric Break (kV)	43.8	48.8	46.8	45.5	53.4	52.2	44.7
Water in Fluid (ppm)	1.1	5.1	4.5	6	6.8	6.3	3.4
Acid Number (mg KOH/g)	0.02	0.014	0.01	0.014	0.008	0.011	0.014
Interfacial Tens.(dynes/cm)	41	34.4	40.1	40.4	38.5	38.5	37.2
ASTM Color	L1.5	L1.5	L1.5	L1.5	L1.5	1	L1.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.88	0.88	0.883	0.8785	0.879	0.8804	0.88
Relative Saturation	1.09	7.49	8.13	10.84	6.03	4.17	3.25
OPERATING CONDITIONS							
Ambient Temp. F:	70	50	65	75	71	80	70
Winding Temp. C:							
Liquid Temp. C:	35	25	20	20	38	46	36
Pressure							npg
Liquid Level	low	low	low	low	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	2-0-1-0	2-0-1-0	2-0-1-0	2-0-1-0	1-0-1-0		
Cellulose Ratio (CO_2/CO)	3.79	3.33%	3.79	4.21%	4.80%		
IEEE/ANSI (C57.104-1991)							

COMMENTS XO Bushing leak.

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/30/2007
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667	STR Job No:	1419
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Berth 306	MVA:	0.3
Transformer No.:	H425082M68	Gallons:	122
Manufacturer:	GE	PCB's	5ppm
Voltage:	13200/480	% Imp.	1.71

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/30/2007	11/17/2006	10/21/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	0	0	0	0	0
Hydrogen	0	4	3	4	2	0	1
Ethylene	2	2	1	0	3	2	2
Methane	1	1	1	1	1	1	1
Ethane	0	0	0	0	0	0	0
Carbon Monoxide	35	10	18	25	35	30	33
Carbon Dioxide	908	682	409	530	990	884	884
Oxygen	21487	20430	4770	13687	16303	15456	22095
Total Combustibles	38	17	23	30	41	33	37
Total Gas	7.56%	10.67%	3.94%	6.35%	6.34%	6.55%	7.46%
OIL QUALITY							
Dielectric Break (kV)	30	43.2	49.4	44.9	54.2	49.9	43.7
Water in Fluid (ppm)	30.1	15.9	11.4	6.8	29	35.8	25
Acid Number (mg KOH/g)	0.01	0.016	0.01	0.014	0.011	0.008	0.014
Interfacial Tens.(dynes/cm)	38	34.2	40.4	41	37.8	37.9	38.2
ASTM Color	L1.5	L1.5	L1.5	L1.5	L1.5	L1.5	L1.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.875	0.875	0.875	0.8726	0.873	0.8735	0.874
Relative Saturation	25.70	19.13	16.75	12.28	22.18	19.92	20.57
OPERATING CONDITIONS							
Ambient Temp. F:	70	40	65	75	72	80	70
Winding Temp. C:							
Liquid Temp. C:	39	30	25	20	42	51	40
Pressure		npg					npg
Liquid Level	ok	ok	ok	ok	ok	high	high
GAS DIAGNOSTICS							
Rogers Ratio	2-0-2-0	0-0-2-0	0-0-2-0	0-0-2-2	0-0-2-0		
Cellulose Ratio (CO2/CO)	25.94%	68.20%	22.72%	21.20%	28.29%		
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/29/2007	
Address:	5555 N Channel Blvd. PDX	Report by:	KH	
Phone:	503-247-1667	STR Job No:	1419	
Contact:	Ken Swingle	Class:	NP	
Substation/Site:	Sub 7A	MVA:	2	
Transformer No.:	PQH0715	Gallons:	415	rtemp
Manufacturer:	NP	PCB's	no data	
Voltage:	12470/460	% Imp.	5.4	

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/29/2007	11/9/2006	10/11/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	0	0	0	0	0
Hydrogen	5	6	7	7	9	7	6
Ethylene	6	7	7	8	7	8	7
Methane	12	14	12	15	14	15	15
Ethane	6	7	6	6	6	6	5
Carbon Monoxide	660	796	685	739	767	777	856
Carbon Dioxide	1969	2905	2313	2783	3076	3401	5619
Oxygen	325	3810	13	59	85	55	81
Total Combustibles	689	830	717	775	803	813	889
Total Gas	5.13%	7.57%	3.21%	5.00%	5.09%	5.13%	5.92%
OIL QUALITY							
Dielectric Break (kV)	36.4	39.8	39.1	40.8	43.5	39.5	39.2
Water in Fluid (ppm)	2.3	13.4	11.4	16.3	17.4	12.8	14.4
Acid Number (mg KOH/g)	0.03	0.033	0.023	0.022	0.023	0.02	0.014
Interfacial Tens.(dynes/cm)	47	39.6	37.2	37.5	37.1	37.7	37.6
ASTM Color	L3.0	L2.5	L3.0	L3.0	L3.0	L3.0	L3.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.873	0.87	0.8745	0.873	0.873	0.873	0.8725
Relative Saturation	1.89	16.13	9.38	16.17	11.94	6.22	10.25
OPERATING CONDITIONS							
Ambient Temp. F:	80	55	65	75	79	80	70
Winding Temp. C:							
Liquid Temp. C:	40	30	40	35	45	55	44
Pressure				npg	npg	npg	npg
Liquid Level	ok	ok	ok	ok	ok	ok	
GAS DIAGNOSTICS							
Rogers Ratio	1-0-1-0						
Cellulose Ratio (CO2/CO)	2.98%	3.65	3.38%	3.77			
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/30/2007		
Address:	5555 N Channel Blvd. PDX	Report by	KH		
Phone:	503-247-1667	STR Job No:	1419		
Contact:	Ken Swingle	Class:	OA		
Substation/Site:	Crane #14	MVA:	0.75		
Transformer No.:	L243297	Gallons:	142	silicone	
Manufacturer:	NP	PCB's	no data		
Voltage:	2.4/0.5kV	% Imp.	5.7		

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/30/2007	11/8/2006	10/12/2005	6/19/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	0	0	0	0	0
Hydrogen	178	146	152	170	163	168	174
Ethylene	0	1	1	0	1	1	1
Methane	50	48	47	56	52	51	56
Ethane	6	6	6	5	5	5	6
Carbon Monoxide	1047	919	902	1019	948	941	1054
Carbon Dioxide	3328	3157	3592	4434	4550	4392	4861
Oxygen	1698	1116	349	969	1617	1018	1881
Total Combustibles	1281	1120	1108	1250	1169	1166	1291
Total Gas	11.63%	10.20%	7.05%	11.09%	10.75%	1.07%	1.19%
OIL QUALITY							
Dielectric Break (kV)	37.6	44.1	44.9	42.4	47.8	47.3	46.7
Water in Fluid (ppm)	5.2	5.7	7.8	7.3	9.4	21.6	11
Acid Number (mg KOH/g)	0.01	0.003	0.005	0.006	0.003	0.008	0.008
Interfacial Tens.(dynes/cm)							
ASTM Color	0	0	0	0	0	0	0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.962	0.968	0.965	0.9625	0.9696	0.9638	0.963
Relative Saturation	4.28	6.86	9.39	8.78	8.03	96.11	9.05
OPERATING CONDITIONS							
Ambient Temp. F:	80	55	65	75	78	80	70
Winding Temp. C:							
Liquid Temp. C:	40	30	30	30	39		40
Pressure	0	-0.5	-1	-0.5	-0.3	-0.3	-0.5
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0-0-0-2	0-0-0-0	0-0-0-0	0-0-0-2	0-0-0-0		
Cellulose Ratio (CO2/CO)	3.18	3.44	3.98	4.35	4.80		
IEEE/ANSI (C57.104-1991)							

COMMENTS needs pressure

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/29/2007	
Address:	5555 N Channel Blvd. PDX	Report by	KH	
Phone:	503-247-1667	STR Job No:	1419	
Contact:	Ken Swingle	Class:	NP	
Substation/Site:	Crane #17	MVA:	0.5	
Transformer No.:	L243299B	Gallons:	125	silicone
Manufacturer:	NP	PCB's	no data	
Voltage:	2400/480	% Imp.	NP	

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/29/2007	11/6/2006	10/11/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	0	0	0	0	0
Hydrogen	177	100	193	152	119	126	170
Ethylene	8	0	0	0	0	0	0
Methane	68	63	78	81	71	72	78
Ethane	0	7	9	7	7	7	7
Carbon Monoxide	1250	902	1328	1168	991	1009	1200
Carbon Dioxide	4590	3507	6085	6030	5630	5743	7642
Oxygen	1984	697	516	1001	976	701	1228
Total Combustibles	1503	1072	1608	1408	1188	1214	1455
Total Gas	14.80%	9.86%	11.11%	13.00%	11.07%	1.12%	1.40%
OIL QUALITY							
Dielectric Break (kV)	40.4	43.1	41.9	38.1	39.6	49.6	43.8
Water in Fluid (ppm)	9.4	9.4	10.9	11.5	17.2	19.6	13
Acid Number (mg KOH/g)	0	0.003	0.005	0.006	0.008	0.008	0.008
Interfacial Tens.(dynes/cm)							
ASTM Color	0	0	0	0	0	0	0
Visual Inspection	Pass	Fail	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.963	0.97	0.962	0.962	0.969	0.9625	0.9615
Relative Saturation	8.33	9.32	13.12	11.41	15.24	15.55	10.70
OPERATING CONDITIONS							
Ambient Temp. F:	75	60	65	75	70	80	70
Winding Temp. C:							
Liquid Temp. C:	38	35	30	35	38	41	40
Pressure	1	1	0.5	0.2	0.9	1.2	1
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0-0-2-0	0-0-0-2	0-0-0-2	0-0-0-2	0-0-0-2		
Cellulose Ratio (CO2/CO)	3.67%	3.89	4.58	6.02	5.68		
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/29/2007		
Address:	5555 N Channel Blvd. PDX	Report by	KH		
Phone:	503-247-1667	STR Job No:	1419		
Contact:	Ken Swingle	Class:	NP		
Substation/Site:	Crane #16	MVA:	0.5		
Transformer No.:	L243299C	Gallons:	125	silicone	
Manufacturer:	GE	PCB's	no data		
Voltage:	2400/480	% Imp.	NP		

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/29/2007	11/8/2006	10/11/2005	6/19/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	0	0	0	0	1
Hydrogen	97	130	97	137	124	181	172
Ethylene	1	1	1	1	1	2	1
Methane	44	47	33	56	44	56	52
Ethane	6	5	4	6	4	6	5
Carbon Monoxide	1053	1034	742	1165	923	1231	1288
Carbon Dioxide	3748	3611	3023	5484	4756	5961	7054
Oxygen	5607	1254	248	2600	2257	802	1381
Total Combustibles	1234	1217	877	1365	1096	1476	1524
Total Gas	12.21%	10.46%	5.31%	12.20%	9.80%	1.25	1.30
OIL QUALITY							
Dielectric Break (kV)	42	47.6	45	40.6	40.8	49.1	45
Water in Fluid (ppm)	10.9	4.2	13	8.3	9.9	14.4	11
Acid Number (mg KOH/g)	0.01	0.005	0.005	0.008	0.006	0.006	0.006
Interfacial Tens.(dynes/cm)							
ASTM Color	0	0	0	0	0	0	0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.962	0.9685	0.965	0.963	0.97	0.9625	0.9675
Relative Saturation	9.31	5.05	10.70	8.23	8.45	11.42	13.24
OPERATING CONDITIONS							
Ambient Temp. F:	80	55	65	75	72	80	70
Winding Temp. C:							
Liquid Temp. C:	39	30	40	35	39	41	30
Pressure	0	-0.3	0	0	-0.1	0.3	0
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0-0-0-0	0-0-0-0	0-0-0-0	0-0-0-0	0-0-0-0		
Cellulose Ratio (CO2/CO)	3.56%	3.49	4.07	4.7	5.15		
IEEE/ANSI (C57.104-1991)							

COMMENTS needs pressure

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/29/2007		
Address:	5555 N Channel Blvd. PDX	Report by	KH		
Phone:	503-247-1667	STR Job No:	1419		
Contact:	Ken Swingle	Class:	NP		
Substation/Site:	Crane #15	MVA:	0.5		
Transformer No.:	L243299A	Gallons:	125	silicone	
Manufacturer:	GE	PCB's	no data		
Voltage:	2.4/0.5kV	% Imp.	5.18		

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/29/2007	11/8/2006	10/12/2005	6/19/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	0	0	0	0	0
Hydrogen	180	171	184	207	200	210	213
Ethylene	0	0	1	0	1	1	1
Methane	40	40	42	47	43	45	48
Ethane	7	7	8	7	6	7	7
Carbon Monoxide	1145	1051	1117	1205	1110	1177	1279
Carbon Dioxide	3547	3447	4229	5083	5104	5351	7016
Oxygen	3045	1731	320	1022	1269	751	2297
Total Combustibles	1372	1269	1352	1466	1360	1440	1548
Total Gas	11.19%	10.08%	7.29%	11.02%	10.48%	1.10	1.24
OIL QUALITY							
Dielectric Break (kV)	44.3	47.4	44.3	43.1	43.8	51	47.9
Water in Fluid (ppm)	5.7	4.7	8.9	7.8	10.4	15.5	12
Acid Number (mg KOH/g)	0.01	0.003	0.005	0.006	0.003	0.008	0.008
Interfacial Tens.(dynes/cm)							
ASTM Color	0	0	0	0	0	0	0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.967	0.9685	0.965	0.9625	0.9695	0.9635	0.9745
Relative Saturation	5.24	5.66	13.08	7.74	8.88	12.75	9.87
OPERATING CONDITIONS							
Ambient Temp. F:	80	53	65	75	73	80	70
Winding Temp. C:							
Liquid Temp. C:	37	30	25	35	39	40	40
Pressure	0	0	-1	-1	-0.5	-0.5	0
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0-0-0-2	0-0-0-2	0-0-0-0	0-0-0-2	0-0-0-0		
Cellulose Ratio (CO2/CO)	3.10	3.28	3.79	4.21	4.60		
IEEE/ANSI (C57.104-1991)							

COMMENTS needs pressure

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/29/2007		
Address:	5555 N Channel Blvd. PDX	Report by	KH		
Phone:	503-247-1667	STR Job No:	1419		
Contact:	Ken Swingle	Class:	NP		
Substation/Site:	Crane #12	MVA:	0.75		
Transformer No.:	L243298	Gallons:	125	silicone	
Manufacturer:	GE	PCB's	no data		
Voltage:	2.1/0.5kV	% Imp.	5.64		

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/29/2007	11/17/2006	10/12/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	0	0	0	0	0
Hydrogen	167	156	172	183	173	185	197
Ethylene	0	0	1	1	1	1	1
Methane	55	60	60	63	66	61	68
Ethane	6	6	7	6	6	6	6
Carbon Monoxide	1040	996	1025	1015	1056	1019	1157
Carbon Dioxide	3205	3063	3721	4050	4219	4351	4895
Oxygen	4673	1496	1025	1685	1511	1554	2323
Total Combustibles	1268	1218	1265	1268	1302	1272	1429
Total Gas	11.53%	10.11%	7.26%	10.56%	10.57%	10.74	11.87
OIL QUALITY							
Dielectric Break (kV)	43.5	40.8	47.3	42	46.4	43.9	47.3
Water in Fluid (ppm)	6.8	4.7	7.3	7.3	9.4	18.6	9.4
Acid Number (mg KOH/g)	0.02	0.005	0.003	0.003	0.003	0.006	0.006
Interfacial Tens.(dynes/cm)							
ASTM Color	0	0	0	0	0	0	0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.963	0.965	0.965	0.9615	0.9711	0.9625	0.9615
Relative Saturation	5.59	8.49	8.78	8.78	8.98	17.11	9.69
OPERATING CONDITIONS							
Ambient Temp. F:	80	40	65	75	70	80	70
Winding Temp. C:							
Liquid Temp. C:	40	20	30	30	36	37	34
Pressure	1	0	-1	-1	-0.1	-0.2	0
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0-0-0-2	0-0-0-2	0-0-0-0	0-0-0-0	0-0-0-0		
Cellulose Ratio (CO2/CO)	3.08%	3.08	3.63	3.99	3.99		
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/30/2007
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667	STR Job No:	1419
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Building 73	MVA:	0.5
Transformer No.:	PCT83390101	Gallons:	141
Manufacturer:	Westinghouse	PCB's	cert.non
Voltage:	12.5/0.5kV	% Imp.	5.86

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/30/2007	11/8/2006	10/18/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	0	0	0	0	0
Hydrogen	22	10	16	21	13	16	17
Ethylene	3	0	0	0	0	1	0
Methane	19	16	17	18	16	16	16
Ethane	0	3	3	2	1	0	1
Carbon Monoxide	1079	687	805	815	617	714	824
Carbon Dioxide	4385	2869	4136	4524	3788	4455	6681
Oxygen	3522	131	288	210	379	882	2328
Total Combustibles	1123	716	841	856	647	747	858
Total Gas	12.96%	6.58%	6.09%	8.41%	5.97%	76069	95351
OIL QUALITY							
Dielectric Break (kV)	37.8	38.6	45	44.1	49	42.1	42.2
Water in Fluid (ppm)	5.1	3.4	12.5	1.7	4	8.5	3.4
Acid Number (mg KOH/g)	0.03	0.035	0.031	0.04	0.028	0.028	0.039
Interfacial Tens.(dynes/cm)	28	30.4	36.7	33.5	40.4	41.6	32.1
ASTM Color	L1.0	L1.5	L1.5	1	1	1	L1.0
Visual Inspection	Pass	Fail	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.867	0.87	0.869	0.8605	0.867	0.868	0.8665
Relative Saturation	6.14	4.09	15.04	2.50	3.41	8.43	5.00
OPERATING CONDITIONS							
Ambient Temp. F:	80	50	65	75	70	80	70
Winding Temp. C:							
Liquid Temp. C:	30	30	30	25	39	35	25
Pressure	4	3	4	4	4	4	4
Liquid Level	ok	low	low	low	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0-0-2-0	1-0-0-2	1-0-0-2	1-0-0-2	1-0-0-2		
Cellulose Ratio (CO2/CO)	4.06%	4.18	5.14	5.55	6.14		
IEEE/ANSI (C57.104-1991)							

COMMENTS Slight gas trend - IFT is lowering

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	**Date:**	8/30/2007
Address:	5555 N Channel Blvd. PDX	**Report by**	KH
Phone:	503-247-1667	**STR Job No:**	1419
Contact:	Ken Swingle	**Class:**	NP
Substation/Site:	Building 73	**MVA:**	0.5
Transformer No.:	PAT80910101	**Gallons:**	141
Manufacturer:	Westinghouse	**PCB's**	cert.non
Voltage:	12470/480	**% Imp.**	5.77

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/30/2007	11/8/2006	10/18/2005	6/29/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	0	0	0	0	0
Hydrogen	15	11	16	13	8	17	16
Ethylene	2	0	0	0	0	1	0
Methane	17	17	15	17	13	14	16
Ethane	0	2	2	1	0	0	1
Carbon Monoxide	919	822	800	732	509	640	759
Carbon Dioxide	3373	3239	3666	3833	3027	3746	4828
Oxygen	2336	595	199	923	956	1604	3059
Total Combustibles	953	852	833	763	531	672	792
Total Gas	10.75%	8.89%	6.29%	8.36%	5.51%	7.64	9.33
OIL QUALITY							
Dielectric Break (kV)	37.7	48.3	46.9	39.9	45.5	42.4	43.6
Water in Fluid (ppm)	5.7	1.7	3.4	6	6.3	6.3	4.5
Acid Number (mg KOH/g)	0.03	0.027	0.031	0.037	0.023	0.023	0.031
Interfacial Tens.(dynes/cm)	32	32.4	36.6	37	35.1	33.2	35.7
ASTM Color	L1.5	L1.5	L1.5	L1.5	1	1	1
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.869	0.87	0.8695	0.8665	0.8675	0.868	0.8675
Relative Saturation	7.42	2.05	4.09	6.94	5.38	5.18	4.46
OPERATING CONDITIONS							
Ambient Temp. F:	80	55	65	75	70	80	70
Winding Temp. C:							
Liquid Temp. C:	28	30	30	31	39	40	35
Pressure	4	3	4	4	4	5	4
Liquid Level	ok	low	low	low	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	1-0-2-0	1-0-0-2	0-0-0-2	1-0-0-2	1-0-0-2		
Cellulose Ratio (CO2/CO)	3.67%	3.94	4.58	5.24	5.95		
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/30/2007
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1419
Contact:	Ken Swingle	Class:	OA
Substation/Site:	BWTP	MVA:	0.75
Transformer No.:	PCT786301	Gallons:	179
Manufacturer:	Westinghouse	PCB's	cert.non
Voltage:	12.5/0.5kV	% Imp.	6.24

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/30/2007	11/9/2006	10/18/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	0	0	0	0	0
Hydrogen	12	6	8	6	6	3	2
Ethylene	3	3	2	2	2	1	1
Methane	6	4	3	3	3	2	2
Ethane	1	0	0	0	0	0	0
Carbon Monoxide	469	345	243	205	161	109	73
Carbon Dioxide	2917	2556	2172	2449	2351	1688	1236
Oxygen	15675	9449	2782	11070	12764	12730	20698
Total Combustibles	491	358	256	216	172	115	78
Total Gas	9.79%	7.37%	4.13%	7.06%	6.68%	6.85	8.94
OIL QUALITY							
Dielectric Break (kV)	39.4	44	42.5	44.9	44.2	45.3	47.9
Water in Fluid (ppm)	2.8	2.8	6.3	4	7.4	9.7	5.1
Acid Number (mg KOH/g)	0.05	0.038	0.042	0.054	0.041	0.043	0.053
Interfacial Tens.(dynes/cm)	31	28.9	35.3	35.3	31	29.7	31.1
ASTM Color	L1.5	L1.5	L1.5	L1.5	L1.5	L1.5	L1.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.88	0.88	0.8805	0.879	0.879	0.8796	0.88
Relative Saturation	2.30	4.11	7.58	4.81	9.64	10.00	5.68
OPERATING CONDITIONS							
Ambient Temp. F:	89	55	65	75	69	80	70
Winding Temp. C:							
Liquid Temp. C:	40	25	30	30	28	34	32
Pressure	3	2.5	2.5	2.5	2.5	3.2	3.5
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0-0-2-0	0-0-2-0	0-0-2-0	0-0-2-0	0-0-2-0		
Cellulose Ratio (CO2/CO)	6.22%	7.41	8.94	11.95	14.60		
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/29/2007	
Address:	5555 N Channel Blvd. PDX	Report by:	KH	
Phone:	503-247-1667	STR Job No:	1419	
Contact:	Ken Swingle	Class:	NP	
Substation/Site:	Sub 8A	MVA:	2	
Transformer No.:	PQH-0714	Gallons:	451	rtemp
Manufacturer:	NP	PCB's	no data	
Voltage:	12470/460	% Imp.	5.4	

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/29/2007	11/8/2006	10/11/2005	6/16/2004	8/12/2002	8/12/2002	9/11/2001
Acetylene	0	0	0	0	0	0	0
Hydrogen	3	2	51	4	5	6	5
Ethylene	6	4	5	5	6	6	6
Methane	10	9	9	12	13	13	14
Ethane	5	4	7	8	6	5	6
Carbon Monoxide	581	440	415	336	597	611	635
Carbon Dioxide	2288	1722	2136	2340	2995	3178	4654
Oxygen	3613	1572	62	113	67	106	62
Total Combustibles	605	459	438	365	627	641	666
Total Gas	6.19%	3.91%	3.01%	5.30%	5.25%	5.30%	5.92%
OIL QUALITY							
Dielectric Break (kV)	34.4	47.1	43.9	43.7	42.5	39	39.5
Water in Fluid (ppm)	3.4	11	19.8	20.3	23.3	27.3	20.1
Acid Number (mg KOH/g)	0.04	0.033	0.016	0.014	0.014	0.014	0.022
Interfacial Tens.(dynes/cm)	45	41.1	44.2	44	44.5	45.1	45
ASTM Color	L3.0	L2.5	L2.5	L2.5	L2.5	L2.5	L2.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.875	0.865	0.874	0.875	0.8745	0.875	0.8745
Relative Saturation	2.25	9.75	15.14	20.14	14.39	15.72	13.80
OPERATING CONDITIONS							
Ambient Temp. F:	80	50	65	75	71	80	70
Winding Temp. C:							
Liquid Temp. C:	46	38	42	35	48	50	45
Pressure		0	0				
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	2-0-1-0						
Cellulose Ratio (CO2/CO)	3.94%	3.91	5.15%	6.96			
IEEE/ANSI (C57.104-1991)							

COMMENTS needs pressure

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/29/2007		
Address:	5555 N Channel Blvd. PDX	Report by:	KH		
Phone:	503-247-1667	STR Job No:	1419		
Contact:	Ken Swingle	Class:	NP		
Substation/Site:	Portable 32-5	MVA:	1		
Transformer No.:	PO15676	Gallons:	240	silicone	
Manufacturer:	GE	PCB's	no data		
Voltage:	12.5/0.46kV	% Imp.	5.5		

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/29/2007	11/9/2006	10/11/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	0	0	0	0	0
Hydrogen	33	7	17	46	21	47	62
Ethylene	0	0	0	0	0	0	0
Methane	10	11	18	28	29	42	42
Ethane	2	2	3	3	2	3	0
Carbon Monoxide	269	239	444	662	728	1236	1254
Carbon Dioxide	4350	4386	5205	5433	5225	5567	5849
Oxygen	33493	23277	6877	17946	14219	5220	3851
Total Combustibles	314	259	482	739	780	1328	1351
Total Gas	13.94%	12.81%	7.94%	11.89%	11.12%	11.48	10.31
OIL QUALITY							
Dielectric Break (kV)	40.4	39.2	43.5	41.1	38.4	46.7	43.5
Water in Fluid (ppm)	21.3	5.7	14.1	6.8	9.4	13.9	6.8
Acid Number (mg KOH/g)	0.01	0.005	0.005	0.006	0.008	0.006	0.011
Interfacial Tens.(dynes/cm)							
ASTM Color	0	0	0	0	0	0	0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.965	0.97	0.966	0.964	0.9626	0.9644	0.9628
Relative Saturation	8.77	10.30	13.99	8.18	9.32	8.58	7.57
OPERATING CONDITIONS							
Ambient Temp. F:	80	53	65	75	66	80	70
Winding Temp. C:							
Liquid Temp. C:	60	20	35	30	35	48	32
Pressure	npg						npg
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0-0-0-2	1-0-0-2	1-0-0-2	1-0-0-2	1-0-0-2		
Cellulose Ratio (CO2/CO)	16.17%	18.35	11.72%	8.21	7.18		
IEEE/ANSI (C57.104-1991)							

COMMENTS

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/30/2007	
Address:	5555 N Channel Blvd. PDX	Report by:	KH	
Phone:	503-247-1667	STR Job No:	1419	
Contact:	Ken Swingle	Class:	NP	
Substation/Site:	Portable 32-3	MVA:	2	
Transformer No.:	87V1243	Gallons:	600	rtemp
Manufacturer:	Vantram	PCB's	no data	
Voltage:	12470/460	% Imp.	5.7	

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/30/2007	11/9/2006	11/11/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	0	0	0	0	0
Hydrogen	5	5	11	17	16	16	7
Ethylene	13	15	15	17	14	1	18
Methane	10	12	12	17	13	16	16
Ethane	3	4	3	4	4	0	5
Carbon Monoxide	375	427	470	608	479	714	333
Carbon Dioxide	2461	2636	2797	3603	3372	4455	4915
Oxygen	7634	4410	260	111	81	882	82
Total Combustibles	406	463	511	663	526	747	319
Total Gas	5.56%	5.22%	3.17%	5.30%	5.11	7.61	6.10
OIL QUALITY							
Dielectric Break (kV)	39.7	46.2	39	41.6	39.2	32.5	39.1
Water in Fluid (ppm)	4.7	9.9	15.7	15.7	29.7	15.7	21.3
Acid Number (mg KOH/g)	0.02	0.22	0.01	0.011	0.011	0.008	0.014
Interfacial Tens.(dynes/cm)	48	42.4	45.7	46	45.7	46.2	46.5
ASTM Color	L2.0	L2.0	L2.0	1.5	1.5	1.5	1.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.877	0.865	0.871	0.875	0.875	0.87	0.8705
Relative Saturation	4.66	10.20	13.40	10.78	9.49	9.69	17.53
OPERATING CONDITIONS							
Ambient Temp. F:	85	47	65	75	69	80	70
Winding Temp. C:							
Liquid Temp. C:	35	34	39	45	68	48	40
Pressure	0.5	0	0	0	0	0	0
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	1-0-2-0						
Cellulose Ratio (CO2/CO)	6.56	6.17	5.95	5.93			
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/30/2007	
Address:	5555 N Channel Blvd. PDX	Report by:	KH	
Phone:	503-247-1667	STR Job No:	1419	
Contact:	Ken Swingle	Class:	NP	
Substation/Site:	Sub 5	MVA:	1	
Transformer No.:	PO14476	Gallons:	240	silicone
Manufacturer:	GE	PCB's	no data	
Voltage:	12470/460	% Imp.	5.5	

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/30/2007	11/9/2006	10/12/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	0	0	0	0	0
Hydrogen	31	27	58	60	7	61	60
Ethylene	0	0	0	0	0	0	0
Methane	17	18	23	23	11	21	22
Ethane	2	2	2	2	1	2	2
Carbon Monoxide	680	676	981	984	267	861	903
Carbon Dioxide	3522	3265	4274	4490	3355	3985	3935
Oxygen	19727	11026	4210	8032	23275	5442	10752
Total Combustibles	730	723	1064	1069	286	945	987
Total Gas	12.87%	10.72%	9.82%	11.78%	11.39%	10.23	12.21
OIL QUALITY							
Dielectric Break (kV)	40.9	37.7	40.8	48.5	39.6	42	46.1
Water in Fluid (ppm)	10.4	4.7	6.8	7.8	25	14.4	5.7
Acid Number (mg KOH/g)	0.01	0.005	0.003	0.003	0.003	0.006	0.006
Interfacial Tens.(dynes/cm)							
ASTM Color	0	0	0	0	0	0	0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.965	0.9665	0.9625	0.963	0.9712	0.9635	0.9622
Relative Saturation	8.56	5.66	8.86	8.35	30.09	11.85	5.05
OPERATING CONDITIONS							
Ambient Temp. F:	85	70	65	75	71	80	70
Winding Temp. C:							
Liquid Temp. C:	40	30	28	33	30	40	38
Pressure	npg						npg
Liquid Level	ok	low	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0-0-0-2	0-0-0-2	0-0-0-2	0-0-0-2	1-0-0-2		
Cellulose Ratio (CO2/CO)	5.18%	4.83	4.82%	4.56	12.57		
IEEE/ANSI (C57.104-1991)							

COMMENTS

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/30/2007		
Address:	5555 N Channel Blvd. PDX	Report by:	KH		
Phone:	503-247-1667	STR Job No:	1419		
Contact:	Ken Swingle	Class:	NP		
Substation/Site:	Sub 5	MVA:	1.5		
Transformer No.:	PO14490	Gallons:	315	silicone	
Manufacturer:	GE	PCB's	no data		
Voltage:	12470/460	% Imp.	5.54		

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/30/2007	11/9/2007	10/18/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	0	0	0	0	0
Hydrogen	14	7	14	19	17	23	31
Ethylene	0	0	1	0	1	1	0
Methane	52	52	67	81	83	81	100
Ethane	4	4	5	4	4	4	4
Carbon Monoxide	302	250	340	367	360	367	452
Carbon Dioxide	2273	1757	2042	2048	2060	1691	1894
Oxygen	25922	14830	5669	15938	1419	10942	14571
Total Combustibles	372	313	427	471	465	476	587
Total Gas	13.14%	10.03%	8.03%	11.89%	11.12%	11.02	12.49
OIL QUALITY							
Dielectric Break (kV)	40.5	45.4	44.8	37.9	39.5	50.9	47.1
Water in Fluid (ppm)	7.3	4.2	6.8	6.8	12	9.8	6.3
Acid Number (mg KOH/g)	0.01	0.008	0.003	0.003	0.003	0.006	0.006
Interfacial Tens.(dynes/cm)							
ASTM Color	0	0	0	0	0	0	0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.965	0.964	0.965	0.963	0.9672	0.9612	0.9632
Relative Saturation	6.01	8.26	8.18	8.51	13.89	8.37	5.38
OPERATING CONDITIONS							
Ambient Temp. F:	85	40	65	75	71	80	70
Winding Temp. C:							
Liquid Temp. C:	40	18	30	29	31	39	39
Pressure	npg	npg		npg	npg	npg	npg
Liquid Level	ok	ok	low	ok	ok	ok	low
GAS DIAGNOSTICS							
Rogers Ratio	2-0-0-2	2-0-0-2	2-0-0-0	2-0-0-2	2-0-0-0		
Cellulose Ratio (CO2/CO)	7.53%	7.03	6.01%	5.58	5.72		
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/30/2007		
Address:	5555 N Channel Blvd. PDX	Report by:	KH		
Phone:	503-247-1667	STR Job No:	1419		
Contact:	Ken Swingle	Class:	NP		
Substation/Site:	Sub 4	MVA:	1		
Transformer No.:	PCT2521-0101	Gallons:	200	silicone	
Manufacturer:	Westinghouse	PCB's	no data		
Voltage:	12.5/0.5kV	% Imp.	5.94		

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/30/2007	11/6/2006	10/18/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	0	0	0	0	0
Hydrogen	53	27	51	6	30	32	46
Ethylene	0	0	0	0	0	0	0
Methane	83	73	86	42	79	78	82
Ethane	4	4	5	4	4	4	3
Carbon Monoxide	2227	1637	2328	496	1655	1648	2037
Carbon Dioxide	6113	4709	7609	6951	6794	7421	11838
Oxygen	1345	946	510	25599	1245	2864	3384
Total Combustibles	2367	1741	2470	548	1768	1762	2168
Total Gas	17.70%	11.13%	11.78	13.68%	11.33%	125571	158357
OIL QUALITY							
Dielectric Break (kV)	38.6	39.3	36.6	36.3	43.9	37.1	45.5
Water in Fluid (ppm)	4.7	5.7	12.5	27.1	8.3	12.4	7.8
Acid Number (mg KOH/g)	0.02	0.005	0.005	0.006	0.003	0.006	0.008
Interfacial Tens.(dynes/cm)							
ASTM Color	0	0	0	0	0	0	0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Clear
Specific Gravity	0.964	0.967	0.9655	0.962	0.969	0.963	0.962
Relative Saturation	2.71	3.91	7.20	14.08	4.78	7.14	34.71
OPERATING CONDITIONS							
Ambient Temp. F:	85	65	65	75	80	80	
Winding Temp. C:							
Liquid Temp. C:	50	45	50	53	50	50	
Pressure	3	3	4	4	4	4	
Liquid Level	ok	ok	ok	ok	ok	ok	
GAS DIAGNOSTICS							
Rogers Ratio	1-0-0-2	1-0-0-2	1-0-0-2	2-0-0-2	1-0-0-2		
Cellulose Ratio (CO2/CO)	2.47	2.88	3.27	14.02	4.11		
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/30/2007		
Address:	5555 N Channel Blvd. PDX	Report by:	KH		
Phone:	503-247-1667	STR Job No:	1419		
Contact:	Ken Swingle	Class:	NP		
Substation/Site:	Sub 3	MVA:	1.5		
Transformer No.:	R277558	Gallons:	321	silicone	
Manufacturer:	GE	PCB's	no data		
Voltage:	12470/480	% Imp.	NP		

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/30/2007	11/6/2006	10/18/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	0	0	0	0	0
Hydrogen	49	42	50	40	35	33	46
Ethylene	0	0	0	0	0	1	0
Methane	27	27	27	27	27	26	29
Ethane	3	3	3	3	3	3	2
Carbon Monoxide	847	730	742	613	583	563	681
Carbon Dioxide	5396	4721	6157	6108	6355	6341	9382
Oxygen	1444	7699	2640	8673	8771	8119	13861
Total Combustibles	926	802	822	883	648	626	758
Total Gas	16.08%	11.80%	9.2%	11.42%	11.30%	11.5%	15.2%
OIL QUALITY							
Dielectric Break (kV)	42.2	41.8	40.6	39.3	39.7	47.7	46.1
Water in Fluid (ppm)	35.9	22.4	30.2	30.2	35.4	42.8	36.5
Acid Number (mg KOH/g)	0.02	0.005	0.003	0.003	0.003	0.006	0.006
Interfacial Tens.(dynes/cm)							
ASTM Color	0	0	0	0	0	0	0
Visual Inspection	Pass	Fail	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.965	0.968	0.9655	0.9625	0.9695	0.8638	0.9625
Relative Saturation	23.78	22.22	24.85	24.85	26.11	29.38	25.97
OPERATING CONDITIONS							
Ambient Temp. F:	85	64	65	75	75	80	70
Winding Temp. C:							
Liquid Temp. C:	46	35	40	40	43	45	44
Pressure	1.5	1	1	1.2	1.8	2	3
Liquid Level	ok	ok	ok	ok	high	high	high
GAS DIAGNOSTICS							
Rogers Ratio	0-0-0-2	0-0-0-2	0-0-0-2	0-0-0-2	0-0-0-2		
Cellulose Ratio (CO2/CO)	6.37	6.47	8.30	9.96	10.90		
IEEE/ANSI (C57.104-1991)							

COMMENTS slight moisture

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/30/2007	
Address:	5555 N Channel Blvd. PDX	Report by:	KH	
Phone:	503-247-1667	STR Job No:	1419	
Contact:	Ken Swingle	Class:	NP	
Substation/Site:	Sub 3	MVA:	1	
Transformer No.:	R277557	Gallons:	268	silicone
Manufacturer:	GE	PCB's	no data	
Voltage:	12.5/0.5kV	% Imp.	6	

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/30/2007	11/6/2006	10/18/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	0	0	0	0	0
Hydrogen	33	37	30	26	19	13	10
Ethylene	0	0	0	0	0	0	0
Methane	7	10	9	7	5	4	3
Ethane	1	1	2	1	1	1	0
Carbon Monoxide	332	385	333	240	184	131	78
Carbon Dioxide	2881	4141	4635	4423	3503	2626	1671
Oxygen	15838	16101	6105	22150	21138	20870	32373
Total Combustibles	373	433	374	274	209	149	91
Total Gas	9.30%	12.09%	7.9%	12.32%	11.34%	11.7%	14%
OIL QUALITY							
Dielectric Break (kV)	44.9	45.8	45.7	50.2	39.7	50.9	43.6
Water in Fluid (ppm)	36.5	28.1	36.5	37	42.7	48.5	42.8
Acid Number (mg KOH/g)	0.02	0.005	0.003	0.003	0.003	0.006	0.008
Interfacial Tens.(dynes/cm)							
ASTM Color	0	0	0	0	0	0	0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.962	0.97	0.965	0.962	0.969	0.9628	0.963
Relative Saturation	23.34	27.88	36.21	32.78	32.66	37.09	33.95
OPERATING CONDITIONS							
Ambient Temp. F:	85	64	65	75	75	80	70
Winding Temp. C:							
Liquid Temp. C:	47	35	35	38	42	42	41
Pressure	0	-0.75	0.5	-0.5	0	0	0
Liquid Level	ok	ok	ok	ok	high	high	high
GAS DIAGNOSTICS							
Rogers Ratio	0-0-0-2	0-0-0-2	0-0-0-2	0-0-0-2	0-0-0-2		
Cellulose Ratio (CO2/CO)	8.68	10.76	13.92	18.43	19.04		
IEEE/ANSI (C57.104-1991)							

COMMENTS Slight moisture - needs pressure

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/30/2007	
Address:	5555 N Channel Blvd. PDX	Report by:	KH	
Phone:	503-247-1667	STR Job No:	1419	
Contact:	Ken Swingle	Class:	NP	
Substation/Site:	Sub 1	MVA:	1.5	
Transformer No.:	910396-A1	Gallons:	345	rtemp
Manufacturer:	Square D	PCB's	no data	
Voltage:	12470/480	% Imp.	6.3	

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	08/30/207	11/9/2006	10/18/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	0	0	0	0	0
Hydrogen	2	1	4	4	4	5	4
Ethylene	11	12	14	14	15	18	19
Methane	12	13	14	14	14	16	17
Ethane	2	2	3	2	3	3	3
Carbon Monoxide	345	314	321	290	287	323	342
Carbon Dioxide	1634	1557	1949	2025	2159	2610	2584
Oxygen	773	52	33	53	68	131	63
Total Combustibles	372	342	356	324	323	365	385
Total Gas	5.85%	4.92%	4.06%	5.40%	5.42	6.23	6.76
OIL QUALITY							
Dielectric Break (kV)	38.1	46.3	39.9	40.5	40.6	41.1	40.8
Water in Fluid (ppm)	1.5	4.1	4.7	13.4	4.7	9.9	5.2
Acid Number (mg KOH/g)	0.04	0.033	0.026	0.025	0.023	0.02	0.042
Interfacial Tens.(dynes/cm)	47	40.2	41.8	42.4	42.3	43.4	43.1
ASTM Color	L4.0	L3.5	L3.5	L3.5	L3.5	L3.5	L3.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.879	0.872	0.879	0.879	0.8781	0.879	0.8784
Relative Saturation	1.23	4.93	3.87	11.03	4.01	7.85	4.28
OPERATING CONDITIONS							
Ambient Temp. F:	85	53	65	75	71	80	70
Winding Temp. C:							
Liquid Temp. C:	40	30	40	40	39	41	40
Pressure	2.5	1.5	2	2.5	2	2.9	2.5
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	2-0-2-0						
Cellulose Ratio (CO2/CO)	4.74	4.96	6.07	6.98			
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/30/2007
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1419
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 1	MVA:	2
Transformer No.:	910396-B1	Gallons:	390 rtemp
Manufacturer:	Square D	PCB's	no data
Voltage:	12470/480	% Imp.	6.05

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/30/2007	11/9/2006	10/18/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	0	0	0	0	0
Hydrogen	2	0	4	2	3	6	4
Ethylene	2	2	2	2	2	2	2
Methane	12	12	15	15	12	14	15
Ethane	4	3	4	4	3	3	3
Carbon Monoxide	337	333	411	337	323	375	412
Carbon Dioxide	1647	1669	2552	2379	2419	3021	4192
Oxygen	226	37	19	57	68	73	74
Total Combustibles	357	350	436	360	343	400	436
Total Gas	4.81%	4.30%	4.04%	4.60%	4.57	5.22	5.81
OIL QUALITY							
Dielectric Break (kV)	31.3	44.3	42.1	39.4	40.3	44.4	43
Water in Fluid (ppm)	14.2	5.8	3.5	10.5	5.8	19.8	5.2
Acid Number (mg KOH/g)	0.03	0.035	0.023	0.022	0.023	0.023	0.02
Interfacial Tens.(dynes/cm)	48	42.3	44.3	48.4	42	44.3	44.2
ASTM Color	L3.5	L3.5	3	3	3	3	3
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.879	0.872	0.87	0.877	0.877	0.877	0.8765
Relative Saturation	11.68	6.98	2.88	8.64	5.14	15.70	4.61
OPERATING CONDITIONS							
Ambient Temp. F:	85	50	65	75	71	80	70
Winding Temp. C:							
Liquid Temp. C:	40	30	40	40	38	41	38
Pressure	0.5	0	0	0	-0.8	-0.2	0
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	2-0-0-0						
Cellulose Ratio (CO2/CO)	4.89	5.01	6.21	7.06			
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	**Date:**	8/30/2007
Address:	5555 N Channel Blvd. PDX	**Report by:**	KH
Phone:	503-247-1667	**STR Job No:**	1419
Contact:	Ken Swingle	**Class:**	NP
Substation/Site:	Sub 1	**MVA:**	2
Transformer No.:	910396-C1	**Gallons:**	390 rtemp
Manufacturer:	Square D	**PCB's**	no data
Voltage:	12470/480	**% Imp.**	5.75

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/30/2007	11/9/2006	10/18/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	0	0	0	0	0
Hydrogen	11	17	16	19	21	27	26
Ethylene	1	1	2	1	1	2	1
Methane	8	10	10	11	9	10	12
Ethane	2	2	2	2	2	2	3
Carbon Monoxide	281	275	278	285	278	3005	310
Carbon Dioxide	1622	1620	2007	2263	2379	2853	3629
Oxygen	1008	50	14	36	68	209	57
Total Combustibles	303	305	308	318	311	346	352
Total Gas	4.78%	4.25%	3.22%	4.50%	4.53	5.01	5.29
OIL QUALITY							
Dielectric Break (kV)	44.1	48.1	40.1	41	46.1	42.7	42.8
Water in Fluid (ppm)	2.6	4.1	4.7	14	7	12.8	8.6
Acid Number (mg KOH/g)	0.03	0.03	0.023	0.022	0.023	0.025	0.025
Interfacial Tens.(dynes/cm)	49	41.4	41.6	42.3	42	42.2	42.3
ASTM Color	L3.5	L3.5	3	3	3	3	3
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.877	0.871	0.878	0.878	0.8776	0.879	0.8785
Relative Saturation	2.14	4.93	3.87	11.62	5.98	9.44	7.08
OPERATING CONDITIONS							
Ambient Temp. F:	85	55	65	75	81	80	70
Winding Temp. C:							
Liquid Temp. C:	40	30	40	40	39	43	40
Pressure	1	0	0	0	-0.5	0	0
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0-0-0-0						
Cellulose Ratio (CO2/CO)	5.77	5.89	7.22	7.94			
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/29/2007
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1419
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 7	MVA:	0.75
Transformer No.:	M590624TLPA	Gallons:	230
Manufacturer:	GE	PCB's	ND
Voltage:	12470/480	% Imp.	5.75

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/29/2007	11/9/2006	10/12/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	0	0	1	0	0
Hydrogen	48	32	29	36	34	40	41
Ethylene	5	4	5	4	5	5	5
Methane	14	12	13	12	12	14	15
Ethane	4	3	4	3	3	3	3
Carbon Monoxide	751	563	611	478	517	604	656
Carbon Dioxide	2630	2091	2430	2136	2574	3089	4176
Oxygen	5837	2689	10	81	62	1080	166
Total Combustibles	822	614	672	533	572	688	720
Total Gas	8.39%	5.71%	3.98%	4.38%	4.82%	5.84	6.29
OIL QUALITY							
Dielectric Break (kV)	42.7	44.3	46.1	47.3	51.3	48.4	45.6
Water in Fluid (ppm)	2.8	3.4	5.1	11.7	12.5	11.4	8.5
Acid Number (mg KOH/g)	0.02	0.022	0.013	0.017	0.011	0.011	0.014
Interfacial Tens.(dynes/cm)	39	36.1	42.7	44.2	36.9	37.1	37.1
ASTM Color	L0.5	L0.5	0.5	0.5	L0.5	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.892	0.891	0.884	0.891	0.8918	0.8924	0.8925
Relative Saturation	2.14	4.93	3.87	11.52	5.98	9.44	7.08
OPERATING CONDITIONS							
AmbientTemp. F:	80	70	65F	75F	75F	80F	70F
Winding Temp. C:							
Liquid Temp. C:	30C	25C	30C	25C	25C	35C	26C
Pressure	0	-2	0	-2	-3	0	-1.5
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0-0-1-0	0-0-1-0	0-0-1-0	0-0-1-0	0-0-1-0		
Cellulose Ratio (CO2/CO)	3.50%	3.71	3.98%	4.47	4.98		
IEEE/ANSI (C57.104-1991)							

COMMENTS needs pressure

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/29/2007
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1419
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 8	MVA:	0.75
Transformer No.:	M590623TLPA	Gallons:	230
Manufacturer:	GE	PCB's	no data
Voltage:	12.5/0.46kV	% Imp.	5.75

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	8/29/2007	11/10/2006	10/11/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	0	0	0	0	0
Hydrogen	46	27	35	42	36	38	38
Ethylene	3	3	3	3	3	3	3
Methane	14	13	12	16	11	13	15
Ethane	4	3	3	4	2	3	3
Carbon Monoxide	731	539	516	614	477	538	609
Carbon Dioxide	2648	1983	1976	2616	2246	2529	3217
Oxygen	4637	693	11	73	65	79	114
Total Combustibles	798	585	569	679	529	595	668
Total Gas	9.64%	5.93%	5.91%	5.91%	4.67%	5.36	6.10
OIL QUALITY							
Dielectric Break (kV)	43.5	47.3	43.5	53.2	50.9	46.9	41.5
Water In Fluid (ppm)	3.4	4	4	7	6.3	8	13
Acid Number (mg KOH/g)	0.02	0.014	0.013	0.011	0.011	0.014	0.017
Interfacial Tens.(dynes/cm)	37	34.2	42.1	42.1	41.1	43	38.7
ASTM Color	L0.5	L0.5	0.5	0.5	0.5	0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.892	0.891	0.8945	0.89	0.8915	0.8919	0.8925
Relative Saturation	2.14	4.93	3.87	11.52	5.98	9.44	7.08
OPERATING CONDITIONS							
AmbientTemp. F:	80	55	65	75	69	80	70
Winding Temp. C:							
Liquid Temp. C:	26	18	24	35	30	35	27
Pressure	0	0	0	-0.5	0	0	0
Liquid Level	ok	ok			NO LG	NO LG	NA
GAS DIAGNOSTICS							
Rogers Ratio	0-0-0-0	0-0-1-0	0-0-1-0	0-0-0-0	0-0-1-0		
Cellulose Ratio (CO2/CO)	3.62%	3.68	3.83	4.24	4.71		
IEEE/ANSI (C57.104-1991)							

COMMENTS needs pressure

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Dry Dock 3	MVA:	1
Transformer No.:	16121-1	Gallons:	415
Manufacturer:	Sierra	PCB's	cert.non
Voltage:	12470/480	% Imp.	

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	10/21/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0	0
Hydrogen	6	4	5	5	6	8	2
Ethylene	1	2	3	3	3	9	1
Methane	2	2	2	2	2	5	1
Ethane	1	0	0	0	1	2	0
Carbon Monoxide	265	196	241	236	271	463	167
Carbon Dioxide	2233	1849	2608	2634	3000	2522	1597
Oxygen	1773	3871	7647	8019	14222	10690	18253
Total Combustibles	278	204	251	246	283	487	170
Total Gas	3.59%	4.23%	0.0569	60171	80888	60062	84526
OIL QUALITY							
Dielectric Break (kV)	43.8	47	51.3	49.4	43.8	41	51
Water in Fluid (ppm)	7.4	4.5	9.7	11.4	10.3	4	5
Acid Number (mg KOH/g)	0.005	0.006	0.003	0.003	0.006	0.008	0.002
Interfacial Tens.(dynes/cm)	43.3	44.1	38.8	36.7	42.3	36	38
ASTM Color	L1.0	L1.0	L1.0	1	1	L1.5	L1.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.878	0.876	0.877	0.877	0.0876	0.882	0.887
OPERATING CONDITIONS							
AmbientTemp.	60F	75F	79F	80F	70F	80F	
Winding Temp.							
Liquid Temp.	30C	30C	36C	43C	36C	30c	35
Pressure	-2	-1.5	-1	-0.2	0	-1	-0.5
Liquid Level	ok	low	ok	ok	ok	ok	
GAS DIAGNOSTICS							
Rogers Ratio	0-0-2-0	0-0-2-0					
Cellulose Ratio (CO2/CO)	8.43	9.43					
IEEE/ANSI (C57.104-1991)							

COMMENTS Needs pressure.

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Dry Dock 3	MVA:	1.5
Transformer No.:	16745-1	Gallons:	327
Manufacturer:	Sierra	PCB's	cert.non
Voltage:	12470/480	% Imp.	

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	10/21/2005	6/19/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0	0
Hydrogen	10	12	2	8	11	14	4
Ethylene	18	16	13	16	59	44	10
Methane	5	5	3	5	5	12	1
Ethane	1	1	1	1	1	2	0
Carbon Monoxide	562	520	149	499	606	817	435
Carbon Dioxide	2648	2850	2951	3524	5669	4774	3862
Oxygen	342	1019	11059	3753	3488	6444	8625
Total Combustibles	596	544	168	529	682	889	450
Total Gas	3.78%	5.25%	0.0574	60238	68142	57266	71595
OIL QUALITY							
Dielectric Break (kV)	45.7	49	50.8	46.8	44.5	48	39
Water in Fluid (ppm)	9	6.3	18.2	15.3	15.3	16	4
Acid Number (mg KOH/g)	0.008	0.008	0.008	0.008	0.008	0.011	0.005
Interfacial Tens.(dynes/cm)	44.8	46.2	39	39.2	37.6	35	33
ASTM Color	L1.5	L1.5	1	1	1	L1.5	L1.0
Visual Inspection	pass	pass	pass	pass	pass	pass	pass
Specific Gravity	0.8775	0.876	0.876	0.8774	0.08755	0.883	0.882
OPERATING CONDITIONS							
AmbientTemp.	60F	75F	79F	80F	70F	80F	
Winding Temp.							
Liquid Temp.	40C	40C	52C	52c	54C	45c	50c
Pressure	0	-1	-0.5	-0.5	-1	-1.5	-1
Liquid Level	ok	ok	ok	ok	ok	ok	
GAS DIAGNOSTICS							
Rogers Ratio	0-0-2-0	0-0-2-0					
Cellulose Ratio (CO2/CO)	4.71	5.48					
IEEE/ANSI (C57.104-1991)							

COMMENTS Needs nitrogen

drain valve leak - valve should be changed ASAP

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Dry Dock 3	MVA:	1
Transformer No.:	16121-3	Gallons:	415
Manufacturer:	Sierra	PCB's	cert.non
Voltage:	12470/480	% Imp.	

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	10/12/2005	6/19/2004	8/5/2003	11/14/2002	8/12/2002	9/11/2001	8/24/2000
Acetylene	1	1	1	0	35	16	23
Hydrogen	3	0	2	2	86	53	60
Ethylene	11	11	9	0	758	472	463
Methane	3	2	2	0	284	177	161
Ethane	1	1	1	1	93	53	103
Carbon Monoxide	66	33	16	2	274	282	489
Carbon Dioxide	1491	866	471	346	2815	2846	2660
Oxygen	3316	11042	10706	1989	7615	11160	10060
Total Combustibles	85	48	31	5	1530	1053	1319
Total Gas	4.8%	7.17%	0.058	46791	66940	72780	60122
OIL QUALITY							
Dielectric Break (kV)	39.3	45.2	48.2	42.5	30	40	32
Water in Fluid (ppm)	23.3	14.2	27.3	6	39.8	22.2	22
Acid Number (mg KOH/g)	0.008	0.008	0.003	0.003	0.006	0.0008	0.005
Interfacial Tens.(dynes/cm)	43.6	49.4	39.8	49.2	41.7	39.1	36
ASTM Color	L0.5	L0.5	L1.0	0	1	1	L1.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.886	0.885	0.885	0.8938	0.876	0.8754	0.884
OPERATING CONDITIONS							
AmbientTemp.	60F	75F	79F	60F	80F	70F	80F
Winding Temp.							
Liquid Temp.	30C	28C	40C	40C	40C	35C	30c
Pressure	1.5	1.6	2.5	1	0.5	0	-1
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	1-0-2-0	2-0-2-0					
Cellulose Ratio (CO2/CO)	22.59	26.24					
IEEE/ANSI (C57.104-1991)							

COMMENTS slight moisture

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
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(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-2	MVA:	0.33
Transformer No.:	7916702	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	10/12/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	6	0	0	0	0	0
Hydrogen	9	11	9	15	2	0	1
Ethylene	1	15	1	1	1	2	0
Methane	4	1	5	5	7	2	0
Ethane	3	0	5	6	9	3	0
Carbon Monoxide	122	88	74	41	42	92	38
Carbon Dioxide	1176	1062	967	638	577	1005	922
Oxygen	11	73	68	97	77	10084	4099
Total Combustibles	139	121	94	68	61	96	39
Total Gas	2.63%	0.041	41103	41682	32969	52215	47305
OIL QUALITY							
Dielectric Break (kV)	39.9	41.5	42.7	44.8	44.9	32	50
Water in Fluid (ppm)	18	40.1	18	19.8	17.8	14	21
Acid Number (mg KOH/g)	0.023	0.022	0.025	0.025	0.025	0.02	0.02
Interfacial Tens.(dynes/cm)	32.6	32.6	32.1	32.7	32.6	26	39
ASTM Color	5.5	5.5	5.5	5.5	5.5	L5.0	L5.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.885	0.8825	0.883	0.884	0.8835	0.892	0.896
OPERATING CONDITIONS							
AmbientTemp.	55F	75F	79F	80F	70F	80F	
Winding Temp.							
Liquid Temp.	35C	30C	38C	29C	18C	35c	35c
Pressure	0	0	2	1	0	0	0.5
Liquid Level	ok	low	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio							
Cellulose Ratio (CO2/CO)							
IEEE/ANSI (C57.104-1991)							

COMMENTS needs pressure

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-4	MVA:	0.33
Transformer No.:	79F6704	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	10/11/2005	7/28/2004	6/16/2004	8/12/2002	8/12/2002	9/11/2001	8/24/2000
Acetylene	1	<1	0	1	1	0	3
Hydrogen	7	<1	5	4	7	0	7
Ethylene	4	<1	17	22	21	2	96
Methane	2	<1	3	3	4	1	17
Ethane	0	<1	3	3	3	1	21
Carbon Monoxide	76	<10	88	112	111	5	326
Carbon Dioxide	860	<100	1614	1853	1931	113	2730
Oxygen	441	<100	64	122	97	2	4460
Total Combustibles	90	*	116	117	147	9	470
Total Gas	2.89%	*	3.58%	3.8%	3.9%	1.5%	51053
OIL QUALITY							
Dielectric Break (kV)	38.4	42	42.2	40	34.8	37.8	38
Water in Fluid (ppm)	76.7	4	93.6	18	22.7	19	9
Acid Number (mg KOH/g)	0.026	0.022	0.025	0.025	0.02	0.028	0.022
Interfacial Tens.(dynes/cm)	37	36.7	36.9	37	37.7	38	29
ASTM Color	L5.5	L5.5	L5.5	5.5	5.5	5.5	L5.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.88	0.8815	0.88	0.8828	0.883	0.8825	0.895
OPERATING CONDITIONS							
AmbientTemp.	62F	80F	75F	78F	80F	70F	80F
Winding Temp.							
Liquid Temp.	35C	55C	30C	38C	36C	38C	35c
Pressure	0	1.5	0	0.5	0	0	0
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio							
Cellulose Ratio (CO2/CO)							
IEEE/ANSI (C57.104-1991)							

COMMENTS Moisture level back up - needs pressure - likely has leak that is allowing water to get in.

SUBSTATION TECHNICAL RESOURCES, INC.

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Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-11	MVA:	0.33
Transformer No.:	79F6701	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	10/11/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0	0
Hydrogen	24	20	5	12	15	22	10
Ethylene	4	4	4	5	5	19	3
Methane	5	14	7	10	16	28	5
Ethane	5	17	6	10	14	21	2
Carbon Monoxide	111	109	96	75	113	262	145
Carbon Dioxide	1529	1872	1965	2061	2727	3118	2688
Oxygen	19	51	69	62	70	4220	1774
Total Combustibles	149	164	118	112	163	372	165
Total Gas	2.51%	0.0394	40811	41897	50768	52072	52491
OIL QUALITY							
Dielectric Break (kV)	34.9	40.6	26	33.8	30	34	39
Water in Fluid (ppm)	16.9	36	22.1	14.5	22.4	8	14
Acid Number (mg KOH/g)	0.023	0.022	0.023	0.02	0.02	0.02	0.021
Interfacial Tens.(dynes/cm)	33.3	33	32.2	33	33.9	28	31
ASTM Color	L6.0	L6.0	L6.0	5.5	5.5	G8.0	L6.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.882	0.882	0.882	0.886	0.886	0.897	0.892
OPERATING CONDITIONS							
AmbientTemp.	65F	75F	70F	80F	70F	80F	
Winding Temp.							
Liquid Temp.	35C	30C	30C	40C	40C	35c	35c
Pressure	0	0	0	1	0	0	0.5
Liquid Level	low	low	low	low	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio							
Cellulose Ratio (CO2/CO)							
IEEE/ANSI (C57.104-1991)							

COMMENTS Needs nitrogen & oil.

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 12-2	MVA:	1
Transformer No.:	79F67112	Gallons:	316
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.5

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	10/21/2005	6/16/2004	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000
Acetylene	0	<1	0	0	0	0	0
Hydrogen	7	<1	6	5	3	4	6
Ethylene	4	<1	2	4	1	4	10
Methane	1	<1	3	1	0	5	4
Ethane	0	<1	1	0	3	4	1
Carbon Monoxide	65	<10	68	71	56	93	194
Carbon Dioxide	486	<100	560	633	496	604	710
Oxygen	2003	<100	86	96	1051	67	5171
Total Combustibles	77	*	79	81	63	110	216
Total Gas	2.73%	*	3.69%	3.28%	36570	39427	56258
OIL QUALITY							
Dielectric Break (kV)	37	41	42.5	35.8	40.9	42.9	35
Water in Fluid (ppm)	19.2	4.1	80.8	30.2	43.6	27	8
Acid Number (mg KOH/g)	0.023	0.022	0.022	0.023	0.023	0.042	0.023
Interfacial Tens.(dynes/cm)	32	32.9	32	32.2	32	32.7	26
ASTM Color	L6.0	L6.0	L6.0	L6.0	L6.0	6	G8.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.883	0.88	0.88	0.882	0.882	0.882	0.899
OPERATING CONDITIONS							
AmbientTemp.	65F	80F	75F	70F	70F	70F	80F
Winding Temp.							
Liquid Temp.	35C	55C	32C	30C	40C	45C	40c
Pressure	0	1.5	0	0	0	0	0
Liquid Level	ok	ok	High	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio							
Cellulose Ratio (CO2/CO)							
IEEE/ANSI (C57.104-1991)							

COMMENTS Needs Pressure

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-3	MVA:	0.33
Transformer No.:	79F9703	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/16/2004	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	10	10	11	12	15	54	0
Hydrogen	14	11	11	13	24	19	4
Ethylene	25	26	30	32	40	131	0
Methane	9	11	11	13	16	35	1
Ethane	2	5	4	5	7	10	0
Carbon Monoxide	202	165	156	146	139	216	118
Carbon Dioxide	1812	1643	1820	1840	1982	1642	2229
Oxygen	1454	67	118	200	71	7397	3642
Total Combustibles	262	228	223	221	241	465	123
Total Gas	3.23%	4.06%	4.23%	4.53%	50705	51409	66089
OIL QUALITY							
Dielectric Break (kV)	40.2	41.5	45.6	41.8	42.7	35	43
Water in Fluid (ppm)	11.1	20.3	19.8	22.1	20.1	6	25
Acid Number (mg KOH/g)	0.023	0.022	0.023	0.023	0.022	0.03	0.023
Interfacial Tens.(dynes/cm)	32.8	32.7	32	32.8	32.9	27	28
ASTM Color	5	5	5	5	5	L5.0	L5.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.882	0.882	0.889	0.881	0.881	0.894	0.89
OPERATING CONDITIONS							
AmbientTemp.	50F	75F	69F	80F	70F	80F	
Winding Temp.							
Liquid Temp.	30C	33C	34C	43C	42C	30c	40c
Pressure	0	0.7	0.5	1.6	1.5	0	1
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio							
Cellulose Ratio (CO2/CO)							
IEEE/ANSI (C57.104-1991)							

COMMENTS Needs Pressure

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-1	MVA:	0.33
Transformer No.:	79F9701	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/16/2004	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/26/1999
Acetylene	0	0	0	0	0	0	0
Hydrogen	36	8	6	9	33	15	1
Ethylene	3	1	3	2	3	9	1
Methane	1	2	2	2	3	7	0
Ethane	0	1	0	0	2	4	0
Carbon Monoxide	37	47	66	57	75	173	50
Carbon Dioxide	454	429	571	463	733	716	519
Oxygen	2189	98	42	56	105	711	6527
Total Combustibles	77	69	76	70	116	208	52
Total Gas	2.45%	4.00%	4.04%	3.46%	42632	27904	60866
OIL QUALITY							
Dielectric Break (kV)	39.7	41.5	46.7	42	42.5	44	43
Water in Fluid (ppm)	23.2	18.6	29.7	26.7	25.9	26	16
Acid Number (mg KOH/g)	0.029	0.028	0.031	0.031	0.028	0.031	0.024
Interfacial Tens.(dynes/cm)	33.1	33.2	33.6	33.5	33.4	25	28
ASTM Color	6	6	6	6	6	G8.0	L5.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.8825	0.882	0.8815	0.881	0.8808	0.893	0.896
OPERATING CONDITIONS							
AmbientTemp.	65F	75F	65F	80F	70F	80F	
Winding Temp.							
Liquid Temp.	35F	30C	30C	42C	40c	40c	35c
Pressure	0	0	0	0	0	0	0
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio							
Cellulose Ratio (CO2/CO)							
IEEE/ANSI (C57.104-1991)							

COMMENTS Needs Pressure

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-12	MVA:	0.33
Transformer No.:	79F97012	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	7/28/2004	7/28/2004	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000
Acetylene	0	<1	0	0	0	0	0
Hydrogen	10	<1	142	17	7	12	4
Ethylene	5	<1	12	8	6	4	3
Methane	1	<1	15	4	3	9	4
Ethane	0	<1	12	2	1	10	2
Carbon Monoxide	60	<10	116	86	85	85	137
Carbon Dioxide	719	<100	2117	1503	1173	987	518
Oxygen	1203	<100	74	122	233	94	5742
Total Combustibles	76	*	297	117	102	120	150
Total Gas	2.98%	*	4.52%	3.8%	4.1%	41520	48742
OIL QUALITY							
Dielectric Break (kV)	38.5	40	39.7	38	38.5	38.3	40
Water in Fluid (ppm)	26.2	8.7	107	69.7	38.4	40.8	34
Acid Number (mg KOH/g)	0.023	0.022	0.022	0.023	0.023	0.025	0.027
Interfacial Tens.(dynes/cm)	32.3	32.3	32.2	32.4	32	32.2	24
ASTM Color	5.5	5.5	5.5	5.5	5.5	5.5	L5.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.8835	0.882	0.8815	0.8825	0.883	0.883	0.892
OPERATING CONDITIONS							
AmbientTemp.	65F	80F	75F	78F	80F	70F	80F
Winding Temp.							
Liquid Temp.	35C	55C	30C	38C	40C	38C	30c
Pressure	0	1.5	0	0	0	0	-3
Liquid Level	ok	ok	low	low	low	low	low
GAS DIAGNOSTICS							
Rogers Ratio							
Cellulose Ratio (CO2/CO)							
IEEE/ANSI (C57.104-1991)							

COMMENTS Needs Pressure
Slight moisture

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-6	MVA:	0.33
Transformer No.:	79F6706	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/460	% Imp.	5.1

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	10/11/2005	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	1	1	0	0	0	0
Hydrogen	21	7	8	6	17	4
Ethylene	2	2	1	2	4	0
Methane	3	5	6	10	4	0
Ethane	1	4	6	11	6	0
Carbon Monoxide	128	71	103	79	145	64
Carbon Dioxide	1588	1821	1711	1555	1841	1654
Oxygen	220	71	194	115	8873	2452
Total Combustibles	156	90	124	108	176	68
Total Gas	4.9%	4.9%	4.6%	5.8%	5.3%	5.1%
OIL QUALITY						
Dielectric Break (kV)	40	38.5	36.6	35.5	40	46
Water in Fluid (ppm)	19.8	25.6	27.3	26.4	22	19
Acid Number (mg KOH/g)	0.023	0.025	0.023	0.028	0.027	0.029
Interfacial Tens.(dynes/cm)	32.2	34.1	34.4	34.5	27	28
ASTM Color	L6.0	5.5	5.5	5.5	G8.0	L5.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.883	0.884	0.882	0.8815	0.896	0.895
OPERATING CONDITIONS						
AmbientTemp.	65F	70F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	35C	30C	42C	40c	40c	35c
Pressure	1.5	2.5	3.5	0.5	0.5	0.5
Liquid Level	ok	low	low	low	low	
GAS DIAGNOSTICS						
Rogers Ratio						
Cellulose Ratio (CO2/CO)						
IEEE/ANSI (C57.104-1991)						
COMMENTS						

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-9	MVA:	0.33
Transformer No.:	79F6709	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/460	% Imp.	5.1

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	10/11/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0	0
Hydrogen	40	9	20	13	21	52	27
Ethylene	3	3	3	3	3	14	2
Methane	5	10	11	11	14	40	7
Ethane	3	7	8	7	7	23	1
Carbon Monoxide	119	116	145	149	193	581	297
Carbon Dioxide	1613	1903	2281	2368	3430	4425	2964
Oxygen	18	52	69	119	80	4863	3123
Total Combustibles	170	145	187	183	238	710	334
Total Gas	2.53%	4.40%	4.4%	4.3%	54048	59075	72144
OIL QUALITY							
Dielectric Break (kV)	37.4	37.7	41.7	40.8	40.4	39	39
Water in Fluid (ppm)	14	16.9	21.6	22.7	17.2	9	6
Acid Number (mg KOH/g)	0.021	0.022	0.023	0.023	0.02	0.022	0.017
Interfacial Tens.(dynes/cm)	36.9	37.1	37	37	37.1	31	32
ASTM Color	L6.0	5.5	5.5	5.5	5.5	L5.0	L5.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.882	0.882	0.882	0.881	0.881	0.895	0.894
OPERATING CONDITIONS							
AmbientTemp.	65F	75F	60F	80F	70F	80F	
Winding Temp.							
Liquid Temp.	35C	30C	36C	50C	40C	35c	35c
Pressure	0	0	0	0	0.5	0	0.25
Liquid Level	ok	ok	Low	ok	ok	ok	
GAS DIAGNOSTICS							
Rogers Ratio							
Cellulose Ratio (CO2/CO)							
IEEE/ANSI (C57.104-1991)							

COMMENTS Needs pressure.

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-10	MVA:	0.33
Transformer No.:	79F67010	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/460	% Imp.	5.1

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	10/11/2005	7/28/2004	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/1999
Acetylene	0	<1	0	0	0	0	0
Hydrogen	10	<1	382	23	23	20	24
Ethylene	1	<1	3	3	3	2	10
Methane	2	<1	9	9	9	8	23
Ethane	1	<1	6	5	5	4	20
Carbon Monoxide	38	<10	113	118	119	108	280
Carbon Dioxide	287	<100	1312	1152	1188	999	1260
Oxygen	73	<100	68	91	83	73	5009
Total Combustibles	52	*	513	168	159	142	357
Total Gas	2.22%	*	4.77%	50412	51019	45638	48483
OIL QUALITY							
Dielectric Break (kV)	35.9	40.9	42.8	34.3	34.9	34.4	41
Water in Fluid (ppm)	21.5	4	68.6	11.6	10.5	25	3
Acid Number (mg KOH/g)	0.021	0.025	0.02	0.02	0.011	0.02	0.02
Interfacial Tens.(dynes/cm)	35.4	35	35.1	34	36	36.1	31
ASTM Color	L5.0	L5.0	L5.0	L5.0	L5.0	L5.0	L5.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.882	0.8815	0.881	0.881	0.883	0.883	0.898
OPERATING CONDITIONS							
AmbientTemp.	65F	80F	75F	78F	80F	70F	80F
Winding Temp.							
Liquid Temp.	20C	55C	35C	40C	40C	40C	35c
Pressure	-1	1.5	0	0.1	1	0.5	0
Liquid Level	ok	ok	low	ok	ok	low	low
GAS DIAGNOSTICS							
Rogers Ratio							
Cellulose Ratio (CO2/CO)							
IEEE/ANSI (C57.104-1991)							

COMMENTS needs pressure

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-8	MVA:	0.33
Transformer No.:	79F6708	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/460	% Imp.	5.1

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI	ATCI
DISSOLVED GASES PPM	10/11/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	11	12	10	12	13	43	14
Hydrogen	54	497	44	34	44	56	7
Ethylene	366	385	365	385	435	793	318
Methane	61	68	61	66	75	176	58
Ethane	49	43	39	45	49	168	40
Carbon Monoxide	203	187	177	183	207	478	195
Carbon Dioxide	1764	1925	1875	1852	1995	2010	1375
Oxygen	15	136	71	178	81	4556	1634
Total Combustibles	744	1192	696	725	823	1716	632
Total Gas	3.41%	5.00%	4.7%	5.1%	63741	52831	56461
OIL QUALITY							
Dielectric Break (kV)	33	32.9	34.3	35	35.5	33	40
Water in Fluid (ppm)	20.9	36	20.9	29.7	15.5	14	11
Acid Number (mg KOH/g)	0.031	0.031	0.031	0.028	0.036	0.031	0.031
Interfacial Tens.(dynes/cm)	36	35.1	34.7	35.5	35.7	28	42
ASTM Color	L2.0	L2.0	L2.0	2.5	2.5	L2.0	L2.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.8835	0.881	0.881	0.882	0.8815	0.894	0.886
OPERATING CONDITIONS							
AmbientTemp.	65%	75F	70F	80F	70F	80F	
Winding Temp.							
Liquid Temp.	35C	33C	30C	45C	40c	40c	33c
Pressure	0	0	0	1.5	1.5	-1	-1.5
Liquid Level	ok	ok	ok	ok	ok	ok	
GAS DIAGNOSTICS							
Rogers Ratio							
Cellulose Ratio (CO2/CO)							
IEEE/ANSI (C57.104-1991)							

COMMENTS Needs pressure.

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 12-1	MVA:	1
Transformer No.:	79F6711	Gallons:	316
Manufacturer:	Elect. Tech.	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.5

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	10/12/2005	7/28/2004	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2001
Acetylene	0	0	36	0	0	0	0
Hydrogen	5	1	3	6	9	6	6
Ethylene	1	0	0	1	1	1	0
Methane	1	1	1	1	2	6	2
Ethane	0	1	0	0	0	6	0
Carbon Dioxide	777	65	1390	589	575	63	77
Carbon Monoxide	62	15	67	55	57	577	669
Oxygen	2214	222	35310	3968	708	68	12705
Total Combustibles	69	18	108	63	69	82	85
Total Gas	3.44%	1.00%	4.00%	4257100.00%	36986	40883	58336
OIL QUALITY TESTS							
Dielectric Break	39	38.8	39.4	37	32.2	33.6	35
Water in Fluid	23.8	14.8	99.4	41.3	43	41.1	21
Acid Number	0.023	0.025	0.022	0.025	0.025	0.025	0.027
Interfacial Tens.	40.4	40.4	41.1	40	41.5	41.5	31
ASTM Color	L3.0	L3.0	L3.0	L3.0	L3.0	L3.0	L2.5
Visual Inspection	PASS	PASS	PASS	PASS	PASS	PASS	PASS
Specific Gravity	0.8765	0.875	0.874	0.8725	0.874	0.8735	0.883
OPERATING CONDITIONS							
AmbientTemp.	55F	80F	75F	78F	80F	70F	80F
Winding Temp.							
Liquid Temp.	35C	55C	37C	41C	41C	37C	40C
Pressure	0.5	1.5	0	0	0	0	0
Liquid Level	ok	ok	low	OK	OK	LOW	OK
GAS DIAGNOSTICS							
Rogers Ratio							
Cellulose Ratio (CO2/CO)							
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Dry Dock	MVA:	1
Transformer No.:	771382	Gallons:	310
Manufacturer:		PCB's	cert-non
Voltage:		% Imp.	

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	10/18/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	22	23	23	25	25	96	23
Hydrogen	40	38	34	36	34	45	9
Ethylene	9	9	8	8	7	23	2
Methane	22	23	21	21	20	29	8
Ethane	5	4	4	4	4	14	0
Carbon Monoxide	607	557	509	473	437	604	240
Carbon Dioxide	2933	3173	3489	3652	4637	3964	2148
Oxygen	568	829	4328	4645	8500	9375	10799
Total Combustibles	705	654	599	567	527	811	282
Total Gas	4.19%	6.06%	0.062	65953	74225	62356	74852
OIL QUALITY							
Dielectric Break (kV)	50.2	53.5	51.4	46.9	45.4	44	50
Water in Fluid (ppm)	9.7	7.4	13.1	20.5	12.5	5	13
Acid Number (mg KOH/g)	0.005	0.006	0.003	0.003	0.011	0.002	0.002
Interfacial Tens.(dynes/cm)	46.9	51.5	44.4	45.9	48.6	41	38
ASTM Color	L0.5	L0.5	L0.5	0.5	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.878	0.8765	0.8775	0.8785	0.8785	0.886	0.883
OPERATING CONDITIONS							
AmbientTemp.	65F	75F	70F	80F	70F	80F	
Winding Temp.							
Liquid Temp.	40C	40C	45C	54C	47C	40C	50C
Pressure	0	0	0.25	0	0	0	0.25
Liquid Level	ok	ok	ok	ok	ok	ok	
GAS DIAGNOSTICS							
Rogers Ratio	0-0-1-1	0-0-1-1					
Cellulose Ratio (CO2/CO)	4.83	5.7					
IEEE/ANSI (C57.104-1991)							

COMMENTS Needs nitrogen

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	C.U.S.	MVA:	1.5
Transformer No.:	SBV567601	Gallons:	259
Manufacturer:	West.	PCB's	cert-non
Voltage:	12470/240	% Imp.	5.5

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	10/18/2005	6/19/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0	0
Hydrogen	14	11	8	8	11	15	5
Ethylene	17	18	18	17	19	67	20
Methane	11	12	10	10	11	25	4
Ethane	2	2	2	1	2	6	0
Carbon Monoxide	487	481	326	381	492	765	375
Carbon Dioxide	3159	3467	2764	3077	3569	3399	2534
Oxygen	148	141	266	613	517	4625	3174
Total Combustibles	531	524	364	417	535	878	404
Total Gas	6.5%	9.25%	5.72%	7.4%	9.3%	6.8%	67637
OIL QUALITY							
Dielectric Break (kV)	45.6	43.7	50.4	43.2	45.1	42	49
Water in Fluid (ppm)	4.5	6	8.5	7.4	4	2	8
Acid Number (mg KOH/g)	0.021	0.022	0.014	0.017	0.025	0.028	0.02
Interfacial Tens.(dynes/cm)	38.8	38.9	36.1	35.9	37.1	31	32
ASTM Color	L2.0	L2.0	1.5	1.5	L2.0	L2.0	L1.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.874	0.871	0.872	0.8725	0.8715	0.881	0.883
OPERATING CONDITIONS							
AmbientTemp.	65F	75F	70F	80F	70F	80F	
Winding Temp.							
Liquid Temp.	25C	15	32C	45C	35C	40c	40C
Pressure	3	3.5	4.5	5	4.5	0	0.25
Liquid Level	ok	low	ok	ok	ok	ok	
GAS DIAGNOSTICS							
Rogers Ratio	0-0-2-0	1-0-2-0					
Cellulose Ratio (CO2/CO)	6.4	7.21					
IEEE/ANSI (C57.104-1991)							

COMMENTS

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	C.U.S.	MVA:	1.5
Transformer No.:	SBV667602	Gallons:	259
Manufacturer:	West.	PCB's	cert-non
Voltage:	12470/240	% Imp.	5.47

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/19/2004	6/19/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0	0
Hydrogen	10	11	11	9	11	25	7
Ethylene	26	31	33	28	33	113	24
Methane	8	10	10	9	11	30	3
Ethane	26	2	2	1	2	6	24
Carbon Monoxide	589	678	678	555	750	1204	719
Carbon Dioxide	3166	3955	4472	4150	8100	8179	6154
Oxygen	911	2158	3730	4461	4819	7605	8665
Total Combustibles	635	732	734	602	807	1378	753
Total Gas	5.4%	6.79%	6.93%	6.4%	8.1%	6.7%	82842
OIL QUALITY							
Dielectric Break (kV)	44.6	47.6	52.3	43.6	45.6	39	49
Water in Fluid (ppm)	4.5	6	7.4	8.5	2.3	5	10
Acid Number (mg KOH/g)	0.018	0.025	0.011	0.014	0.008	0.023	0.018
Interfacial Tens.(dynes/cm)	35.3	38.3	34.4	34.3	34.3	30	30
ASTM Color	L2.0	L2.0	1.5	1.5	L1.5	L1.5	L1.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.8735	0.8715	0.872	0.8725	0.8715	0.875	0.887
OPERATING CONDITIONS							
AmbientTemp.	65F	75F	70F	80F	70F	80F	
Winding Temp.							
Liquid Temp.	35C	31C	40C	45C	40C	40c	40C
Pressure	0	0	0	1	0.5	0	0.5
Liquid Level	ok	ok	ok	ok	ok	ok	
GAS DIAGNOSTICS							
Rogers Ratio	0-0-2-0	0-0-2-0					
Cellulose Ratio (CO2/CO)	5.38	5.83					
IEEE/ANSI (C57.104-1991)							

COMMENTS needs pressure

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	C.U.S.	MVA:	1.5
Transformer No.:	SBV567604	Gallons:	259
Manufacturer:	West.	PCB's	cert-non
Voltage:	12470/240	% Imp.	5.47

Lab Used	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	10/18/2005	6/19/2004	8/5/2003	8/12/2002
Acetylene	0	0	0	0
Hydrogen	12	13	8	10
Ethylene	25	25	26	21
Methane	11	12	11	10
Ethane	2	2	2	2
Carbon Monoxide	566	616	477	559
Carbon Dioxide	3145	3647	3274	3659
Oxygen	229	247	572	540
Total Combustibles	616	668	524	602
Total Gas	5.47%	8.64%	6.24%	7.4%
OIL QUALITY				
Dielectric Break (kV)	42.6	40.9	45.9	44.6
Water in Fluid (ppm)	9.7	11.9	9.1	6.1
Acid Number (mg KOH/g)	0.021	0.022	0.02	0.023
Interfacial Tens.(dynes/cm)	39.7	38.2	44	44.6
ASTM Color	L2.0	L2.0	L1.5	1.5
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.875	0.871	0.871	0.8725
OPERATING CONDITIONS				
AmbientTemp.	65F	75F	70F	80F
Winding Temp.				
Liquid Temp.	30C	30C	39C	45C
Pressure	2	2	3	4.2
Liquid Level	ok	ok	ok	ok
GAS DIAGNOSTICS				
Rogers Ratio	0-0-2-0			
Cellulose Ratio (CO2/CO)	5.56			
IEEE/ANSI (C57.104-1991)				

COMMENTS

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	C.U.S.	MVA:	1.5
Transformer No.:	SBV567603	Gallons:	259
Manufacturer:	West.	PCB's	cert-non
Voltage:	12470/240	% Imp.	5.51

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	10/18/2005	6/19/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0	0
Hydrogen	12	13	8	11	13	12	8
Ethylene	21	21	22	24	22	62	20
Methane	11	11	10	11	11	24	7
Ethane	2	2	2	2	2	5	0
Carbon Monoxide	681	685	486	542	673	846	624
Carbon Dioxide	3500	3864	3221	3609	4435	3542	3828
Oxygen	164	208	501	556	853	5320	2350
Total Combustibles	727	732	528	590	721	949	659
Total Gas	6.47%	9.53%	6.15%	7.30%	9.30%	5.40%	69074
OIL QUALITY							
Dielectric Break (kV)	46.5	43	46.6	49.4	40.4	40	47
Water in Fluid (ppm)	3.4	2.3	8	5.7	8	6	9
Acid Number (mg KOH/g)	0.023	0.031	0.02	0.023	0.022	0.03	0.019
Interfacial Tens.(dynes/cm)	39.3	39.4	35.8	35.7	36.9	31	37
ASTM Color	L2.0	L2.0	L1.5	1.5	L2.0	L2.0	L1.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.8735	0.871	0.871	0.8732	0.8725	0.88	0.877
OPERATING CONDITIONS							
AmbientTemp.	65F	75F	70F	80F	70F	80F	
Winding Temp.							
Liquid Temp.	25C	15	31C	42C	33C	30c	35c
Pressure	4	4	4.5	5.2	5	-1	-0.75
Liquid Level		low	ok	ok	ok	ok	
GAS DIAGNOSTICS							
Rogers Ratio	0-0-2-0	0-0-2-0					
Cellulose Ratio (CO2/CO)	5.14%	5.64					
IEEE/ANSI (C57.104-1991)							

COMMENTS

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	C.U.S.	MVA:	1
Transformer No.:	PAT716001	Gallons:	224
Manufacturer:	West.	PCB's	cert-non
Voltage:	12470/480	% Imp.	5.81

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	10/18/2005	6/19/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0	0
Hydrogen	13	18	10	15	12	19	8
Ethylene	11	15	16	15	17	48	14
Methane	13	15	12	11	11	26	6
Ethane	6	5	4	2	2	5	0
Carbon Monoxide	495	579	448	488	536	827	595
Carbon Dioxide	2867	3672	3185	3315	3834	3024	3116
Oxygen	29	150	158	182	230	5555	2541
Total Combustibles	538	632	490	531	578	925	623
Total Gas	5.32%	8.98%	6.39%	72997	79845	57173	75150
OIL QUALITY							
Dielectric Break (kV)	48.3	45.6	50.2	45.6	39.4	48	49
Water in Fluid (ppm)	6.8	2	2.8	6.8	3.4	4	10
Acid Number (mg KOH/g)	0.026	0.037	0.02	0.023	0.034	0.028	0.022
Interfacial Tens.(dynes/cm)	38.9	38.6	34.5	34.3	35.4	31	29
ASTM Color	L2.0	L2.0	L1.5	1.5	2	L1.5	L1.5
Visual Inspection	Pass	Pass	Pass	Pass	2	Pass	Pass
Specific Gravity	0.875	0.872	0.872	0.8725	0.873	0.878	0.876
OPERATING CONDITIONS							
AmbientTemp.	65F	75F	70F	80F	70F	80F	
Winding Temp.							
Liquid Temp.	25C	15C	21C	36C	21C	30C	20C
Pressure	2	2.8	3	4	3	-1	-0.5
Liquid Level	ok	ok	ok	ok	ok	ok	
GAS DIAGNOSTICS							
Rogers Ratio	1-0-1-0						
Cellulose Ratio (CO2/CO)	5.79						
IEEE/ANSI (C57.104-1991)							

COMMENTS

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-7	MVA:	0.33
Transformer No.:	79F670-71	Gallons:	176
Manufacturer:	Elect. Tech.	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	10/12/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/25/2000
Acetylene	0	0	0	0	0	0
Hydrogen	14	22	23	31	6	3
Ethylene	0	0	1	1	1	0
Methane	1	5	5	4	11	14
Ethane	0	6	5	3	13	13
Carbon Dioxide	393	395	492	605	513	1129
Carbon Monoxide	31	37	54	62	56	88
Oxygen	2216	56	59	81	113	2829
Total Combustibles	46	70	88	101	87	118
Total Gas	2.9%	3.06%	3.3%	3.8%	4.1%	59313
OIL QUALITY TESTS						
Dielectric Break	42	47.5	42.7	41.8	41.6	46
Water in Fluid	20.9	33.1	29.7	36.6	29.9	26
Acid Number	0.023	0.022	0.023	0.023	0.036	0.024
Interfacial Tens.	34.5	34.6	34.7	34.9	34.6	28
ASTM Color	L5.5	L5.5	5.5	5.5	5.5	L5.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.884	0.882	0.882	0.883	0.883	0.891
OPERATING CONDITIONS						
AmbientTemp.	50F	75F	79F	90F	70F	
Winding Temp.						
Liquid Temp.	35C	30C	36C	40C	35C	
Pressure	0	0	0	0	0	
Liquid Level	Low	Low			OK	
GAS DIAGNOSTICS						
Rogers Ratio						
Cellulose Ratio (CO2/CO)						
IEEE/ANSI (C57.104-1991)						

COMMENTS Needs pressure.

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4	MVA:	1.5
Transformer No.:	P008188	Gallons:	295
Manufacturer:	GE	PCB's	silicone
Voltage:	12470/480	% Imp.	

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	10/18/2005	6/19/2004	8/6/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0	0
Hydrogen	57	63	52	56	65	70	35
Ethylene	1	1	1	1	1	4	0
Methane	29	31	30	30	32	57	25
Ethane	3	2	2	2	2	6	0
Carbon Monoxide	932	886	852	879	980	963	887
Carbon Dioxide	3944	4163	4339	4254	4672	2850	4012
Oxygen	932	2264	2510	1409	4772	5509	6046
Total Combustibles	1022	973	937	968	1080	1100	947
Total Gas	8.41%	10.63%	10.57%	105420	128402	65012	1211804
OIL QUALITY							
Dielectric Break (kV)	45.4	46.8	38.7	50.4	44.2	33	38
Water In Fluid (ppm)	7.8	8.3	16.1	13.4	10.9	12	16
Acid Number (mg KOH/g)	0.005	0.006	0.003	0.006	0.008	0.01	0.003
Interfacial Tens.(dynes/cm)				43.7	43.7		
ASTM Color	0	0	0	0	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.965	0.963	0.972	0.9618	0.9615	0.977	0.975
OPERATING CONDITIONS							
AmbientTemp.	65F	75F	80F	80F	70F	80F	
Winding Temp.							
Liquid Temp.	40C	40C	42C	45C	42C	40C	35C
Pressure					npg	npg	npg
Liquid Level	ok	ok	high	high	high	high	
GAS DIAGNOSTICS							
Rogers Ratio	0-0-0-0						
Cellulose Ratio (CO2/CO)	4.23						
IEEE/ANSI (C57.104-1991)							

COMMENTS

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 6	MVA:	1
Transformer No.:	836002311	Gallons:	392
Manufacturer:	RTE	PCB's	rtemp
Voltage:	12470/460	% Imp.	5.6

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	10/18/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/25/1999
Acetylene	0	0	0	0	0	0
Hydrogen	8	7	7	9	7	4
Ethylene	3	2	3	3	3	1
Methane	9	10	11	12	12	2
Ethane	6	6	6	6	6	1
Carbon Monoxide	331	314	383	394	421	1657
Carbon Dioxide	1700	1972	2269	2522	2676	299
Oxygen	21	97	78	64	71	8657
Total Combustibles	357	339	410	424	449	307
Total Gas	3.22%	4.30%	4.98%	5.02%	54662	78081
OIL QUALITY						
Dielectric Break (kV)	42	48.3	43.7	34.9	41	47
Water in Fluid (ppm)	19.2	27.9	29.1	15.1	21.3	9
Acid Number (mg KOH/g)	0.021	0.022	0.02	0.02	0.018	0.011
Interfacial Tens.(dynes/cm)	34.6	34.8	37.7	40.5	37.2	34
ASTM Color	3	3	3	3	3	L3.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.8745	0.873	0.8715	0.873	0.873	0.879
OPERATING CONDITIONS						
AmbientTemp.	65F	75F	70F	80F	70F	
Winding Temp.						
Liquid Temp.	45C	35C	46C	50C	52C	
Pressure	0				NG	
Liquid Level	OK	OK	OK	OK		
GAS DIAGNOSTICS						
Rogers Ratio						
Cellulose Ratio (CO2/CO)						
IEEE/ANSI (C57.104-1991)						

COMMENTS Needs Pressure

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 6	MVA:	1.5
Transformer No.:	836002464	Gallons:	540
Manufacturer:	RTE	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.6

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	10/18/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/2000
Acetylene	0	0	0	0	0	0	0
Hydrogen	5	5	5	13	5	8	4
Ethylene	3	3	4	4	4	13	2
Methane	10	12	12	14	15	34	10
Ethane	3	4	4	4	4	16	0
Carbon Monoxide	289	326	315	353	377	620	363
Carbon Dioxide	1298	1655	1604	1849	1703	1809	1652
Oxygen	13	189	70	126	60	4814	2059
Total Combustibles	310	350	340	388	405	691	379
Total Gas	2.75%	4.71%	4.23%	46392	51137	49768	58373
OIL QUALITY							
Dielectric Break (kV)	38.9	44.8	41.5	34.9	45.2	33	42
Water in Fluid (ppm)	27.9	29.1	22.1	16.3	21.3	18	7
Acid Number (mg KOH/g)	0.018	0.017	0.017	0.011	0.02	0.017	0.012
Interfacial Tens.(dynes/cm)	36.4	36.5	36.8	39.1	36.5	35	35
ASTM Color	L3.0	L3.0	L3.5	3	3	L3.5	L3.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.874	0.8718	0.8725	0.872	0.872	0.882	0.88
OPERATING CONDITIONS							
AmbientTemp.	65F	75F	70F	80F	70F	80F	
Winding Temp.							
Liquid Temp.	30C	30C	36C	40C	37C	40c	40c
Pressure	npg	npg	npg	npg	npg	npg	npg
Liquid Level	ok	ok	ok	ok	ok	ok	
GAS DIAGNOSTICS							
Rogers Ratio							
Cellulose Ratio (CO2/CO)							
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Berth 307	MVA:	0.3
Transformer No.:	H425084M68	Gallons:	122
Manufacturer:	GE	PCB's	no data
Voltage:	12470/480	% Imp.	1.71

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	10/21/2005	6/19/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0	0
Hydrogen	7	7	9	10	11	26	5
Ethylene	6	6	7	7	7	27	4
Methane	21	26	23	26	28	84	23
Ethane	6	6	5	5	5	27	1
Carbon Monoxide	587	663	636	745	812	1307	666
Carbon Dioxide	2223	2791	3060	3539	4614	4962	3833
Oxygen	13	139	85	81	106	5119	2245
Total Combustibles	627	708	680	793	863	1466	699
Total Gas	3.62%	5.91%	5.69%	67149	71820	73149	69390
OIL QUALITY							
Dielectric Break (kV)	46.8	45.5	53.4	52.2	44.7	43	53
Water in Fluid (ppm)	4.5	6	6.8	6.3	3.4	11	10
Acid Number (mg KOH/g)	0.01	0.014	0.008	0.011	0.014	0.011	0.009
Interfacial Tens.(dynes/cm)	40.1	40.4	38.5	38.5	37.2	31	32
ASTM Color	L1.5	L1.5	L1.5	1	L1.5	L1.5	L1.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.883	0.8785	0.879	0.8804	0.88	0.885	0.885
OPERATING CONDITIONS							
AmbientTemp.	65F	75F	71F	80F	70F	80F	
Winding Temp.							
Liquid Temp.	20C	20C	38C	46C	36C	40C	35C
Pressure					npg	npg	npg
Liquid Level	low	low	ok	ok	ok	ok	
GAS DIAGNOSTICS							
Rogers Ratio	2-0-1-0						
Cellulose Ratio (CO2/CO)	3.79						
IEEE/ANSI (C57.104-1991)							

COMMENTS

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Berth 306	MVA:	0.3
Transformer No.:	H425082M68	Gallons:	122
Manufacturer:	GE	PCB's	no data
Voltage:	13200/480	% Imp.	1.71

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	10/21/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0	0
Hydrogen	3	4	2	0	1	0	0
Ethylene	1	0	3	2	2	4	0
Methane	1	1	1	1	1	3	0
Ethane	0	0	0	0	0	0	0
Carbon Monoxide	18	25	35	30	33	133	46
Carbon Dioxide	409	530	990	884	884	1018	688
Oxygen	4770	13687	16303	15456	22095	18404	20235
Total Combustibles	23	30	41	33	37	140	46
Total Gas	3.94%	6.35%	0.0634	65542	74661	73320	73481
OIL QUALITY							
Dielectric Break (kV)	49.4	44.9	54.2	49.9	43.7	34	38
Water in Fluid (ppm)	11.4	6.8	29	35.8	25	26	29
Acid Number (mg KOH/g)	0.01	0.014	0.011	0.008	0.014	0.012	0.018
Interfacial Tens.(dynes/cm)	40.4	41	37.8	37.9	38.2	24	33
ASTM Color	L1.5	L1.5	L1.5	L1.5	L1.5	L1.0	L1.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.875	0.8726	0.873	0.8735	0.874	0.878	0.877
OPERATING CONDITIONS							
AmbientTemp.	65F	75F	72F	80F	70F	80F	
Winding Temp.							
Liquid Temp.	25C	20C	42C	51C	40C	45C	36C
Pressure					npg	npg	npg
Liquid Level	ok	ok	ok	high	high	high	
GAS DIAGNOSTICS							
Rogers Ratio	0-0-2-0	0-0-2-2					
Cellulose Ratio (CO2/CO)	22.72	21.2					
IEEE/ANSI (C57.104-1991)							

COMMENTS

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 7A	MVA:	2
Transformer No.:	PQH0715	Gallons:	415
Manufacturer:		PCB's	rtemp
Voltage:	12470/460	% Imp.	5.4

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	10/11/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0	0
Hydrogen	7	7	9	7	6	14	5
Ethylene	7	8	7	8	7	32	6
Methane	12	15	14	15	15	43	7
Ethane	6	6	6	6	5	27	2
Carbon Monoxide	685	739	767	777	856	1346	811
Carbon Dioxide	2313	2783	3076	3401	5619	7301	4227
Oxygen	13	59	85	55	81	4656	2748
Total Combustibles	717	775	803	813	889	1462	831
Total Gas	3.2%	5.00%	50933	51306	59219	64487	66375
OIL QUALITY							
Dielectric Break (kV)	39.1	40.8	43.5	39.5	39.2	32	43
Water in Fluid (ppm)	11.4	16.3	17.4	12.8	14.4	24	8
Acid Number (mg KOH/g)	0.023	0.022	0.023	0.02	0.014	0.033	0.022
Interfacial Tens.(dynes/cm)	37.2	37.5	37.1	37.7	37.6	38	36
ASTM Color	L3.0	L3.0	L3.0	L3.0	L3.0	L3.0	L3.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.8745	0.873	0.873	0.873	0.8725	0.881	0.884
OPERATING CONDITIONS							
AmbientTemp.	65F	75F	79F	80F	70F	80F	
Winding Temp.							
Liquid Temp.	40C	35C	45C	55C	44C	45c	42c
Pressure		npg	npg	npg	npg	npg	npg
Liquid Level	ok	ok	ok	ok		high	
GAS DIAGNOSTICS							
Rogers Ratio							
Cellulose Ratio (CO2/CO)							
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Crane #14	MVA:	0.75
Transformer No.:	L243297	Gallons:	142
Manufacturer:		PCB's	silicone
Voltage:	2400/480	% Imp.	5.7

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	10/12/2005	6/19/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0	0
Hydrogen	152	170	163	168	174	208	501
Ethylene	1	0	1	1	1	4	0
Methane	47	56	52	51	56	122	41
Ethane	6	5	5	5	6	20	1
Carbon Monoxide	902	1019	948	941	1054	1224	853
Carbon Dioxide	3592	4434	4550	4392	4861	3758	3068
Oxygen	349	969	1617	1018	1881	4803	4504
Total Combustibles	1108	1250	1169	1166	1291	1578	1398
Total Gas	7.05%	11.09%	10.75%	107320	118776	79103	115933
OIL QUALITY							
Dielectric Break (kV)	44.9	42.4	47.8	47.3	46.7	33	34
Water in Fluid (ppm)	7.8	7.3	9.4	21.6	11	11	26
Acid Number (mg KOH/g)	0.005	0.006	0.003	0.008	0.008	0.006	0.001
Interfacial Tens.(dynes/cm)							
ASTM Color	0	0	0	0	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.965	0.9625	0.9696	0.9638	0.963	0.967	0.969
OPERATING CONDITIONS							
AmbientTemp.	65F	75F	78F	80F	70F	80F	
Winding Temp.							
Liquid Temp.	30C	30C	39C	39C	40C	35C	35C
Pressure	-1	-0.5	-0.3	-0.3	-0.5	0	-0.5
Liquid Level	ok	ok	ok	ok	ok	ok	
GAS DIAGNOSTICS							
Rogers Ratio	0-0-0-0	0-0-0-2					
Cellulose Ratio (CO2/CO)	3.98	4.35					
IEEE/ANSI (C57.104-1991)							

COMMENTS

needs pressure

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Crane #17	MVA:	0.5
Transformer No.:	L243299B	Gallons:	125
Manufacturer:		PCB's	silicone
Voltage:	2400/480	% Imp.	

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	10/11/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0	0
Hydrogen	193	152	119	126	170	203	198
Ethylene	0	0	0	0	0	3	1
Methane	78	81	71	72	78	166	51
Ethane	9	7	7	7	7	31	0
Carbon Monoxide	1328	1168	991	1009	1200	1473	889
Carbon Dioxide	6085	6030	5630	5743	7642	7095	5679
Oxygen	516	1001	976	701	1228	6358	5654
Total Combustibles	1608	1408	1188	1214	1455	1876	1139
Total Gas	11.11%	13.00%	11.07%	111859	140295	94624	119876
OIL QUALITY							
Dielectric Break (kV)	41.9	38.1	39.6	49.6	43.8	36	36
Water in Fluid (ppm)	10.9	11.5	17.2	19.6	13	27	21
Acid Number (mg KOH/g)	0.005	0.006	0.008	0.008	0.008	0.008	0.001
Interfacial Tens.(dynes/cm)							
ASTM Color	0	0	0	0	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.962	0.962	0.969	0.9625	0.9615	0.969	0.971
OPERATING CONDITIONS							
AmbientTemp.	65F	75F	70F	80F	70F	80F	
Winding Temp.							
Liquid Temp.	30C	35C	38C	41C	40C	35C	40C
Pressure	0.5	0.2	0.9	1.2	1	1	1.28
Liquid Level	ok	ok	ok	ok	ok	ok	
GAS DIAGNOSTICS							
Rogers Ratio	0-0-0-2						
Cellulose Ratio (CO2/CO)	4.58						
IEEE/ANSI (C57.104-1991)							

COMMENTS

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Crane #15	MVA:	0.5
Transformer No.:	L243299A	Gallons:	125
Manufacturer:	GE	PCB's	silicone
Voltage:	2400/480	% Imp.	5.18

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	10/12/2005	6/19/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000
Acetylene	0	0	0	0	0	0
Hydrogen	184	207	200	210	213	265
Ethylene	1	0	1	1	1	4
Methane	42	47	43	45	48	113
Ethane	8	7	6	7	7	27
Carbon Monoxide	1117	1205	1110	1177	1279	1473
Carbon Dioxide	4229	5083	5104	5351	7016	5545
Oxygen	320	1022	1269	751	2297	4649
Total Combustibles	1352	1466	1360	1440	1548	1882
Total Gas	7.29%	11.02%	10.48%	109825	124508	79505
OIL QUALITY						
Dielectric Break (kV)	44.3	43.1	43.8	51	47.9	37
Water in Fluid (ppm)	8.9	7.8	10.4	15.5	12	13
Acid Number (mg KOH/g)	0.005	0.006	0.003	0.008	0.008	0.007
Interfacial Tens.(dynes/cm)						
ASTM Color	0	0	0	0	0	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.965	0.9625	0.9695	0.9635	0.9745	0.968
OPERATING CONDITIONS						
AmbientTemp.	65F	75F	73F	80F	70F	80F
Winding Temp.						
Liquid Temp.	26C	35C	39C	40C	40C	35C
Pressure	-1	-1	-0.5	-0.5	0	0
Liquid Level	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS						
Rogers Ratio	0-0-0-0					
Cellulose Ratio (CO2/CO)	3.8					
IEEE/ANSI (C57.104-1991)						

COMMENTS

needs pressure

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Crane #12	MVA:	0.75
Transformer No.:	L243298	Gallons:	125
Manufacturer:	GE	PCB's	silicone
Voltage:	2400/480	% Imp.	5.64

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	10/12/2005	6/19/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0	0
Hydrogen	172	173	179	185	197	243	109
Ethylene	1	1	1	1	1	4	0
Methane	60	66	63	61	68	138	43
Ethane	7	6	6	6	6	22	2
Carbon Monoxide	1025	1056	1034	1019	1157	1309	995
Carbon Dioxide	3721	4219	4455	4361	4895	3751	3893
Oxygen	1025	1511	1979	1554	2323	6243	6584
Total Combustibles	1265	1302	1283	1272	1429	1716	1149
Total Gas	7.26%	10.57%	10.71%	107397	118691	78350	123954
OIL QUALITY							
Dielectric Break (kV)	47.3	42	46.4	43.9	47.3	33	37
Water in Fluid (ppm)	7.3	7.3	9.4	18.6	9.4	12	22
Acid Number (mg KOH/g)	0.003	0.003	0.003	0.006	0.006	0.005	0.002
Interfacial Tens.(dynes/cm)							
ASTM Color	0	0	0	0	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.965	0.9615	0.9711	0.9625	0.9615	0.971	0.973
OPERATING CONDITIONS							
AmbientTemp.	65F	75F	70F	80F	70F	80F	
Winding Temp.							
Liquid Temp.	30C	30C	36C	37C	34C	35C	
Pressure	-1	-1	-0.1	-0.2	0	0	0.5
Liquid Level	ok	ok	ok	ok	ok	ok	

GAS DIAGNOSTICS	
Rogers Ratio	0-0-0-0
Cellulose Ratio (CO2/CO)	3.63
IEEE/ANSI (C57.104-1991)	

COMMENTS

needs pressure

SUBSTATION TECHNICAL RESOURCES, INC.

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Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Building 73	MVA:	0.5
Transformer No.:	PAT80910101	Gallons:	141
Manufacturer:	West	PCB's	cert.non
Voltage:	12470/480	% Imp.	5.77

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	10/18/2005	6/29/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0	0
Hydrogen	16	13	8	17	16	42	7
Ethylene	0	0	0	1	0	2	0
Methane	15	17	13	14	16	56	6
Ethane	2	1	0	0	1	8	0
Carbon Monoxide	800	732	509	640	759	1391	645
Carbon Dioxide	3666	3833	3027	3746	4828	6001	3473
Oxygen	199	923	956	1604	3059	3564	11258
Total Combustibles	833	763	531	672	792	1499	658
Total Gas	6.29%	8.36%	5.51%	76411	93274	76157	96744
OIL QUALITY							
Dielectric Break (kV)	46.9	39.9	45.6	42.4	43.6	35	47
Water in Fluid (ppm)	3.4	6	6.3	6.3	4.5	8	11
Acid Number (mg KOH/g)	0.031	0.037	0.023	0.023	0.031	0.027	0.028
Interfacial Tens.(dynes/cm)	36.6	37	35.1	33.2	35.7	28	28
ASTM Color	L1.5	L1.5	1	1	1	L1.5	L1.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.8695	0.8665	0.8675	0.868	0.8675	0.873	0.871
OPERATING CONDITIONS							
AmbientTemp.	65F	75F	70F	80F	70F	80F	
Winding Temp.							
Liquid Temp.	30C	31C	39C	40C	35C	40C	40C
Pressure	4	4	4	5	4	0	0
Liquid Level	low	low	ok	ok	ok	ok	
GAS DIAGNOSTICS							
Rogers Ratio	0-0-0-2						
Cellulose Ratio (CO2/CO)	4.58						
IEEE/ANSI (C57.104-1991)							

COMMENTS

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5565 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Building 73	MVA:	0.5
Transformer No.:	PCT83390101	Gallons:	141
Manufacturer:	West.	PCB's	cert.non
Voltage:	12470/480	% Imp.	5.86

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	10/18/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0	0
Hydrogen	16	21	13	16	17	37	9
Ethylene	0	0	0	1	0	2	9
Methane	17	18	16	16	16	51	5
Ethane	3	2	1	0	1	6	0
Carbon Monoxide	805	815	617	714	824	1347	680
Carbon Dioxide	4136	4524	3788	4455	6681	6940	4699
Oxygen	288	210	379	882	2328	3837	8862
Total Combustibles	841	858	647	747	858	1443	694
Total Gas	6.09%	8.41%	5.97%	76069	95351	71804	86182
OIL QUALITY							
Dielectric Break (kV)	45	44.1	49	42.1	42.2	43	49
Water in Fluid (ppm)	12.5	1.7	4	8.5	3.4	6	16
Acid Number (mg KOH/g)	0.031	0.04	0.028	0.028	0.039	0.033	0.038
Interfacial Tens.(dynes/cm)	36.7	33.5	40.4	41.6	32.1	27	27
ASTM Color	L1.5	1	1	1	L1.0	L1.0	L1.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.869	0.8805	0.867	0.868	0.8665	0.876	0.871
OPERATING CONDITIONS							
AmbientTemp.	65C	75C	70F	80F	70F	80F	
Winding Temp.							
Liquid Temp.	30C	25C	39C	35C	25C	35C	40C
Pressure	4	4	4	4	4	0	0.5
Liquid Level	low	low	ok	ok	ok	ok	
GAS DIAGNOSTICS							
Rogers Ratio	1-0-0-2						
Cellulose Ratio (CO2/CO)	5.14						
IEEE/ANSI (C57.104-1991)							

COMMENTS low oil

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	BWTP	MVA:	0.75
Transformer No.:	PCT786301	Gallons:	179
Manufacturer:	West.	PCB's	cert.non
Voltage:	12470/480	% Imp.	6.24

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	10/18/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0	0
Hydrogen	8	6	6	3	2	0	0
Ethylene	2	2	2	1	1	1	0
Methane	3	3	3	2	2	2	0
Ethane	0	0	0	0	0	0	0
Carbon Monoxide	243	205	161	109	73	38	0
Carbon Dioxide	2172	2449	2351	1688	1236	553	412
Oxygen	2782	11070	12764	12730	20698	17164	22184
Total Combustibles	256	216	172	115	78	41	0
Total Gas	4.13%	7.06%	6.68%	68553	89368	65417	68858
OIL QUALITY							
Dielectric Break (kV)	42.5	44.9	44.2	45.3	47.9	30	53
Water in Fluid (ppm)	6.3	4	7.4	9.7	5.1	8	24
Acid Number (mg KOH/g)	0.042	0.054	0.041	0.043	0.053	0.047	0.041
Interfacial Tens.(dynes/cm)	35.3	35.3	31	29.7	31.1	26	25
ASTM Color	L1.5	L1.5	L1.5	L1.5	L1.5	L1.5	L1.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.8805	0.879	0.879	0.8796	0.88	0.885	0.887
OPERATING CONDITIONS							
AmbientTemp.	65F	75F	69F	80F	70F	80F	
Winding Temp.							
Liquid Temp.	30C	30C	28C	34C	32C	30C	40C
Pressure	2.5	2.5	2.5	3.2	3.5	0	0
Liquid Level	ok	ok	ok	ok	ok	ok	
GAS DIAGNOSTICS							
Rogers Ratio	0-0-2-0						
Cellulose Ratio (CO2/CO)	8.94						
IEEE/ANSI (C57.104-1991)							

COMMENTS

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 8A	MVA:	2
Transformer No.:	PQH-0714	Gallons:	451
Manufacturer:		PCB's	rtemp
Voltage:	12470/460	% Imp.	5.4

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	10/11/2005	6/16/2004	8/12/2002	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0	0
Hydrogen	51	4	5	6	5	5	3
Ethylene	5	5	6	6	6	19	1
Methane	9	12	13	13	14	30	2
Ethane	7	8	6	5	6	18	1
Carbon Monoxide	415	336	597	611	535	885	574
Carbon Dioxide	2136	2340	2995	3178	4654	4642	3431
Oxygen	62	113	67	106	62	4325	3520
Total Combustibles	438	365	627	641	666	957	581
Total Gas	3%	5.30%	52463	52988	59232	57139	71043
OIL QUALITY							
Dielectric Break (kV)	43.9	43.7	42.5	39	39.5	34	50
Water in Fluid (ppm)	19.8	20.3	23.3	27.3	20.1	5	16
Acid Number (mg KOH/g)	0.016	0.014	0.014	0.014	0.022	0.02	0.017
Interfacial Tens.(dynes/cm)	44.2	44	44.6	45.1	45	38	38
ASTM Color	L2.5	L2.5	L2.5	L2.5	L2.5	L2.5	L2.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.874	0.875	0.8745	0.875	0.8745	0.883	0.887
OPERATING CONDITIONS							
AmbientTemp.	65F	75F	71F	80F	70F	80F	
Winding Temp.							
Liquid Temp.	42C	35C	48C	50C	45C	45C	46c
Pressure	0						0
Liquid Level	ok	ok	ok	ok	ok	ok	
GAS DIAGNOSTICS							
Rogers Ratio							
Cellulose Ratio (CO2/CO)							
IEEE/ANSI (C57.104-1991)							

COMMENTS needs pressure

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ELECTRICAL TECHNOLOGY

WEIDMANN-ACTI INC.
4011 POWER INN ROAD + SACRAMENTO, CA + 95826
916 455 2284 + 916 455 0191
WWW.WEIDMANN-ACTI.COM

POWER TESTING & ENERGIZATION INC.	Location:	CASCADE GENERAL	Mfr:	Account:	276
14006 NW 3RD COURT SUITE 101	Serial #:	P0156676	KV: 12.47	Order #:	159697
	Bank/Ph:	3	KVA: 2500	Control #:	5334543
VANCOUVER, WA 98685 US	Tank:	TRANSFORMER	Imp.(% Z): 5.38	Received:	04/17/2006
ATTN: TONY ASCIUTTO	Breathing:	SEAL	Container: 100970	Reported:	04/17/2006
PO #: NA	Fluid:	SIL Gallons: 415	Project ID:	Customer ID:	

ASTM D-3612
Report Units: PPM

	Lab Control Number:	5334543
	Date Sampled:	04/14/2006
	Order Number:	159697
	Oil Temp.(C):	
Dissolved Gas Analysis		
	Hydrogen (H2):	14
	Methane (CH4):	20
	Ethane (C2H6):	4
	Ethylene (C2H4):	0
	Acetylene (C2H2):	0
	Carbon Monoxide (CO):	441
	Carbon Dioxide (CO2):	8148
	Nitrogen (N2):	77140
	Oxygen (O2):	35001
	Total Dissolved Gas:	120768
	Total Dissolved Combustible Gas:	479
	Equivalent TCG Percent:	0.36

Oil Screen			
D-1533B	Moisture In Oil (ppm):		11
	% Saturation at Top Oil Temp:		NA
D-971	Interfacial Tension (dynes/cm):		
D-974	Acid Number (mg KOH/g):		0.005
D-1500	Color Number (Relative):		L0.5
D-1524	Visual Exam. (Relative):		CLR&SPRK
D-1524	Sediment Exam. (Relative):		ND
D-877	Dielectric Breakdown (kV):		25
D-1816	Dielectric Breakdown 1 mm (kV mm-C):		
D-1816	Dielectric Breakdown 2 mm (kV mm-C):		
D-924	Power Factor @ 25C (%):		0.006
D-924	Power Factor @ 100C (%):		
D-1298	Specific Gravity (Relative):		0.973
D-2668	Oxidation Inhibitor (wt. %):		

Diagnostics	
DGA Key Gas / Interpretive Method: IEEE (C57.146) (Most recent sample)	Hydrogen within limits (200 ppm). No indications of electrical arcing (H2 200 ppm C2H2 1 ppm). Carbon Monoxide within limits (3000 ppm). Carbon Monoxide and Carbon Dioxide within limits (33000 ppm).
DGA Rogers Ratio Method:	Ratios are applicable to Mineral Oil only.
DGA Cellulose (Paper) Insulation:	CO2/CO Ratio applicable to Mineral Oil only.
DGA IEEE/ANSI (C57.104-1991): (Two most recent samples)	Applicable to Mineral Oil only.
Moisture in Oil:	Acceptable for in-service oil (100 ppm max).
Interfacial Tension:	
Acid Number:	Acceptable for in-service oil (0.2 mg KOH/g max).
Color Number and Visual:	Color Number diagnostic not applicable. Visual acceptable for in-service oil (CLR&SPRK).
Dielectric Breakdown D-877:	Acceptable for in-service oil (25 kV min).
Dielectric Breakdown D-1816:	
Power Factor @ 25C:	Acceptable for in-service oil (0.2% max).
Power Factor @ 100C:	
Oxidation Inhibitor:	

The analyses, opinions or interpretations contained in this report are based upon material and information supplied by the client. Weidmann-ACTI Inc. does not imply that the contents of the sample received by this laboratory are the same as all such material in the environment from which the sample was taken. Our test results relate only to the sample or samples tested. Any interpretations or opinions expressed represent the best judgement of Weidmann-ACTI. Weidmann-ACTI assumes no responsibility and makes no warranty or representation, expressed or implied as to the condition, productivity or proper operation of any equipment or other property for which this report may be used or relied upon for any reason whatsoever.

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Portable 32-5	MVA:	1
Transformer No.:	PO15676	Gallons:	240
Manufacturer:	GE	PCB's	silicone
Voltage:	12470/460	% Imp.	5.5

Lab Used	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	10/11/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	0	0	0
Hydrogen	17	46	21	47	52
Ethylene	0	0	0	0	0
Methane	18	28	29	42	42
Ethane	3	3	2	3	0
Carbon Monoxide	444	662	728	1236	1254
Carbon Dioxide	5205	5433	5225	5567	5849
Oxygen	6877	17946	14219	5220	3851
Total Combustibles	482	739	780	1328	1351
Total Gas	11.72%	11.89%	11.12%	114823	103110
OIL QUALITY					
Dielectric Break (kV)	43.5	41.1	38.4	46.7	43.5
Water in Fluid (ppm)	14.1	6.8	9.4	13.9	6.8
Acid Number (mg KOH/g)	0.005	0.006	0.008	0.006	0.011
Interfacial Tens.(dynes/cm)					
ASTM Color	0	0	0	0	0
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.966	0.964	0.9626	0.9644	0.9628
OPERATING CONDITIONS					
AmbientTemp.	65F	75F	66F	80f	70F
Winding Temp.					
Liquid Temp.	35C	30C	35C	48C	32C
Pressure					npg
Liquid Level	ok	ok	ok	ok	ok
GAS DIAGNOSTICS					
Rogers Ratio	1-0-0-2				
Cellulose Ratio (CO2/CO)	7.94				
IEEE/ANSI (C57.104-1991)					

COMMENTS

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Portable 32-3	MVA:	2
Transformer No.:	87V1243	Gallons:	600
Manufacturer:	Vantram	PCB's	rtemp
Voltage:	12470/460	% Imp.	5.7

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	11/11/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0	0
Hydrogen	11	17	16	16	7	18	6
Ethylene	15	17	14	1	18	75	14
Methane	12	17	13	16	16	48	10
Ethane	3	4	4	0	5	16	1
Carbon Monoxide	470	608	479	714	333	962	4501
Carbon Dioxide	2797	3603	3372	4455	4915	6055	596
Oxygen	260	111	81	882	82	4850	1900
Total Combustibles	511	663	526	747	319	1119	627
Total Gas	3.17%	5.30%	51075	76069	60933	61085	65369
OIL QUALITY							
Dielectric Break (kV)	39	41.6	39.2	32.5	39.1	33	49
Water in Fluid (ppm)	15.7	15.7	29.7	15.7	21.3	7	13
Acid Number (mg KOH/g)	0.01	0.011	0.011	0.008	0.014	0.016	0.008
Interfacial Tens.(dynes/cm)	45.7	46	45.7	46.2	46.5	39	42
ASTM Color	L2.0	1.5	1.5	1.5	1.5	L2.0	L2.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.871	0.875	0.875	0.87	0.8705	0.88	0.883
OPERATING CONDITIONS							
AmbientTemp.	65F	75F	69F	80F	70F	80F	
Winding Temp.							
Liquid Temp.	39C	45C	68C	48C	40c	40c	42c
Pressure	0	0	0	0	0	npg	
Liquid Level	ok	ok	ok	ok	ok	ok	
GAS DIAGNOSTICS							
Rogers Ratio							
Cellulose Ratio (CO2/CO)							
IEEE/ANSI (C57.104-1991)							

COMMENTS needs pressure

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 5	MVA:	1
Transformer No.:	PO14476	Gallons:	240
Manufacturer:	GE	PCB's	silicone
Voltage:	12470/460	% Imp.	5.5

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	10/12/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0	0
Hydrogen	58	60	7	61	60	91	28
Ethylene	0	0	0	0	0	1	0
Methane	23	23	11	21	22	45	6
Ethane	2	2	1	2	2	6	0
Carbon Monoxide	981	984	267	861	903	1027	730
Carbon Dioxide	4274	4490	3355	3985	3935	2846	2858
Oxygen	4210	8032	23275	5442	10752	9121	15323
Total Combustibles	1064	1069	286	945	987	1170	764
Total Gas	9.82%	11.78%	11.39%	102305	122087	74431	114837
OIL QUALITY							
Dielectric Break (kV)	40.8	48.5	39.6	42	46.1	30	32
Water in Fluid (ppm)	6.8	7.8	25	14.4	5.7	12	26
Acid Number (mg KOH/g)	0.003	0.003	0.003	0.006	0.006	0.002	0.003
Interfacial Tens.(dynes/cm)							
ASTM Color	0	0	0	0	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.9625	0.963	0.9712	0.9635	0.9622	0.971	0.976
OPERATING CONDITIONS							
AmbientTemp.	65F	75F	71F	80F	70F	80F	
Winding Temp.							
Liquid Temp.	28C	33C	30C	40C	38C	40C	33C
Pressure					npg	npg	
Liquid Level	ok	ok	ok	ok	ok	ok	
GAS DIAGNOSTICS							
Rogers Ratio	0-0-0-2						
Cellulose Ratio (CO2/CO)	4.8						
IEEE/ANSI (C57.104-1991)							

COMMENTS

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 5	MVA:	1.5
Transformer No.:	*PO14490*	*Gallons:*	*315*
Manufacturer:	GE	PCB's	silicone
Voltage:	12470/460	% Imp.	5.54

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	10/18/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/2000
Acetylene	0	0	0	0	0	0	0
Hydrogen	14	19	17	23	31	53	28
Ethylene	1	0	1	1	0	2	0
Methane	67	81	83	81	100	183	76
Ethane	5	4	4	4	4	16	1
Carbon Monoxide	340	367	360	367	452	659	458
Carbon Dioxide	2042	2048	2060	1691	1894	1306	1455
Oxygen	5669	15938	1419	10942	14571	9079	13837
Total Combustibles	427	471	465	476	587	913	563
Total Gas	8.03%	11.89%	11.12%	110157	124866	74179	126025
OIL QUALITY							
Dielectric Break (kV)	44.8	37.9	39.5	50.9	47.1	37	38
Water in Fluid (ppm)	6.8	6.8	12	9.8	6.3	19	9
Acid Number (mg KOH/g)	0.003	0.003	0.003	0.006	0.006	0.002	0.001
Interfacial Tens.(dynes/cm)							
ASTM Color	0	0	0	0	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.965	0.963	0.9672	0.9612	0.9632	0.969	0.973
OPERATING CONDITIONS							
AmbientTemp.	65F	75F	71F	80F	70F	80F	
Winding Temp.							
Liquid Temp.	30C	29C	31C	39C	39C	35C	33C
Pressure		npg	npg	npg	npg	npg	
Liquid Level	low	ok	ok	ok	low	low	
GAS DIAGNOSTICS							
Rogers Ratio	2-0-0-2						
Cellulose Ratio (CO2/CO)							
IEEE/ANSI (C57.104-1991)							
COMMENTS							

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4	MVA:	1
Transformer No.:	PCT2521-0101	Gallons:	200
Manufacturer:	West	PCB's	silicone
Voltage:	12470/460	% Imp.	5.94

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	10/18/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/25/1999
Acetylene	0	0	0	0	0	0
Hydrogen	51	6	30	32	46	21
Ethylene	0	0	0	0	0	0
Methane	86	42	79	78	82	53
Ethane	5	4	4	4	3	0
Carbon Monoxide	2328	496	1655	1648	2037	1612
Carbon Dioxide	7609	6951	6794	7421	11838	9722
Oxygen	510	25599	1245	2864	3384	10872
Total Combustibles	2470	548	1768	1762	2168	1686
Total Gas	11.78	13.68%	11.33%	125571	158357	125843
OIL QUALITY						
Dielectric Break (kV)	36.6	36.3	43.9	37.1	45.5	36
Water in Fluid (ppm)	12.5	27.1	8.3	12.4	7.8	14
Acid Number (mg KOH/g)	0.005	0.006	0.003	0.006	0.008	0.003
Interfacial Tens.(dynes/cm)						
ASTM Color	0	0	0	0	0	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Clear	Pass
Specific Gravity	0.9655	0.962	0.969	0.963	0.962	0.974
OPERATING CONDITIONS						
AmbientTemp.	65F	75F	80F	80F		
Winding Temp.						
Liquid Temp.	50C	53C	50C	50C		50C
Pressure	4	4	4	4		-0.25
Liquid Level	ok	ok	ok	ok		
GAS DIAGNOSTICS						
Rogers Ratio	1-0-0-2					
Cellulose Ratio (CO2/CO)	3.27					
IEEE/ANSI (C57.104-1991)						

COMMENTS suspect gas history

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 3	MVA:	1.5
Transformer No.:	R277558	Gallons:	321
Manufacturer:		PCB's	silicone
Voltage:	12470/480	% Imp.	

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	10/18/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/25/2000	2/7/2000
Acetylene	0	0	0	0	0	19	0
Hydrogen	50	40	35	33	46	100	18
Ethylene	0	0	0	1	0	13	0
Methane	27	27	27	26	29	83	7
Ethane	3	3	3	3	2	13	0
Carbon Monoxide	742	613	583	563	681	1046	535
Carbon Dioxide	6167	6108	6355	6341	9382	8934	730
Oxygen	2640	8673	8771	8119	13861	13060	20371
Total Combustibles	822	683	648	626	758	1274	560
Total Gas	9.2%	11.42%	11.30%	11.5%	15.2%	10.2%	130420
OIL QUALITY							
Dielectric Break (kV)	40.6	39.3	39.7	47.7	46.1	36	37
Water in Fluid (ppm)	30.2	30.2	35.4	42.8	36.5	38	34
Acid Number (mg KOH/g)	0.003	0.003	0.003	0.006	0.006	0.005	0.003
Interfacial Tens.(dynes/cm)							
ASTM Color	0	0	0	0	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.9655	0.9625	0.9695	0.8638	0.9625	0.969	0.973
OPERATING CONDITIONS							
AmbientTemp.	65C	75F	75F	80F	70F	80F	
Winding Temp.							
Liquid Temp.	40C	40C	43C	45C	44C	40C	42C
Pressure	1	1.2	1.8	2	3	1.5	1.5
Liquid Level	ok	ok	high	high	high	high	
GAS DIAGNOSTICS							
Rogers Ratio	0-0-0-2	0-0-0-2					
Cellulose Ratio (CO2/CO)	8.3	9.96					
IEEE/ANSI (C57.104-1991)							

COMMENTS

SUBSTATION TECHNICAL RESOURCES, INC.

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Milwaukie, Oregon
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 3	MVA:	1
Transformer No.:	R277557	Gallons:	268
Manufacturer:		PCB's	silicone
Voltage:	12470/480	% Imp.	6

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	10/18/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0	0
Hydrogen	30	26	19	13	10	0	0
Ethylene	0	0	0	0	0	0	0
Methane	9	7	5	4	3	0	0
Ethane	2	1	1	1	0	0	0
Carbon Monoxide	333	240	184	131	78	22	0
Carbon Dioxide	4635	4423	3503	2626	1671	580	460
Oxygen	6105	22150	21138	20870	32373	24101	43478
Total Combustibles	374	274	209	149	91	24	0
Total Gas	7.9%	12.32%	11.34%	11.7%	14%	9.2%	141319
OIL QUALITY							
Dielectric Break (kV)	45.7	50.2	39.7	50.9	43.6	29	31
Water in Fluid (ppm)	36.5	37	42.7	48.5	42.8	49	42
Acid Number (mg KOH/g)	0.003	0.003	0.003	0.006	0.008	0.005	0.002
Interfacial Tens.(dynes/cm)							
ASTM Color	0	0	0	0	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.965	0.962	0.969	0.9628	0.963	0.967	0.981
OPERATING CONDITIONS							
AmbientTemp.	65F	75F	75F	80F	70F	80F	
Winding Temp.							
Liquid Temp.	35C	38C	42C	42C	41C	40C	42C
Pressure	0.5	-0.5	0	0	0	0	-0.25
Liquid Level	ok	ok	high	high	high	high	
GAS DIAGNOSTICS							
Rogers Ratio	0-0-0-2	0-0-0-2					
Cellulose Ratio (CO2/CO)	13.9	18.42					
IEEE/ANSI (C57.104-1991)							

COMMENTS

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 1	MVA:	1.5
Transformer No.:	910396-A1	Gallons:	345
Manufacturer:	Square D	PCB's	rtemp
Voltage:	12470/480	% Imp.	6.3

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	10/18/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0	0
Hydrogen	4	4	4	5	4	7	3
Ethylene	14	14	15	18	19	81	5
Methane	14	14	14	16	17	46	3
Ethane	3	2	3	3	3	13	0
Carbon Monoxide	321	290	287	323	342	665	237
Carbon Dioxide	1949	2025	2159	2610	2584	3022	1378
Oxygen	33	53	68	131	63	1677	3503
Total Combustibles	356	324	323	365	385	812	248
Total Gas	4.06%	5.40%	54216	62288	67529	42953	57834
OIL QUALITY							
Dielectric Break (kV)	39.9	40.5	40.6	41.1	40.8	41	41
Water in Fluid (ppm)	4.7	13.4	4.7	9.9	5.2	8	7
Acid Number (mg KOH/g)	0.026	0.025	0.023	0.02	0.042	0.029	0.027
Interfacial Tens.(dynes/cm)	41.8	42.4	42.3	43.4	43.1	36	35
ASTM Color	L3.5	L3.6	L3.6	L3.5	L3.5	L3.5	L3.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.879	0.879	0.8781	0.879	0.8784	0.888	0.892
OPERATING CONDITIONS							
AmbientTemp.	65F	75F	71F	80F	70F	80F	
Winding Temp.							
Liquid Temp.	40C	40C	39C	41C	40c	40c	42c
Pressure	2	2.5	2	2.9	2.5	0	0.25
Liquid Level	ok	ok	ok	ok	ok	ok	
GAS DIAGNOSTICS							
Rogers Ratio							
Cellulose Ratio (CO2/CO)							
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 1	MVA:	2
Transformer No.:	910396-B1	Gallons:	390
Manufacturer:	Square D	PCB's	rtemp
Voltage:	12470/480	% Imp.	6.05

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	10/18/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0	0
Hydrogen	4	2	3	6	4	5	3
Ethylene	2	2	2	2	2	9	0
Methane	15	15	12	14	15	36	3
Ethane	4	4	3	3	3	13	0
Carbon Monoxide	411	337	323	375	412	654	190
Carbon Dioxide	2552	2379	2419	3021	4192	4147	1703
Oxygen	19	57	68	73	74	1711	16668
Total Combustibles	436	360	343	400	436	717	198
Total Gas	4.04%	4.60%	45628	52232	58144	39997	103832
OIL QUALITY							
Dielectric Break (kV)	42.1	39.4	40.3	44.4	43	39	34
Water in Fluid (ppm)	3.5	10.5	5.8	19.8	5.2	6	11
Acid Number (mg KOH/g)	0.023	0.022	0.023	0.023	0.02	0.028	0.028
Interfacial Tens.(dynes/cm)	44.3	48.4	42	44.3	44.2	35	36
ASTM Color	3	3	3	3	3	L3.5	L3.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.87	0.877	0.877	0.877	0.8765	0.885	0.889
OPERATING CONDITIONS							
AmbientTemp.	65C	75F	71F	80F	70F	80F	
Winding Temp.							
Liquid Temp.	40C	40C	38C	41C	38C	40c	42c
Pressure	0	0	-0.8	-0.2	0	0	-1
Liquid Level	ok	ok	ok	ok	ok	ok	
GAS DIAGNOSTICS							
Rogers Ratio							
Cellulose Ratio (CO2/CO)							
IEEE/ANSI (C57.104-1991)							

COMMENTS needs pressure

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 1	MVA:	2
Transformer No.:	910396-C1	Gallons:	390
Manufacturer:	Square D	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.75

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	10/18/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0	0
Hydrogen	16	19	21	27	26	44	17
Ethylene	2	1	1	2	1	6	0
Methane	10	11	9	10	12	24	6
Ethane	2	2	2	2	3	9	0
Carbon Monoxide	278	285	278	3005	310	550	296
Carbon Dioxide	2007	2263	2379	2853	3629	3540	3125
Oxygen	14	36	68	209	57	1640	1306
Total Combustibles	308	318	311	346	352	633	319
Total Gas	3.22%	4.50%	45310	50073	52887	36014	56537
OIL QUALITY							
Dielectric Break (kV)	40.1	41	46.1	42.7	42.8	34	45
Water in Fluid (ppm)	4.7	14	7	12.8	8.6	2	29
Acid Number (mg KOH/g)	0.023	0.022	0.023	0.025	0.025	0.027	0.028
Interfacial Tens.(dynes/cm)	41.6	42.3	42	42.2	42.3	36	37
ASTM Color	3	3	3	3	3	L3.5	L3.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.878	0.878	0.8776	0.879	0.8785	0.884	0.885
OPERATING CONDITIONS							
AmbientTemp.	65F	75F	81F	80F	70F	80F	
Winding Temp.							
Liquid Temp.	40C	40	39	43C	40c	40c	43c
Pressure	0	0	-0.5	0	0	-1	-1
Liquid Level	ok	ok	ok	ok	ok	ok	
GAS DIAGNOSTICS							
Rogers Ratio							
Cellulose Ratio (CO2/CO)							
IEEE/ANSI (C57.104-1991)							

COMMENTS

need pressure

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 7	MVA:	0.75
Transformer No.:	M590624TLPA	Gallons:	230
Manufacturer:	GE	PCB's	no data
Voltage:	12470/480	% Imp.	5.75

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	10/12/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	1	0	0	0	0
Hydrogen	29	36	34	40	41	73	19
Ethylene	5	4	5	5	5	15	1
Methane	13	12	12	14	15	37	5
Ethane	4	3	3	3	3	13	1
Carbon Monoxide	611	478	517	604	656	917	531
Carbon Dioxide	2430	2136	2574	3089	4176	3797	3035
Oxygen	10	81	62	1080	166	3874	3583
Total Combustibles	672	533	572	688	720	1055	557
Total Gas	3.98%	4.38%	4.82%	58424	62867	46226	65891
OIL QUALITY							
Dielectric Break (kV)	46.1	47.3	51.3	48.4	45.6	46	37
Water in Fluid (ppm)	5.1	11.7	12.5	11.4	8.5	7	17
Acid Number (mg KOH/g)	0.013	0.017	0.011	0.011	0.014	0.02	0.014
Interfacial Tens.(dynes/cm)	42.7	44.2	36.9	37.1	37.1	31	32
ASTM Color	0.5	0.5	L0.5	L0.5	L0.5	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.884	0.891	0.8918	0.8924	0.8925	0.902	0.901
OPERATING CONDITIONS							
AmbientTemp.	65F	75F	75F	80F	70F	80F	
Winding Temp.							
Liquid Temp.	30C	25C	25C	35C	26C	25C	32C
Pressure	0	-2	-3	0	-1.5	0	0
Liquid Level	ok	ok	ok	ok	ok	ok	
GAS DIAGNOSTICS							
Rogers Ratio	0-0-1-0						
Cellulose Ratio (CO2/CO)	3.98%						
IEEE/ANSI (C57.104-1991)							

COMMENTS needs pressure

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 8	MVA:	0.75
Transformer No.:	M590623TLPA	Gallons:	230
Manufacturer:	GE	PCB's	no data
Voltage:	12470/480	% Imp.	5.75

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	10/11/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0	0
Hydrogen	35	42	36	38	38	62	20
Ethylene	3	3	3	3	3	8	1
Methane	12	16	11	13	15	34	8
Ethane	3	4	2	3	3	11	0
Carbon Monoxide	516	614	477	538	609	836	502
Carbon Dioxide	1976	2616	2246	2529	3217	2748	2269
Oxygen	11	73	65	79	114	3386	3246
Total Combustibles	569	679	529	595	668	951	531
Total Gas	5.91%	5.91%	4.67%	53457	60959	44515	64744
OIL QUALITY							
Dielectric Break (kV)	43.5	53.2	50.9	46.9	41.5	36	39
Water in Fluid (ppm)	4	7	6.3	8	13	5	20
Acid Number (mg KOH/g)	0.013	0.011	0.011	0.014	0.017	0.02	0.014
Interfacial Tens.(dynes/cm)	42.1	42.1	41.1	43	38.7	30	31
ASTM Color	0.5	0.5	0.5	0.5	L0.5	L0.5	0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.8945	0.89	0.8915	0.8919	0.8925	0.898	0.898
OPERATING CONDITIONS							
AmbientTemp.	65F	75F	69F	80F	70F	80F	
Winding Temp.							
Liquid Temp.	24C	35C	30C	35C	27C	25C	27C
Pressure	0	-0.5	0	0	0		
Liquid Level			NO LG	NO LG	NA	ok	
GAS DIAGNOSTICS							
Rogers Ratio	0-0-1-0						
Cellulose Ratio (CO2/CO)	3.83						
IEEE/ANSI (C57.104-1991)							

COMMENTS needs pressure

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2005
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Crane #16	MVA:	0.5
Transformer No.:	L243299C	Gallons:	125
Manufacturer:	GE	PCB's	silicone
Voltage:	2400/480	% Imp.	

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	10/11/2005	6/19/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/24/1999
Acetylene	0	0	0	0	1	9	0
Hydrogen	97	137	124	181	172	231	65
Ethylene	1	1	1	2	1	7	0
Methane	33	56	44	56	52	131	24
Ethane	4	6	4	6	5	21	0
Carbon Monoxide	742	1165	923	1231	1288	1557	845
Carbon Dioxide	3023	5484	4756	5961	7054	6117	5087
Oxygen	248	2600	2257	802	1381	6293	12063
Total Combustibles	877	1365	1096	1476	1524	1956	924
Total Gas	5.31%	12.20%	9.80%	125501	130421	92128	129232
OIL QUALITY							
Dielectric Break (kV)	45	40.6	40.8	49.1	45	33	46
Water in Fluid (ppm)	13	8.3	9.9	14.4	11	25	20
Acid Number (mg KOH/g)	0.005	0.008	0.006	0.006	0.006	0.01	0.005
Interfacial Tens.(dynes/cm)							
ASTM Color	0	0	0	0	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.965	0.963	0.97	0.9625	0.9675	0.968	0.974
OPERATING CONDITIONS							
AmbientTemp.	65F	75F	72F	80F	70F	80F	
Winding Temp.							
Liquid Temp.	40C	35C	39C	41C	30C	40C	45C
Pressure	0	0	-0.1	0.3	0	0	0.5
Liquid Level	ok	ok	ok	ok	ok	ok	
GAS DIAGNOSTICS							
Rogers Ratio	0-0-0-0						
Cellulose Ratio (CO2/CO)	4.07						
IEEE/ANSI (C57.104-1991)							

COMMENTS needs pressure

SUBSTATION TECHNICAL RESOURCES, INC.

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Milwaukie, Oregon
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/9/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Portable 32-3	MVA:	2
Transformer No.:	87V1243	Gallons:	600
Manufacturer:	Vantram	PCB's	Rtemp
Voltage:	12470/460	% Imp.	5.7

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	11/9/2006	11/11/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000
Acetylene	0	0	0	0	0	0	0
Hydrogen	5	11	17	16	16	7	18
Ethylene	15	15	17	14	1	18	75
Methane	12	12	17	13	16	16	48
Ethane	4	3	4	4	0	5	16
Carbon Monoxide	427	470	608	479	714	333	962
Carbon Dioxide	2636	2797	3603	3372	4455	4915	6055
Oxygen	4410	260	111	81	882	82	4850
Total Combustibles	463	511	663	526	747	319	1119
Total Gas	5.22%	3.17%	5.30%	51075	76069	60933	61085
OIL QUALITY							
Dielectric Break (kV)	46.2	39	41.6	39.2	32.5	39.1	33
Water in Fluid (ppm)	9.9	15.7	15.7	29.7	15.7	21.3	7
Acid Number (mg KOH/g)	0.22	0.01	0.011	0.011	0.008	0.014	0.015
Interfacial Tens.(dynes/cm)	42.4	45.7	46	45.7	46.2	46.5	39
ASTM Color	L2.0	L2.0	1.5	1.5	1.5	1.5	L2.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.865	0.871	0.875	0.875	0.87	0.8705	0.88
OPERATING CONDITIONS							
AmbientTemp.	47F	65F	75F	69F	80F	70F	80F
Winding Temp.							
Liquid Temp.	34C	39C	45C	68C	48C	40c	40c
Pressure	0	0	0	0	0	0	npg
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio							
Cellulose Ratio (CO2/CO)	6.17	5.95	5.93				
IEEE/ANSI (C57.104-1991)							

COMMENTS

no pressure - add N2

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/9/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Portable 32-5	MVA:	1
Transformer No.:	PO15676	Gallons:	240
Manufacturer:	GE	PCB's	Silicone
Voltage:	12470/460	% Imp.	5.5

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	11/9/2006	10/11/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	0	0	0	0
Hydrogen	7	17	46	21	47	52
Ethylene	0	0	0	0	0	0
Methane	11	18	28	29	42	42
Ethane	2	3	3	2	3	0
Carbon Monoxide	239	444	662	728	1236	1254
Carbon Dioxide	4386	5205	5433	5225	5567	5849
Oxygen	23277	6877	17946	14219	5220	3851
Total Combustibles	259	482	739	780	1328	1351
Total Gas	12.81%	11.72%	11.89%	11.12%	114823	103110
OIL QUALITY						
Dielectric Break (kV)	39.2	43.5	41.1	38.4	46.7	43.5
Water in Fluid (ppm)	5.7	14.1	6.8	9.4	13.9	6.8
Acid Number (mg KOH/g)	0.005	0.005	0.006	0.008	0.006	0.011
Interfacial Tens.(dynes/cm)						
ASTM Color	0	0	0	0	0	0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.97	0.966	0.964	0.9626	0.9644	0.9628
OPERATING CONDITIONS						
AmbientTemp.	53F%	65F	75F	66F	80f	70F
Winding Temp.						
Liquid Temp.	20C	35C	30C	35C	48C	32C
Pressure						npg
Liquid Level	low	ok	ok	ok	ok	ok
GAS DIAGNOSTICS						
Rogers Ratio	1-0-0-2	1-0-0-2	1-0-0-2	1-0-0-2		
Cellulose Ratio (CO2/CO)	18.35	11.72	8.21	7.18		
IEEE/ANSI (C57.104-1991)						

COMMENTS

check oil level

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/8/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 12-1	MVA:	1
Transformer No.:	79F6711	Gallons:	316
Manufacturer:	Elect. Tech.	PCB's	Rtemp
Voltage:	12470/480	% Imp.	5.5

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	11/8/2006	10/12/2005	7/28/2004	6/16/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	2	0	0	36	0	0	0
Hydrogen	3	5	1	3	6	9	6
Ethylene	8	1	0	0	1	1	1
Methane	3	1	1	1	1	2	6
Ethane	1	0	1	0	0	0	6
Carbon Dioxide	1045	777	65	1390	589	575	63
Carbon Monoxide	63	62	15	67	55	57	577
Oxygen	4475	2214	222	35310	3968	708	68
Total Combustibles	80	69	18	108	63	69	82
Total Gas	4.94%	3.44%	1.00%	4.00%	4257100.00%	36986	40883
OIL QUALITY TESTS							
Dielectric Break	42.2	39	38.8	39.4	37	32.2	33.6
Water in Fluid	19.2	23.8	14.8	99.4	41.3	43	41.1
Acid Number	0.027	0.023	0.025	0.022	0.025	0.025	0.025
Interfacial Tens.	35.3	40.4	40.4	41.1	40	41.5	41.5
ASTM Color	L2.5	L3.0	L3.0	L3.0	L3.0	L3.0	L3.0
Visual Inspection	PASS	PASS	PASS	PASS	PASS	PASS	PASS
Specific Gravity	0.872	0.8765	0.875	0.874	0.8725	0.874	0.8735
OPERATING CONDITIONS							
AmbientTemp.	53F	55F	80F	75F	78F	80F	70F
Winding Temp.							
Liquid Temp.	28C	35C	55C	37C	41C	41C	37C
Pressure	0	0.5	1.5	0	0	0	0
Liquid Level	ok	ok	ok	low	OK	OK	LOW
GAS DIAGNOSTICS							
Rogers Ratio							
Cellulose Ratio (CO2/CO)	16.59	10.22		20.75			
IEEE/ANSI (C57.104-1991)							

COMMENTS

no pressure - add N2

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/9/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 12-4	MVA:	1
Transformer No.:	79F6714	Gallons:	316
Manufacturer:	Elect. Tech	PCB's	Rtemp
Voltage:	12470/460	% Imp.	5.5

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	11/9/2006	7/28/2004	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000
Acetylene	1	<1	1	1	1	1	4
Hydrogen	3	<1	6	5	6	5	7
Ethylene	10	<1	40	42	45	39	145
Methane	3	<1	27	24	30	28	82
Ethane	2	<1	28	29	35	31	154
Carbon Monoxide	115	<10	389	345	388	373	667
Carbon Dioxide	1120	<100	2337	2381	2783	3506	4173
Oxygen	1329	<100	95	79	109	61	4595
Total Combustibles	134	*	491	446	505	477	1059
Total Gas	3.37	*	0.043	42413	46588	46289	54942
OIL QUALITY							
Dielectric Break (kV)	41.1	43.1	44.1	34	39.2	38.8	37
Water in Fluid (ppm)	7	7.6	84.9	18.6	21.5	23.1	21
Acid Number (mg KOH/g)	0.044	0.022	0.02	0.02	0.017	0.022	0.025
Interfacial Tens.(dynes/cm)	33.7	35.1	35.6	31.1	37.5	37.6	31
ASTM Color	L5.5	L6.0	5.5	5.5	5.5	5.5	G8.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.878	0.881	0.88	0.881	0.881	0.8805	0.897
OPERATING CONDITIONS							
AmbientTemp.		80F	75F	65F	80F	70F	80F
Winding Temp.							
Liquid Temp.	25C	55C	41C	36C	48C	42C	40c
Pressure	1.5	1.5	0.5	1	2	1	0
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio							
Cellulose Ratio (CO2/CO)	9.74						
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/17/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1258
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 12-2	MVA:	1
Transformer No.:	79F67112	Gallons:	316 Rtemp
Manufacturer:	Elect. Tech	PCB's	NP
Voltage:	12470/480	% Imp.	5.5

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	11/17/2006	10/21/2005	6/16/2004	6/16/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	<1	0	0	0	0
Hydrogen	5	7	<1	5	5	3	4
Ethylene	3	4	<1	2	4	1	4
Methane	1	1	<1	3	1	0	5
Ethane	0	0	<1	1	0	3	4
Carbon Monoxide	29	65	<10	68	71	56	93
Carbon Dioxide	432	486	<100	560	633	496	604
Oxygen	9479	2003	<100	86	96	1051	67
Total Combustibles	38	77	*	79	81	63	110
Total Gas	4.44%	2.73%	*	3.69%	3.28%	36570	39427
OIL QUALITY							
Dielectric Break (kV)	33.6	37	41	42.5	35.8	40.9	42.9
Water In Fluid (ppm)	9.9	19.2	4.1	80.8	30.2	43.6	27
Acid Number (mg KOH/g)	0.049	0.023	0.022	0.022	0.023	0.023	0.042
Interfacial Tens.(dynes/cm)	31.9	32	32.9	32	32.2	32	32.7
ASTM Color	L6.0	L6.0	L6.0	L6.0	L6.0	L6.0	6
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.88	0.883	0.88	0.88	0.882	0.882	0.882
OPERATING CONDITIONS							
AmbientTemp.	40F	65F	80F	75F	70F	70F	70F
Winding Temp.							
Liquid Temp.	30C	35C	55C	32C	30C	40C	45C
Pressure	0	0	1.5	0	0	0	0
Liquid Level	ok	ok	ok	High	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio							
Cellulose Ratio (CO2/CO)	14.9	7.48	8.24				
IEEE/ANSI (C57.104-1991)							

COMMENTS

no pressure - add N2

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/17/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1258
Contact:	Ken Swingle	Class:	
Substation/Site:	32-1	MVA:	2.5
Transformer No.:	79F835	Gallons:	488 Rtemp
Manufacturer:	Elect. Tech	PCB's	NP
Voltage:	11400/480	% Imp.	6.4

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	11/17/2006	7/28/2004	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/25/1999
Acetylene	0	<1	2	3	1	1	0
Hydrogen	0	<1	21	7	6	4	3
Ethylene	1	<1	35	48	31	34	42
Methane	2	<1	5	11	7	11	1
Ethane	0	<1	5	6	4	5	3
Carbon Monoxide	24	<10	140	83	93	84	76
Carbon Dioxide	709	<100	1937	1127	967	1044	1132
Oxygen	9350	<100	1778	5282	4756	79	14614
Total Combustibles	27	*	208	158	142	139	125
Total Gas	4.38	*	4.53%	44005	46558	44186	64396
OIL QUALITY							
Dielectric Break (kV)	33.3	40.4	41.2	29.7	37.8	37.8	44
Water in Fluid (ppm)	24.4	2.3	73.8	27.9	26.2	26.5	19
Acid Number (mg KOH/g)	0.06	0.041	0.044	0.042	0.04	0.042	0.038
Interfacial Tens.(dynes/cm)	31.7	34	34.1	34	34.4	34	28
ASTM Color	L6.0	5.5	5.5	5.5	5.5	5.5	L5.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.875	0.8782	0.8778	0.8778	0.878	0.8775	0.888
OPERATING CONDITIONS							
AmbientTemp.	45F	80F	75F	74F	80F	70F	
Winding Temp.							
Liquid Temp.	40C	55C	42C	42C	54C	50C	45c
Pressure	0	1.5	0	0	0	0	2
Liquid Level	ok	HIGH	HIGH	ok	HIGH	HIGH	
GAS DIAGNOSTICS							
Rogers Ratio			0-1-2-0				
Cellulose Ratio (CO2/CO)	29.54		13.84				
IEEE/ANSI (C57.104-1991)							

COMMENTS Oil leak from H2 & H3

no pressure - repair leak and add N2

2006 Oil Analysis for Cascade General - Portland, OR

TC #	Location	S/N	Notes
1	Dry Dock #3	16121-1	needs pressure
2	Dry Dock #3	16745-1	needs pressure
3	Dry Dock #3	16121-3	
26	32-1	79F835	needs pressure - has leaks
27	Sub 4-5	79F6705	needs pressure
29	Sub 4-2	7916702	needs pressure
30	Sub 4-4	79F6704	
31	Sub 4-11	79F67011	needs pressure / add R-Temp
32	Sub 12-2	79F67112	needs pressure
33	Sub 4-3	79F9703	not tested
34	Sub 4-1	79F6701	needs pressure
35	Sub 4-12	79F67012	needs pressure
36	Sub 12-4	79F6714	
37	Sub 4-6	79F6706	needs pressure
38	Sub 4-9	79F6709	needs pressure / add R-Temp
39	Sub 4-10	79F67010	needs pressure
40	Sub 4-8	79F67081	needs pressure
41	Sub 12-1	79F6711	needs pressure
47	Dry Dock	771382	needs pressure
48	C.U.S.	SBV567601	
49	C.U.S.	SBV567602	needs pressure
50	C.U.S.	SBV567604	
51	C.U.S.	SBV567603	
52	C.U.S.	PAT716001	
53	Sub 4-7	79F67097	high moisture - no pressure
54	Sub 4	PG08188	
55	Sub 6	836002311	needs pressure

56	Sub 6	836002464	
57	Berth 308	H425083M68	not tested
58	Berth 307	H425084M68	check oil level
59	Berth 306	H425082M68	
60	Sub 7A	PQH0715	
62	Crane #14	L243297	needs pressure
63	Crane #17	L243299B	
64	Crane #16	L243299C	needs pressure
65	Crane #15	L243299A	needs pressure
66	Crane #12	L243298	needs pressure
67	Build. 73	PCT83390101	check oil level
68	Build. 73	PAT80910101	check oil level
69	BWTP	PCT786301	not tested
70	Sub 8A	POH-0714	needs pressure
71	portable	PO15676	check oil level
73	32-3 Portable	87V1243	needs pressure
74	Sub 5	PO14476	check oil level
75	Sub 5	PO14490	check oil level
76	Sub 4	PCT2521-0101	
77	Sub 3	R277558	
78	Sub 3	R277557	needs pressure
79	Sub 1	910396-A1	
80	Sub 1	910396-B1	needs pressure
81	Sub 1	910396-C1	needs pressure
82	Sub 7	M590624TLPA	needs pressure
83	Sub 8A	M590623TLPA	needs pressure

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/17/2006
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667	STR Job No.:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Dry Dock 3	MVA:	1
Transformer No.:	16121-1	Gallons:	415 Mineral
Manufacturer:	Sierra	PCB's	Cert-Non
Voltage:	12.5/0.48kV	% Imp.	

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	11/17/2006	10/21/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000
Acetylene	0	0	0	0	0	0	0
Hydrogen	4	6	4	5	5	6	8
Ethylene	4	4	2	3	3	3	9
Methane	3	2	2	2	2	2	5
Ethane	1	1	0	0	0	1	2
Carbon Monoxide	288	265	196	241	236	271	463
Carbon Dioxide	2373	2233	1849	2608	2634	3000	2522
Oxygen	8094	1773	3871	7647	8019	14222	10690
Total Combustibles	300	278	204	251	246	283	487
Total Gas	7.16%	3.59%	4.23%	0.0569	60171	80888	60062
OIL QUALITY							
Dielectric Break (kV)	53	43.8	47	51.3	49.4	43.8	41
Water in Fluid (ppm)	5.7	7.4	4.5	9.7	11.4	10.3	4
Acid Number (mg KOH/g)	0.008	0.005	0.006	0.003	0.003	0.006	0.008
Interfacial Tens.(dynes/cm)	41.8	43.3	44.1	38.8	36.7	42.3	36
ASTM Color	L1.0	L1.0	L1.0	L1.0	1	1	L1.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.878	0.878	0.876	0.877	0.877	0.0876	0.882
OPERATING CONDITIONS							
AmbientTemp.	47F	60F	75F	79F	80F	70F	80F
Winding Temp.							
Liquid Temp.	25C	30C	30C	36C	43C	36C	30c
Pressure	-1.5	-2	-1.5	-1	-0.2	0	-1
Liquid Level	ok	ok	low	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0-0-2-0	0-0-2-0	0-0-2-0	0-0-2-0			
Cellulose Ratio (CO2/CO)	8.24	8.43	9.43	10.82			
IEEE/ANSI (C57.104-1991)							

COMMENTS

negative pressure- add N2

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/17/2006
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667	STR Job No.:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Dry Dock 3	MVA:	1.5
Transformer No.:	16745-1	Gallons:	327 Mineral
Manufacturer:	Sierra	PCB's	Cert-Non
Voltage:	12.5/0.5kV	% Imp.	

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	11/17/2006	10/21/2005	6/19/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000
Acetylene	0	0	0	0	0	0	0
Hydrogen	7	10	12	2	8	11	14
Ethylene	20	18	16	13	16	59	44
Methane	6	5	5	3	5	5	12
Ethane	1	1	1	1	1	1	2
Carbon Monoxide	577	562	520	149	499	606	817
Carbon Dioxide	2437	2648	2850	2951	3524	5669	4774
Oxygen	2324	342	1019	11059	3753	3488	6444
Total Combustibles	611	596	544	168	529	682	889
Total Gas	5.89%	3.78%	5.25%	0.0574	60238	68142	57266
OIL QUALITY							
Dielectric Break (kV)	48.2	45.7	49	50.8	46.8	44.5	48
Water in Fluid (ppm)	9.1	9	6.3	18.2	15.3	15.3	16
Acid Number (mg KOH/g)	0.008	0.008	0.008	0.008	0.008	0.008	0.011
Interfacial Tens.(dynes/cm)	37.9	44.8	46.2	39	39.2	37.6	35
ASTM Color	L1.5	L1.5	L1.5	1	1	1	L1.5
Visual Inspection	pass	pass	pass	pass	pass	pass	pass
Specific Gravity	0.875	0.8775	0.876	0.876	0.8774	0.08755	0.883
OPERATING CONDITIONS							
AmbientTemp.	47F	60F	75F	79F	80F	70F	80F
Winding Temp.							
Liquid Temp.	20C	40C	40C	52C	52c	54C	45c
Pressure	0	0	-1	-0.5	-0.5	-1	-1.5
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0-0-2-0	0-0-2-0	0-0-2-0	1-0-2-0			
Cellulose Ratio (CO2/CO)	4.22	4.71	5.48	19.81			
IEEE/ANSI (C57.104-1991)							

COMMENTS

no pressure - add N2

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No.:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Dry Dock 3	MVA:	1
Transformer No.:	16121-3	Gallons:	415 Mineral
Manufacturer:	Sierra	PCB's	Cert-Non
Voltage:	12.5/0.48kV	% Imp.	

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	11/11/2006	10/12/2005	6/19/2004	8/5/2003	11/14/2002	8/12/2002	9/11/2001
Acetylene	1	1	1	1	0	35	16
Hydrogen	3	3	0	2	2	86	53
Ethylene	11	11	11	9	0	758	472
Methane	3	3	2	2	0	284	177
Ethane	2	1	1	1	1	93	53
Carbon Monoxide	83	66	33	16	2	274	282
Carbon Dioxide	1933	1491	868	471	346	2815	2846
Oxygen	14693	3316	11042	10706	1989	7615	11160
Total Combustibles	103	85	48	31	5	1530	1053
Total Gas	10.91%	4.8%	7.17%	0.058	46791	66940	72780
OIL QUALITY							
Dielectric Break (kV)	43.9	39.3	45.2	48.2	42.5	30	40
Water in Fluid (ppm)	10.8	23.3	14.2	27.3	6	39.8	22.2
Acid Number (mg KOH/g)	0.003	0.008	0.008	0.003	0.003	0.006	0.0008
Interfacial Tens.(dynes/cm)	43.4	43.5	49.4	39.8	49.2	41.7	39.1
ASTM Color	L0.5	L0.5	L0.5	L1.0	0	1	1
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.885	0.886	0.885	0.885	0.8938	0.876	0.8754
OPERATING CONDITIONS							
AmbientTemp.	47F	60F	75F	79F	60F	80F	70F
Winding Temp.							
Liquid Temp.	20C	30C	28C	40C	40C	40C	35C
Pressure		1.5	1.5	2.5	1	0.5	0
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	1-0-2-0	1-0-2-0	2-0-2-0				
Cellulose Ratio (CO2/CO)	23.29	22.59	26.24				
IEEE/ANSI (C57.104-1991)							

COMMENTS

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/9/2006
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667	STR Job No:	1258
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-5	MVA:	1
Transformer No.:	79F670-05	Gallons:	316 Rtemp
Manufacturer:		PCB's	NP
Voltage:	12000-480	% Imp.	

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	11/9/2006	6/16/2004	5/27/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	29	29	29	0	0	0	0
Hydrogen	41	71	32	5	4	12	4
Ethylene	14	16	14	1	2	9	1
Methane	13	31	9	6	9	17	5
Ethane	2	23	2	6	11	19	4
Carbon Monoxide	41	54	30	77	66	243	117
Carbon Dioxide	934	987	963	1354	1217	2594	2384
Oxygen	5405	224	1928	116	62	4640	2316
Total Combustibles	140	224	116	95	92	300	131
Total Gas	4.46%	4.00%	0.0486	39000	33439	50838	57961
OIL QUALITY							
Dielectric Break (kV)	34.4	43.1	38.4	38	38.7	39	46
Water in Fluid (ppm)	6.4	61.6	19	20.9	21.3	12	27
Acid Number (mg KOH/g)	0.035	0.028	0.037	0.023	0.025	0.029	0.029
Interfacial Tens.(dynes/cm)	33.8	39.2	39	37.8	37	29	28
ASTM Color	L6.0	6	5.5	6	6	G8.0	L5.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.881	0.882	0.8815	0.883	0.883	0.899	0.899
OPERATING CONDITIONS							
AmbientTemp.	55F	75F	60F	80F	70F	80F	
Winding Temp.							
Liquid Temp.	5C	22C		40C	38C	35c	35c
Pressure	0	0	0	0	0	0	0.5
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio							
Cellulose Ratio (CO2/CO)	22.78						
IEEE/ANSI (C57.104-1991)							

COMMENTS Need to add nitrogen or maybe unit has leak.

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/9/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1867	STR Job No:	1258
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-2	MVA:	0.33
Transformer No.:	7916702	Gallons:	176 Rtemp
Manufacturer:	Elect. Tech	PCB's	
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	11/9/2006	10/12/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000
Acetylene	0	0	6	0	0	0	0
Hydrogen	15	9	11	9	15	2	0
Ethylene	0	1	15	1	1	1	2
Methane	2	4	1	5	5	7	2
Ethane	1	3	0	5	6	9	3
Carbon Monoxide	85	122	88	74	41	42	92
Carbon Dioxide	1016	1176	1062	967	638	577	1005
Oxygen	3591	11	73	68	97	77	10084
Total Combustibles	103	139	121	94	68	61	96
Total Gas	3.52%	2.63%	0.041	41103	41682	32969	52215
OIL QUALITY							
Dielectric Break (kV)	41.8	39.9	41.5	42.7	44.8	44.9	32
Water in Fluid (ppm)	16.8	18	40.1	18	19.8	17.8	14
Acid Number (mg KOH/g)	0.03	0.023	0.022	0.025	0.025	0.025	0.02
Interfacial Tens.(dynes/cm)	31.9	32.5	32.6	32.1	32.7	32.6	26
ASTM Color	L5.5	5.5	5.5	5.5	5.5	5.5	L5.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.88	0.885	0.8825	0.883	0.884	0.8835	0.892
OPERATING CONDITIONS							
AmbientTemp.	55F	55F	75F	79F	80F	70F	80F
Winding Temp.							
Liquid Temp.	5C	35C	30C	38C	29C	18C	35c
Pressure	0	0	0	2	1	0	0
Liquid Level	ok	ok	low	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio							
Cellulose Ratio (CO2/CO)	11.95	9.64	12.07				
IEEE/ANSI (C57.104-1991)							

COMMENTS

no pressure - add N2

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/9/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job:	1258
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-4	MVA:	0.33
Transformer No.:	79F6704	Gallons:	176 Rtemp
Manufacturer:	Elect. Tech	PCB's	NP
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	11/9/2006	10/11/2005	7/28/2004	6/16/2004	8/12/2002	8/12/2002	9/11/2001
Acetylene	0	1	<1	0	1	1	0
Hydrogen	11	7	<1	5	4	7	0
Ethylene	5	4	<1	17	22	21	2
Methane	2	2	<1	3	3	4	1
Ethane	0	0	<1	3	3	3	1
Carbon Monoxide	96	76	<10	88	112	111	5
Carbon Dioxide	1027	860	<100	1614	1853	1931	113
Oxygen	2952	441	<100	64	122	97	2
Total Combustibles	114	90	*	116	117	147	9
Total Gas	4.13%	2.89%	*	3.58%	3.8%	3.9%	1.5%
OIL QUALITY							
Dielectric Break (kV)	45.7	38.4	42	42.2	40	34.8	37.8
Water in Fluid (ppm)	1.2	76.7	4	93.6	18	22.7	19
Acid Number (mg KOH/g)	0.065	0.026	0.022	0.025	0.025	0.02	0.028
Interfacial Tens.(dynes/cm)	35	37	36.7	36.9	37	37.7	38
ASTM Color	L5.5	L5.5	L5.5	L5.5	5.5	5.5	5.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.878	0.88	0.8815	0.88	0.8828	0.883	0.8825
OPERATING CONDITIONS							
AmbientTemp.	52F	52F	80F	75F	78F	80F	70F
Winding Temp.							
Liquid Temp.	25C	35C	55C	30C	38C	36C	38C
Pressure	3	0	1.5	0	0.5	0	0
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio							
Cellulose Ratio (CO2/CO)	10.7	11.32		18.34			
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/9/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1258
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-11	MVA:	0.33
Transformer No.:	79F6701	Gallons:	176 Rtemp
Manufacturer:	Elect. Tech	PCB's	NP
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	11/9/2006	10/11/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000
Acetylene	0	0	0	0	0	0	0
Hydrogen	25	24	20	5	12	15	22
Ethylene	4	4	4	4	5	5	19
Methane	6	5	14	7	10	16	28
Ethane	5	5	17	6	10	14	21
Carbon Monoxide	117	111	109	96	75	113	262
Carbon Dioxide	1770	1529	1872	1965	2061	2727	3118
Oxygen	4750	19	51	69	62	70	4220
Total Combustibles	157	149	164	118	112	163	372
Total Gas	4.81%	2.51%	0.0394	40811	41897	50768	52072
OIL QUALITY							
Dielectric Break (kV)	47.1	34.9	40.6	26	33.8	30	34
Water in Fluid (ppm)	8.1	16.9	36	22.1	14.5	22.4	8
Acid Number (mg KOH/g)	0.038	0.023	0.022	0.023	0.02	0.02	0.02
Interfacial Tens.(dynes/cm)	33.8	33.3	33	32.2	33	33.9	28
ASTM Color	L6.0	L6.0	L6.0	L6.0	5.5	5.5	G8.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.88	0.882	0.882	0.882	0.886	0.886	0.897
OPERATING CONDITIONS							
AmbientTemp.	50F	65F	75F	70F	80F	70F	80F
Winding Temp.							
Liquid Temp.	10C	35C	30C	30C	40C	40C	35c
Pressure	0	0	0	0	1	0	0
Liquid Level	low	low	low	low	low	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio							
Cellulose Ratio (CO2/CO)	15.13	13.77	17.17				
IEEE/ANSI (C57.104-1991)							

COMMENTS

no pressure - add N2

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/11/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 4-1	MVA:	0.33
Transformer No.:	79F9701	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	Rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	11/11/2006	10/11/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000
Acetylene	0	0	0	0	0	0	0
Hydrogen	14	36	8	5	9	33	15
Ethylene	2	3	1	3	2	3	9
Methane	1	1	2	2	2	3	7
Ethane	0	0	1	0	0	2	4
Carbon Monoxide	19	37	47	66	57	75	173
Carbon Dioxide	400	454	429	571	463	733	716
Oxygen	8995	2189	98	42	56	105	711
Total Combustibles	36	77	59	76	70	116	208
Total Gas	4.42%	2.45%	4.00%	4.04%	3.46%	42632	27904
OIL QUALITY							
Dielectric Break (kV)	43.2	39.7	41.5	46.7	42	42.5	44
Water in Fluid (ppm)	24.4	23.2	18.6	29.7	26.7	25.9	26
Acid Number (mg KOH/g)	0.046	0.029	0.028	0.031	0.031	0.028	0.031
Interfacial Tens.(dynes/cm)	30.7	33.1	33.2	33.5	33.5	33.4	25
ASTM Color	L5.5	6	6	6	6	6	G8.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.88	0.8825	0.882	0.8815	0.881	0.8808	0.893
OPERATING CONDITIONS							
AmbientTemp.	50F	65F	75F	65F	80F	70F	80F
Winding Temp.							
Liquid Temp.	25C	35F	30C	30C	42C	40c	40c
Pressure	0	0	0	0	0	0	0
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio							
Cellulose Ratio (CO2/CO)	21.05	12.27	9.13				
IEEE/ANSI (C57.104-1991)							

COMMENTS

no pressure - add N2

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/9/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 4-12	MVA:	0.33
Transformer No.:	79F97012	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	Rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	11/9/2006	10/12/2005	7/28/2004	6/16/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	<1	0	0	0	0
Hydrogen	6	10	<1	142	17	7	12
Ethylene	5	5	<1	12	8	6	4
Methane	1	1	<1	15	4	3	9
Ethane	0	0	<1	12	2	1	10
Carbon Monoxide	37	60	<10	116	86	85	85
Carbon Dioxide	874	719	<100	2117	1503	1173	987
Oxygen	8532	1203	<100	74	122	233	94
Total Combustibles	49	76	*	297	117	102	120
Total Gas	4.98%	2.98%	*	4.52%	3.8%	4.1%	41520
OIL QUALITY							
Dielectric Break (kV)	45	38.5	40	39.7	38	38.5	38.3
Water in Fluid (ppm)	23.8	26.2	8.7	107	69.7	38.4	40.8
Acid Number (mg KOH/g)	0.03	0.023	0.022	0.022	0.023	0.023	0.025
Interfacial Tens.(dynes/cm)	31.9	32.3	32.3	32.2	32.4	32	32.2
ASTM Color	L5.0	5.5	5.5	5.5	5.5	5.5	5.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.88	0.8835	0.882	0.8815	0.8825	0.883	0.883
OPERATING CONDITIONS							
AmbientTemp.	50F	65F	80F	75F	78F	80F	70F
Winding Temp.							
Liquid Temp.	25C	35C	55C	30C	38C	40C	38C
Pressure	0	0	1.5	0	0	0	0
Liquid Level	ok	ok	ok	low	low	low	low
GAS DIAGNOSTICS							
Rogers Ratio							
Cellulose Ratio (CO2/CO)	23.62	11.98		18.25			
IEEE/ANSI (C57.104-1991)							

COMMENTS

no pressure - add N2

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/9/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No.:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 4-6	MVA:	0.33
Transformer No.:	79F6706	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	Rtemp
Voltage:	12470/460	% Imp.	5.1

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	11/9/2006	10/11/2005	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/26/1999
Acetylene	0	1	1	0	0	0	0
Hydrogen	21	21	7	8	6	17	4
Ethylene	2	2	2	1	2	4	0
Methane	4	3	5	6	10	4	0
Ethane	1	1	4	6	11	6	0
Carbon Monoxide	160	128	71	103	79	145	64
Carbon Dioxide	1422	1588	1821	1711	1555	1841	1654
Oxygen	730	220	71	194	115	8873	2452
Total Combustibles	188	156	90	124	108	176	68
Total Gas	3.93%	4.9%	4.9%	4.5%	5.8%	5.3%	5.1%
OIL QUALITY							
Dielectric Break (kV)	45.2	40	38.5	36.5	35.5	40	46
Water In Fluid (ppm)	11.6	19.8	25.6	27.3	26.4	22	19
Acid Number (mg KOH/g)	0.041	0.023	0.025	0.023	0.028	0.027	0.029
Interfacial Tens.(dynes/cm)	31.7	32.2	34.1	34.4	34.5	27	28
ASTM Color	L6.0	L6.0	5.5	5.5	5.5	G8.0	L5.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.875	0.883	0.884	0.882	0.8815	0.896	0.895
OPERATING CONDITIONS							
AmbientTemp.	55F%	65F	70F	80F	70F	80F	
Winding Temp.							
Liquid Temp.	22C	35C	30C	42C	40c	40c	35c
Pressure	0	1.5	2.5	3.5	0.5	0.5	0.5
Liquid Level	ok	ok	low	low	low	low	
GAS DIAGNOSTICS							
Rogers Ratio	8.89	12.41	19.48				
Cellulose Ratio (CO2/CO)							
IEEE/ANSI (C57.104-1991)							

COMMENTS

no pressure - add N2

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/9/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 4-9	MVA:	0.33
Transformer No.:	79F6709	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	Rtemp
Voltage:	12470/460	% Imp.	5.1

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	11/9/2006	10/11/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000
Acetylene	0	0	0	0	0	0	0
Hydrogen	75	40	9	20	13	21	52
Ethylene	3	3	3	3	3	3	14
Methane	6	5	10	11	11	14	40
Ethane	3	3	7	8	7	7	23
Carbon Monoxide	134	119	116	145	149	193	581
Carbon Dioxide	1603	1613	1903	2281	2358	3430	4425
Oxygen	1876	18	52	59	119	80	4863
Total Combustibles	221	170	145	187	183	238	710
Total Gas	4.12%	2.53%	4.40%	4.4%	4.3%	54048	59075
OIL QUALITY							
Dielectric Break (kV)	46.1	37.4	37.7	41.7	40.8	40.4	39
Water in Fluid (ppm)	9.3	14	16.9	21.5	22.7	17.2	9
Acid Number (mg KOH/g)	0.041	0.021	0.022	0.023	0.023	0.02	0.022
Interfacial Tens.(dynes/cm)	31.9	36.9	37.1	37	37	37.1	31
ASTM Color	L6.0	L6.0	5.5	5.5	5.5	5.5	L5.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.88	0.882	0.882	0.882	0.881	0.881	0.895
OPERATING CONDITIONS							
AmbientTemp.	55F	65F	75F	60F	80F	70F	80F
Winding Temp.							
Liquid Temp.	30C	35C	30C	36C	50C	40C	35c
Pressure	0	0	0	0	0	0.5	0
Liquid Level	low	ok	ok	Low	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio							
Cellulose Ratio (CO2/CO)	11.96	13.54	16.41	15.73			
IEEE/ANSI (C57.104-1991)							

COMMENTS

no pressure - add N2

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/9/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No.:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 4-10	MVA:	0.33
Transformer No.:	79F67010	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	Rtemp
Voltage:	12470/460	% Imp.	5.1

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	11/9/2006	10/11/2005	7/28/2004	6/16/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	<1	0	0	0	0
Hydrogen	34	10	<1	382	23	23	20
Ethylene	1	1	<1	3	3	3	2
Methane	2	2	<1	9	9	9	8
Ethane	1	1	<1	6	5	5	4
Carbon Monoxide	79	38	<10	113	118	119	108
Carbon Dioxide	653	287	<100	1312	1152	1188	999
Oxygen	474	73	<100	68	91	83	73
Total Combustibles	117	52	*	513	158	159	142
Total Gas	3.65	2.22%	*	4.77%	50412	51019	45638
OIL QUALITY							
Dielectric Break (kV)	46	35.9	40.9	42.8	34.3	34.9	34.4
Water in Fluid (ppm)	8.7	21.5	4	68.6	11.6	10.5	25
Acid Number (mg KOH/g)	0.022	0.021	0.025	0.02	0.02	0.011	0.02
Interfacial Tens.(dynes/cm)	34.4	35.4	35	35.1	34	36	36.1
ASTM Color	L4.5	L5.0	L5.0	L5.0	L5.0	L5.0	L5.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.88	0.882	0.8815	0.881	0.881	0.883	0.883
OPERATING CONDITIONS							
AmbientTemp.	56F	65F	80F	75F	78F	80F	70F
Winding Temp.							
Liquid Temp.	25C	20C	55C	35C	40C	40C	40C
Pressure	0	-1	1.5	0	0.1	1	0.5
Liquid Level	ok	ok	ok	low	ok	ok	low
GAS DIAGNOSTICS							
Rogers Ratio							
Cellulose Ratio (CO2/CO)	8.27	7.55		11.61			
IEEE/ANSI (C57.104-1991)							

COMMENTS

no pressure - add N2

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/8/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 4-8	MVA:	0.33
Transformer No.:	79F6708	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	Rtemp
Voltage:	12470/460	% Imp.	5.1

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	11/8/2006	10/11/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000
Acetylene	7	11	12	10	12	13	43
Hydrogen	41	54	497	44	34	44	56
Ethylene	252	366	385	365	385	435	793
Methane	46	61	68	61	66	75	178
Ethane	33	49	43	39	45	49	168
Carbon Monoxide	159	203	187	177	183	207	478
Carbon Dioxide	1113	1764	1925	1875	1852	1995	2010
Oxygen	33	15	136	71	178	81	4556
Total Combustibles	538	744	1192	696	725	823	1716
Total Gas	3.32%	3.41%	5.00%	4.7%	5.1%	63741	52831
OIL QUALITY							
Dielectric Break (kV)	39.7	33	32.9	34.3	35	35.5	33
Water in Fluid (ppm)	15.1	20.9	36	20.9	29.7	15.5	14
Acid Number (mg KOH/g)	0.035	0.031	0.031	0.031	0.028	0.036	0.031
Interfacial Tens.(dynes/cm)	34.4	35	35.1	34.7	35.5	35.7	28
ASTM Color	L2.5	L2.0	L2.0	L2.0	2.5	2.5	L2.0
Visual Inspection	*Fail	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.88	0.8835	0.881	0.881	0.882	0.8815	0.894
OPERATING CONDITIONS							
AmbientTemp.	53F	65F	75F	70F	80F	70F	80F
Winding Temp.							
Liquid Temp.	25C	35C	33C	30C	45C	40c	40c
Pressure	-0.2	0	0	0	1.5	1.5	-1
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio							
Cellulose Ratio (CO2/CO)	7	8.69	10.29				
IEEE/ANSI (C57.104-1991)							

COMMENTS

negative pressure - add N2

slight debris in sample

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/6/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Dry Dock	MVA:	1
Transformer No.:	771382	Gallons:	310
Manufacturer:	United Power	PCB's	Cert-Non
Voltage:	NP	% Imp.	

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	11/6/2006	10/18/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000
Acetylene	20	22	23	23	25	25	96
Hydrogen	27	40	38	34	36	34	45
Ethylene	9	9	9	8	8	7	23
Methane	22	22	23	21	21	20	29
Ethane	5	5	4	4	4	4	14
Carbon Monoxide	536	607	557	509	473	437	604
Carbon Dioxide	2387	2933	3173	3489	3652	4637	3964
Oxygen	3066	568	829	4328	4645	8500	9375
Total Combustibles	619	705	654	599	567	527	811
Total Gas	5.57%	4.19%	6.06%	0.062	65953	74225	62356
OIL QUALITY							
Dielectric Break (kV)	53.3	50.2	53.5	51.4	46.9	45.4	44
Water in Fluid (ppm)	6.8	9.7	7.4	13.1	20.5	12.5	5
Acid Number (mg KOH/g)	0.003	0.005	0.006	0.003	0.003	0.011	0.002
Interfacial Tens.(dynes/cm)	47.5	46.9	51.5	44.4	45.9	48.6	41
ASTM Color	L0.5	L0.5	L0.5	L0.5	0.5	0	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.875	0.878	0.8765	0.8775	0.8785	0.8785	0.886
OPERATING CONDITIONS							
AmbientTemp.	64F	65F	75F	70F	80F	70F	80F
Winding Temp.							
Liquid Temp.	45C	40C	40C	45C	54C	47C	40C
Pressure	0	0	0	0.25	0	0	0
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0-0-1-1	0-0-1-1	0-0-1-1	0-0-1-1			
Cellulose Ratio (CO2/CO)	4.45	4.83	5.7	6.85			
IEEE/ANSI (C57.104-1991)							

COMMENTS

no pressure - add N2

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/8/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	C.U.S.	MVA:	1.5
Transformer No.:	SBV567601	Gallons:	259
Manufacturer:	West.	PCB's	Cert-Non
Voltage:	12470/240	% Imp.	5.5

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	11/8/2006	10/18/2005	6/19/2004	8/5/2003	8/12/2002	9/11/2001	6/24/2000
Acetylene	0	0	0	0	0	0	0
Hydrogen	7	14	11	8	8	11	15
Ethylene	17	17	18	18	17	19	67
Methane	12	11	12	10	10	11	25
Ethane	2	2	2	2	1	2	6
Carbon Monoxide	473	487	481	326	381	492	765
Carbon Dioxide	3039	3159	3467	2764	3077	3569	3399
Oxygen	3135	148	141	266	613	517	4625
Total Combustibles	511	531	524	364	417	535	878
Total Gas	10.57%	6.5%	9.25%	5.72%	7.4%	9.3%	6.8%
OIL QUALITY							
Dielectric Break (kV)	44.1	45.6	43.7	50.4	43.2	45.1	42
Water in Fluid (ppm)	2.3	4.5	6	8.5	7.4	4	2
Acid Number (mg KOH/g)	0.016	0.021	0.022	0.014	0.017	0.025	0.028
Interfacial Tens.(dynes/cm)	32.2	38.8	38.9	36.1	35.9	37.1	31
ASTM Color	L2.0	L2.0	L2.0	1.5	1.5	L2.0	L2.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.872	0.874	0.871	0.872	0.8725	0.8715	0.881
OPERATING CONDITIONS							
AmbientTemp.	50F%	65F	75F	70F	80F	70F	80F
Winding Temp.							
Liquid Temp.	10C	25C	15	32C	45C	35C	40c
Pressure	2.5	3	3.5	4.5	5	4.5	0
Liquid Level	ok	ok	low	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	1-0-2-0	0-0-2-0	1-0-2-0	1-0-2-0			
Cellulose Ratio (CO2/CO)	6.42%	6.49%	7.21%	8.48%			
IEEE/ANSI (C57.104-1991)							

COMMENTS

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/8/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	C.U.S.	MVA:	1.5
Transformer No.:	SBV567602	Gallons:	259
Manufacturer:	West.	PCB's	Cert-Non
Voltage:	12470/240	% Imp.	5.47

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	11/8/2006	10/18/2005	6/19/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000
Acetylene	0	0	0	0	0	0	0
Hydrogen	9	10	11	11	9	11	25
Ethylene	31	26	31	33	28	33	113
Methane	9	8	10	10	9	11	30
Ethane	2	26	2	2	1	2	6
Carbon Monoxide	667	589	678	678	555	750	1204
Carbon Dioxide	3112	3166	3955	4472	4150	8100	8179
Oxygen	4299	911	2158	3730	4461	4819	7605
Total Combustibles	718	635	732	734	602	807	1378
Total Gas	6.97%	5.4%	6.79%	6.93%	6.4%	8.1%	6.7%
OIL QUALITY							
Dielectric Break (kV)	44.4	44.6	47.6	52.3	43.6	45.6	39
Water in Fluid (ppm)	5.7	4.5	6	7.4	8.5	2.3	5
Acid Number (mg KOH/g)	0.03	0.018	0.025	0.011	0.014	0.008	0.023
Interfacial Tens.(dynes/cm)	33.6	35.3	38.3	34.4	34.3	34.3	30
ASTM Color	L2.0	L2.0	L2.0	1.5	1.5	L1.5	L1.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.875	0.8735	0.8715	0.872	0.8725	0.8715	0.875
OPERATING CONDITIONS							
AmbientTemp.	50F	65F	75F	70F	80F	70F	80F
Winding Temp.							
Liquid Temp.	30C	35C	31C	40C	45C	40C	40c
Pressure	-0.5	0	0	0	1	0.5	0
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	1-0-2-0	0-0-2-0	0-0-2-0	0-0-2-0			
Cellulose Ratio (CO2/CO)	4.67	5.38	5.83	6.6			
IEEE/ANSI (C57.104-1991)							

COMMENTS

negative pressure - add N2

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/8/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	C.U.S.	MVA:	1.5
Transformer No.:	SBV567604	Gallons:	259
Manufacturer:	West.	PCB's	Cert-Non
Voltage:	12470/240	% Imp.	5.47

Lab Used	JACO	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	11/8/2006	10/18/2005	6/19/2004	8/5/2003	8/12/2002
Acetylene	0	0	0	0	0
Hydrogen	8	12	13	8	10
Ethylene	23	25	25	26	21
Methane	10	11	12	11	10
Ethane	2	2	2	2	2
Carbon Monoxide	549	566	616	477	559
Carbon Dioxide	2731	3145	3647	3274	3659
Oxygen	1894	229	247	572	540
Total Combustibles	592	616	668	524	602
Total Gas	8.21%	5.47%	8.64%	6.24%	7.4%
OIL QUALITY					
Dielectric Break (kV)	41	42.6	40.9	45.9	44.6
Water in Fluid (ppm)	2.8	9.7	11.9	9.1	5.1
Acid Number (mg KOH/g)	0.019	0.021	0.022	0.02	0.023
Interfacial Tens.(dynes/cm)	32.9	39.7	38.2	44	44.6
ASTM Color	L2.0	L2.0	L2.0	L1.5	1.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.873	0.875	0.871	0.871	0.8725
OPERATING CONDITIONS					
AmbientTemp.	50F	65F	75F	70F	80F
Winding Temp.					
Liquid Temp.	30C	30C	30C	39C	45C
Pressure	1.2	2	2	3	4.2
Liquid Level	ok	ok	ok	ok	ok
GAS DIAGNOSTICS					
Rogers Ratio	1-0-2-0	0-0-2-0	0-0-2-0	1-0-2-0	
Cellulose Ratio (CO2/CO)	4.97	5.56	5.92	6.86	
IEEE/ANSI (C57.104-1991)					

COMMENTS

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/8/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	C.U.S.	MVA:	1.5
Transformer No.:	SBV567603	Gallons:	259
Manufacturer:	West.	PCB's	Cert-Non
Voltage:	12470/240	% Imp.	5.51

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	11/8/2006	10/18/2005	6/19/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000
Acetylene	0	0	0	0	0	0	0
Hydrogen	9	12	13	8	11	13	12
Ethylene	21	21	21	22	24	22	62
Methane	11	11	11	10	11	11	24
Ethane	2	2	2	2	2	2	5
Carbon Monoxide	661	681	685	486	542	673	846
Carbon Dioxide	3403	3500	3864	3221	3609	4435	3542
Oxygen	3853	164	206	501	556	853	5320
Total Combustibles	704	727	732	528	590	721	949
Total Gas	10.90%	8.47%	9.53%	6.15%	7.30%	9.30%	5.40%
OIL QUALITY							
Dielectric Break (kV)	44.8	46.5	43	46.6	49.4	40.4	40
Water in Fluid (ppm)	3.4	3.4	2.3	8	5.7	8	6
Acid Number (mg KOH/g)	0.024	0.023	0.031	0.02	0.023	0.022	0.03
Interfacial Tens.(dynes/cm)	35.4	39.3	39.4	35.8	35.7	36.9	31
ASTM Color	L2.0	L2.0	L2.0	L1.5	1.5	L2.0	L2.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.875	0.8735	0.871	0.871	0.8732	0.8725	0.88
OPERATING CONDITIONS							
AmbientTemp.	65F	65F	75F	70F	80F	70F	80F
Winding Temp.							
Liquid Temp.	25C	25C	15	31C	42C	33C	30c
Pressure	4	4	4	4.5	5.2	5	-1
Liquid Level			low	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	1-0-2-0	0-0-2-0	0-0-2-0	1-0-2-0			
Cellulose Ratio (CO2/CO)	5.15%	5.14%	5.64	6.63			
IEEE/ANSI (C57.104-1991)							

COMMENTS

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/8/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	C.U.S.	MVA:	1
Transformer No.:	PAT716001	Gallons:	224
Manufacturer:	West.	PCB's	Cert-Non
Voltage:	12470/480	% Imp.	5.81

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	11/8/2006	10/18/2005	6/19/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000
Acetylene	0	0	0	0	0	0	0
Hydrogen	7	13	18	10	15	12	19
Ethylene	10	11	15	16	15	17	48
Methane	13	13	15	12	11	11	26
Ethane	8	6	5	4	2	2	5
Carbon Monoxide	405	495	579	448	488	536	827
Carbon Dioxide	2066	2867	3672	3185	3315	3834	3024
Oxygen	78	29	150	158	182	230	5555
Total Combustibles	443	538	632	490	531	578	925
Total Gas	5.71%	5.32%	8.98%	6.39%	72997	79845	57173
OIL QUALITY							
Dielectric Break (kV)	42.4	48.3	45.6	50.2	45.6	39.4	48
Water in Fluid (ppm)	3.4	6.8	2	2.8	6.8	3.4	4
Acid Number (mg KOH/g)	0.027	0.026	0.037	0.02	0.023	0.034	0.028
Interfacial Tens.(dynes/cm)	33	38.9	38.6	34.5	34.3	35.4	31
ASTM Color	L2.0	L2.0	L2.0	L1.5	1.5	2	L1.5
Visual Inspection	*Fail	Pass	Pass	Pass	Pass	2	Pass
Specific Gravity	0.875	0.875	0.872	0.872	0.8725	0.873	0.878
OPERATING CONDITIONS							
AmbientTemp.	50F	65F	75F	70F	80F	70F	80F
Winding Temp.							
Liquid Temp.	10C	25C	15C	21C	36C	21C	30C
Pressure	1	2	2.8	3	4	3	-1
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	1-0-1-0	1-0-1-0	1-0-2-0	1-0-2-0			
Cellulose Ratio (CO2/CO)	5.1	5.79	6.34	7.11			
IEEE/ANSI (C57.104-1991)							

COMMENTS

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/8/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 4-7	MVA:	0.33
Transformer No.:	79F670-71	Gallons:	176
Manufacturer:	Elect. Tech.	PCB's	Rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	11/8/2006	10/12/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/25/2000
Acetylene	0	0	0	0	0	0	0
Hydrogen	35	14	22	23	31	6	3
Ethylene	0	0	0	1	1	1	0
Methane	1	1	5	5	4	11	14
Ethane	0	0	6	5	3	13	13
Carbon Dioxide	496	393	395	492	605	513	1129
Carbon Monoxide	19	31	37	54	62	56	88
Oxygen	9747	2215	56	59	81	113	2829
Total Combustibles	55	46	70	88	101	87	118
Total Gas	4.84%	2.9%	3.05%	3.3%	3.8%	4.1%	59313
OIL QUALITY TESTS							
Dielectric Break	36.7	42	47.5	42.7	41.8	41.6	46
Water In Fluid	66.3	20.9	33.1	29.7	36.6	29.9	26
Acid Number	0.038	0.023	0.022	0.023	0.023	0.036	0.024
Interfacial Tens.	31.3	34.5	34.6	34.7	34.9	34.6	28
ASTM Color	L6.0	L5.5	L5.5	5.5	5.5	5.5	L5.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.88	0.884	0.882	0.882	0.883	0.883	0.891
OPERATING CONDITIONS							
AmbientTemp.	50F	50F	75F	79F	90F	70F	
Winding Temp.							
Liquid Temp.	30C	35C	30C	36C	40C	35C	
Pressure	0	0	0	0	0	0	
Liquid Level	ok	Low	Low			OK	
GAS DIAGNOSTICS							
Rogers Ratio							
Cellulose Ratio (CO2/CO)	26.11	12.68	10.68				
IEEE/ANSI (C57.104-1991)							

COMMENTS

High moisture - needs to filtered - check for leaks - needs pressure.

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/6/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 4	MVA:	1.5
Transformer No.:	P008188	Gallons:	295
Manufacturer:	GE	PCB's	Silicone
Voltage:	12470/480	% Imp.	

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	11/6/2006	10/18/2005	6/19/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000
Acetylene	0	0	0	0	0	0	0
Hydrogen	40	57	53	52	56	65	70
Ethylene	1	1	1	1	1	1	4
Methane	29	29	31	30	30	32	57
Ethane	3	3	2	2	2	2	6
Carbon Monoxide	921	932	886	852	879	980	963
Carbon Dioxide	3292	3944	4163	4339	4254	4672	2850
Oxygen	2360	932	2264	2510	1409	4772	5509
Total Combustibles	994	1022	973	937	968	1080	1100
Total Gas	11.15%	8.41%	10.63%	10.57%	105420	128402	65012
OIL QUALITY							
Dielectric Break (kV)	47.3	45.4	46.8	38.7	50.4	44.2	33
Water in Fluid (ppm)	5.2	7.8	8.3	15.1	13.4	10.9	12
Acid Number (mg KOH/g)	0.003	0.005	0.006	0.003	0.006	0.008	0.01
Interfacial Tens.(dynes/cm)	0				43.7	43.7	
ASTM Color	0	0	0	0	0	0	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.97	0.965	0.963	0.972	0.9618	0.9615	0.977
OPERATING CONDITIONS							
AmbientTemp.	65F	65F	75F	80F	80F	70F	80F
Winding Temp.							
Liquid Temp.	35C	40C	40C	42C	45C	42C	40C
Pressure						npg	npg
Liquid Level	ok	ok	ok	high	high	high	high
GAS DIAGNOSTICS							
Rogers Ratio	0-0-0-0	0-0-0-0	0-0-0-0	0-0-0-0			
Cellulose Ratio (CO2/CO)	3.57	4.23	4.69	5.09			
IEEE/ANSI (C57.104-1991)							

COMMENTS

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/17/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 6	MVA:	1
Transformer No.:	836002311	Gallons:	392
Manufacturer:	RTE	PCB's	Rtemp
Voltage:	12470/460	% Imp.	5.6

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	11/17/2006	10/18/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/25/1999
Acetylene	0	0	0	0	0	0	0
Hydrogen	4	8	7	7	9	7	4
Ethylene	2	3	2	3	3	3	1
Methane	9	9	10	11	12	12	2
Ethane	6	6	6	6	6	6	1
Carbon Monoxide	338	331	314	383	394	421	1657
Carbon Dioxide	1443	1700	1972	2269	2522	2676	299
Oxygen	164	21	97	78	64	71	8657
Total Combustibles	359	357	339	410	424	449	307
Total Gas	4.17%	3.22%	4.30%	4.98%	5.02%	54662	78081
OIL QUALITY							
Dielectric Break (kV)	41.9	42	48.3	43.7	34.9	41	47
Water in Fluid (ppm)	14.5	19.2	27.9	29.1	15.1	21.3	9
Acid Number (mg KOH/g)	0.011	0.021	0.022	0.02	0.02	0.018	0.011
Interfacial Tens.(dynes/cm)	35.3	34.6	34.8	37.7	40.5	37.2	34
ASTM Color	3	3	3	3	3	3	L3.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.873	0.8745	0.873	0.8715	0.873	0.873	0.879
OPERATING CONDITIONS							
AmbientTemp.	45F	65F	75F	70F	80F	70F	
Winding Temp.							
Liquid Temp.	35C	45C	35C	46C	50C	52C	
Pressure	0	0				NG	
Liquid Level	OK	OK	OK	OK	OK		
GAS DIAGNOSTICS							
Rogers Ratio							
Cellulose Ratio (CO2/CO)	4.27	5.14	6.28				
IEEE/ANSI (C57.104-1991)							

COMMENTS

no pressure - add N2

SUBSTATION TECHNICAL RESOURCES, INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/17/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 6	MVA:	1.5
Transformer No.:	836002464	Gallons:	540
Manufacturer:	RTE	PCB's	Rtemp
Voltage:	12470/480	% Imp.	5.6

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	11/17/2006	10/18/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000
Acetylene	0	0	0	0	0	0	0
Hydrogen	4	5	5	5	13	5	8
Ethylene	4	3	3	4	4	4	13
Methane	12	10	12	12	14	15	34
Ethane	4	3	4	4	4	4	16
Carbon Monoxide	356	289	326	315	353	377	620
Carbon Dioxide	1361	1298	1655	1604	1849	1703	1809
Oxygen	207	13	189	70	126	60	4814
Total Combustibles	380	310	350	340	388	405	691
Total Gas	4.45%	2.75%	4.71%	4.23%	46392	51137	49768
OIL QUALITY							
Dielectric Break (kV)	48.4	38.9	44.8	41.5	34.9	45.2	33
Water in Fluid (ppm)	12.8	27.9	29.1	22.1	16.3	21.3	18
Acid Number (mg KOH/g)	0.016	0.018	0.017	0.017	0.011	0.02	0.017
Interfacial Tens.(dynes/cm)	35.8	36.4	36.5	36.8	39.1	36.5	35
ASTM Color	L3.0	L3.0	L3.0	L3.5	3	3	L3.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.87	0.874	0.8718	0.8725	0.872	0.872	0.882
OPERATING CONDITIONS							
AmbientTemp.	45F	65F	75F	70F	80F	70F	80F
Winding Temp.							
Liquid Temp.	22C	30C	30C	36C	40C	37C	40c
Pressure	npg	npg	npg	npg	npg	npg	npg
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio							
Cellulose Ratio (CO2/CO)	3.82	4.49	5.08				
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/17/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Berth 307	MVA:	0.3
Transformer No.:	H425084M68	Gallons:	122
Manufacturer:	GE	PCB's	No Data
Voltage:	12470/480	% Imp.	1.71

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	11/17/2006	10/21/2005	6/19/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000
Acetylene	0	0	0	0	0	0	0
Hydrogen	5	7	7	9	10	11	26
Ethylene	5	6	6	7	7	7	27
Methane	20	21	26	23	26	28	84
Ethane	5	6	6	5	5	5	27
Carbon Monoxide	584	587	663	636	745	812	1307
Carbon Dioxide	1943	2223	2791	3050	3539	4614	4962
Oxygen	535	13	139	85	81	106	5119
Total Combustibles	619	627	708	680	793	863	1466
Total Gas	5.24%	3.62%	5.91%	5.69%	67149	71820	73149
OIL QUALITY							
Dielectric Break (kV)	48.8	46.8	45.5	53.4	52.2	44.7	43
Water in Fluid (ppm)	5.1	4.5	6	6.8	6.3	3.4	11
Acid Number (mg KOH/g)	0.014	0.01	0.014	0.008	0.011	0.014	0.011
Interfacial Tens.(dynes/cm)	34.4	40.1	40.4	38.5	38.5	37.2	31
ASTM Color	L1.5	L1.5	L1.5	L1.5	1	L1.5	L1.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.88	0.883	0.8785	0.879	0.8804	0.88	0.885
OPERATING CONDITIONS							
AmbientTemp.	50F	65F	75F	71F	80F	70F	80F
Winding Temp.							
Liquid Temp.	25C	20C	20C	38C	46C	36C	40C
Pressure						npg	npg
Liquid Level	low	low	low	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	2-0-1-0	2-0-1-0	2-0-1-0	1-0-1-0			
Cellulose Ratio (CO2/CO)	3.33	3.79	4.21	4.80			
IEEE/ANSI (C57.104-1991)							

COMMENTS

check oil level

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
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(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/17/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1687	STR Job No:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Berth 306	MVA:	0.3
Transformer No.:	H425082M68	Gallons:	122
Manufacturer:	GE	PCB's	No Data
Voltage:	13200/480	% Imp.	1.71

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	11/17/2006	10/21/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000
Acetylene	0	0	0	0	0	0	0
Hydrogen	4	3	4	2	0	1	0
Ethylene	2	1	0	3	2	2	4
Methane	1	1	1	1	1	1	3
Ethane	0	0	0	0	0	0	0
Carbon Monoxide	10	18	25	35	30	33	133
Carbon Dioxide	682	409	530	990	884	884	1018
Oxygen	20430	4770	13687	16303	15456	22095	18404
Total Combustibles	17	23	30	41	33	37	140
Total Gas	10.67%	3.94%	6.35%	0.0634	65542	74661	73320
OIL QUALITY							
Dielectric Break (kV)	43.2	49.4	44.9	54.2	49.9	43.7	34
Water in Fluid (ppm)	15.9	11.4	6.8	29	35.8	25	26
Acid Number (mg KOH/g)	0.016	0.01	0.014	0.011	0.008	0.014	0.012
Interfacial Tens.(dynes/cm)	34.2	40.4	41	37.8	37.9	38.2	24
ASTM Color	L1.5	L1.5	L1.5	L1.5	L1.5	L1.5	L1.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.875	0.875	0.8726	0.873	0.8735	0.874	0.878
OPERATING CONDITIONS							
AmbientTemp.	40F	65F	75F	72F	80F	70F	80F
Winding Temp.							
Liquid Temp.	30C	25C	20C	42C	51C	40C	45C
Pressure	npg					npg	npg
Liquid Level	ok	ok	ok	ok	high	high	high
GAS DIAGNOSTICS							
Rogers Ratio	0-0-2-0	0-0-2-0	0-0-2-2	0-0-2-0			
Cellulose Ratio (CO2/CO)	68.2	22.72	21.2	28.29			
IEEE/ANSI (C57.104-1991)							

COMMENTS

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/9/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 7A	MVA:	2
Transformer No.:	PQH0715	Gallons:	415
Manufacturer:	NP	PCB's	Rtemp
Voltage:	12470/460	% Imp.	5.4

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	11/9/2006	10/11/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000
Acetylene	0	0	0	0	0	0	0
Hydrogen	6	7	7	9	7	6	14
Ethylene	7	7	8	7	8	7	32
Methane	14	12	15	14	15	15	43
Ethane	7	6	6	6	6	5	27
Carbon Monoxide	796	685	739	767	777	856	1346
Carbon Dioxide	2905	2313	2783	3076	3401	5619	7301
Oxygen	3810	13	59	85	55	81	4656
Total Combustibles	830	717	775	803	813	889	1462
Total Gas	7.57%	3.2%	5.00%	50933	51306	59219	64487
OIL QUALITY							
Dielectric Break (kV)	39.8	39.1	40.8	43.5	39.5	39.2	32
Water in Fluid (ppm)	13.4	11.4	16.3	17.4	12.8	14.4	24
Acid Number (mg KOH/g)	0.033	0.023	0.022	0.023	0.02	0.014	0.033
Interfacial Tens.(dynes/cm)	39.6	37.2	37.5	37.1	37.7	37.6	38
ASTM Color	L2.5	L3.0	L3.0	L3.0	L3.0	L3.0	L3.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.87	0.8745	0.873	0.873	0.873	0.8725	0.881
OPERATING CONDITIONS							
AmbientTemp.	55F	65F	75F	79F	80F	70F	80F
Winding Temp.							
Liquid Temp.	30C	40C	35C	45C	55C	44C	45c
Pressure			npg	npg	npg	npg	npg
Liquid Level	ok	ok	ok	ok	ok		high
GAS DIAGNOSTICS							
Rogers Ratio							
Cellulose Ratio (CO2/CO)	3.65	3.38	3.77				
IEEE/ANSI (C57.104-1991)							

COMMENTS

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/8/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Crane #14	MVA:	0.75
Transformer No.:	L243297	Gallons:	142
Manufacturer:	NP	PCB's	Silicone
Voltage:	2400/480	% Imp.	5.7

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	11/8/2006	10/12/2005	6/19/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000
Acetylene	0	0	0	0	0	0	0
Hydrogen	148	152	170	163	168	174	208
Ethylene	1	1	0	1	1	1	4
Methane	48	47	56	52	51	56	122
Ethane	6	6	5	5	5	6	20
Carbon Monoxide	919	902	1019	948	941	1054	1224
Carbon Dioxide	3157	3592	4434	4550	4392	4861	3758
Oxygen	1116	349	969	1617	1018	1881	4803
Total Combustibles	1120	1108	1250	1169	1166	1291	1578
Total Gas	10.20%	7.05%	11.09%	10.75%	107320	118776	79103
OIL QUALITY							
Dielectric Break (kV)	44.1	44.9	42.4	47.8	47.3	46.7	33
Water In Fluid (ppm)	5.7	7.8	7.3	9.4	21.6	11	11
Acid Number (mg KOH/g)	0.003	0.005	0.006	0.003	0.008	0.008	0.006
Interfacial Tens.(dynes/cm)							
ASTM Color	0	0	0	0	0	0	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.968	0.965	0.9625	0.9696	0.9638	0.963	0.967
OPERATING CONDITIONS							
AmbientTemp.	55F%	65F	75F	78F	80F	70F	80F
Winding Temp.							
Liquid Temp.	30C	30C	30C	39C	39C	40C	35C
Pressure	-0.5	-1	-0.5	-0.3	-0.3	-0.5	0
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0-0-0-0	0-0-0-0	0-0-0-2	0-0-0-0			
Cellulose Ratio (CO2/CO)	3.44	3.98	4.35	4.8			
IEEE/ANSI (C57.104-1991)							

COMMENTS

negative pressure - add N2

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/6/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Crane #17	MVA:	0.5
Transformer No.:	L243299B	Gallons:	125
Manufacturer:	NP	PCB's	Silicone
Voltage:	2400/480	% Imp.	

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	11/6/2006	10/11/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000
Acetylene	0	0	0	0	0	0	0
Hydrogen	100	193	152	119	126	170	203
Ethylene	0	0	0	0	0	0	3
Methane	63	78	81	71	72	78	166
Ethane	7	9	7	7	7	7	31
Carbon Monoxide	902	1328	1168	991	1009	1200	1473
Carbon Dioxide	3507	6085	6030	5630	5743	7642	7095
Oxygen	697	516	1001	976	701	1228	6358
Total Combustibles	1072	1608	1408	1188	1214	1455	1876
Total Gas	9.86%	11.11%	13.00%	11.07%	111859	140295	94624
OIL QUALITY							
Dielectric Break (kV)	43.1	41.9	38.1	39.6	49.6	43.8	36
Water in Fluid (ppm)	9.4	10.9	11.5	17.2	19.6	13	27
Acid Number (mg KOH/g)	0.003	0.005	0.006	0.008	0.008	0.008	0.008
Interfacial Tens.(dynes/cm)							
ASTM Color	0	0	0	0	0	0	L0.5
Visual Inspection	*Fail	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.97	0.962	0.962	0.969	0.9625	0.9615	0.969
OPERATING CONDITIONS							
AmbientTemp.	60F%	65F	75F	70F	80F	70F	80F
Winding Temp.							
Liquid Temp.	35C	30C	35C	38C	41C	40C	35C
Pressure	1	0.5	0.2	0.9	1.2	1	1
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0-0-0-2	0-0-0-2	0-0-0-2	0-0-0-2			
Cellulose Ratio (CO2/CO)	3.89	4.58	6.02	5.68			
IEEE/ANSI (C57.104-1991)							

COMMENTS

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/8/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No;	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Crane #16	MVA:	0.5
Transformer No.:	L243299C	Gallons:	125
Manufacturer:	GE	PCB's	Silicone
Voltage:	2400/480	% Imp.	

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	11/8/2006	10/11/2005	6/19/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000
Acetylene	0	0	0	0	0	1	9
Hydrogen	130	97	137	124	181	172	231
Ethylene	1	1	1	1	2	1	7
Methane	47	33	58	44	56	52	131
Ethane	5	4	6	4	6	5	21
Carbon Monoxide	1034	742	1165	923	1231	1288	1557
Carbon Dioxide	3611	3023	5484	4756	5961	7054	6117
Oxygen	1254	248	2600	2257	802	1381	6293
Total Combustibles	1217	877	1365	1096	1476	1524	1956
Total Gas	10.46%	5.31%	12.20%	9.80%	125501	130421	92128
OIL QUALITY							
Dielectric Break (kV)	47.6	45	40.6	40.8	49.1	45	33
Water in Fluid (ppm)	4.2	13	8.3	9.9	14.4	11	25
Acid Number (mg KOH/g)	0.005	0.005	0.008	0.006	0.006	0.006	0.01
Interfacial Tens.(dynes/cm)							
ASTM Color	0	0	0	0	0	0	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.9685	0.965	0.963	0.97	0.9625	0.9675	0.968
OPERATING CONDITIONS							
AmbientTemp.	55F	65F	75F	72F	80F	70F	80F
Winding Temp.							
Liquid Temp.	30C	40C	35C	39C	41C	30C	40C
Pressure	-0.3	0	0	-0.1	0.3	0	0
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0-0-0-0	0-0-0-0					
Cellulose Ratio (CO2/CO)	3.49	4.07					
IEEE/ANSI (C57.104-1991)							

COMMENTS

Negative pressure - needs N2

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/8/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Crane #15	MVA:	0.5
Transformer No.:	L243299A	Gallons:	125
Manufacturer:	GE	PCB's	Silicone
Voltage:	2400/480	% Imp.	5.18

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	11/8/2006	10/12/2005	6/19/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000
Acetylene	0	0	0	0	0	0	0
Hydrogen	171	184	207	200	210	213	265
Ethylene	0	1	0	1	1	1	4
Methane	40	42	47	43	45	48	113
Ethane	7	8	7	6	7	7	27
Carbon Monoxide	1051	1117	1205	1110	1177	1279	1473
Carbon Dioxide	3447	4229	5083	5104	5351	7016	5545
Oxygen	1731	320	1022	1269	751	2297	4649
Total Combustibles	1269	1352	1466	1360	1440	1548	1882
Total Gas	10.08%	7.29%	11.02%	10.48%	109825	124508	79505
OIL QUALITY							
Dielectric Break (kV)	47.4	44.3	43.1	43.8	51	47.9	37
Water In Fluid (ppm)	4.7	8.9	7.8	10.4	15.5	12	13
Acid Number (mg KOH/g)	0.003	0.005	0.006	0.003	0.008	0.008	0.007
Interfacial Tens.(dynes/cm)							
ASTM Color	0	0	0	0	0	0	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.9685	0.965	0.9625	0.9695	0.9635	0.9745	0.968
OPERATING CONDITIONS							
AmbientTemp.	53F%	65F	75F	73F	80F	70F	80F
Winding Temp.							
Liquid Temp.	30C	25C	35C	39C	40C	40C	35C
Pressure	0	-1	-1	-0.5	-0.5	0	0
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0-0-0-2	0-0-0-0	0-0-0-2	0-0-0-0			
Cellulose Ratio (CO2/CO)	3.28	3.79	4.21	4.6			
IEEE/ANSI (C57.104-1991)							

COMMENTS

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/17/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Crane #12	MVA:	0.75
Transformer No.:	L243298	Gallons:	125
Manufacturer:	GE	PCB's	Silicone
Voltage:	2400/480	% Imp.	5.64

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	11/17/2006	10/12/2005	6/19/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000
Acetylene	0	0	0	0	0	0	0
Hydrogen	156	172	173	179	185	197	243
Ethylene	0	1	1	1	1	1	4
Methane	60	60	66	63	61	68	138
Ethane	6	7	6	6	6	6	22
Carbon Monoxide	996	1025	1056	1034	1019	1157	1309
Carbon Dioxide	3063	3721	4219	4455	4351	4895	3751
Oxygen	1496	1025	1511	1979	1554	2323	6243
Total Combustibles	1218	1265	1302	1283	1272	1429	1716
Total Gas	10.11%	7.26%	10.57%	10.71%	107397	118691	78350
OIL QUALITY							
Dielectric Break (kV)	40.8	47.3	42	46.4	43.9	47.3	33
Water in Fluid (ppm)	4.7	7.3	7.3	9.4	18.6	9.4	12
Acid Number (mg KOH/g)	0.005	0.003	0.003	0.003	0.006	0.006	0.005
Interfacial Tens.(dynes/cm)							
ASTM Color	0	0	0	0	0	0	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.965	0.965	0.9615	0.9711	0.9625	0.9615	0.971
OPERATING CONDITIONS							
AmbientTemp.	40F%	65F	75F	70F	80F	70F	80F
Winding Temp.							
Liquid Temp.	20C	30C	30C	36C	37C	34C	35C
Pressure	0	-1	-1	-0.1	-0.2	0	0
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0-0-0-2	0-0-0-0	0-0-0-0	0-0-0-0			
Cellulose Ratio (CO2/CO)	3.08	3.63	3.99	3.99			
IEEE/ANSI (C57.104-1991)							

COMMENTS

no pressure – add N2

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/8/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Building 73	MVA:	0.5
Transformer No.:	PCT83390101	Gallons:	141
Manufacturer:	West.	PCB's	Cert-Non
Voltage:	12470/480	% Imp.	5.86

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	11/8/2006	10/18/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000
Acetylene	0	0	0	0	0	0	0
Hydrogen	10	16	21	13	16	17	37
Ethylene	0	0	0	0	1	0	2
Methane	16	17	18	16	16	16	51
Ethane	3	3	2	1	0	1	6
Carbon Monoxide	687	805	815	617	714	824	1347
Carbon Dioxide	2869	4136	4524	3788	4455	6681	6940
Oxygen	131	288	210	379	882	2328	3837
Total Combustibles	716	841	856	647	747	858	1443
Total Gas	6.58%	6.09%	8.41%	5.97%	76069	95351	71804
OIL QUALITY							
Dielectric Break (kV)	38.6	45	44.1	49	42.1	42.2	43
Water in Fluid (ppm)	3.4	12.5	1.7	4	8.5	3.4	6
Acid Number (mg KOH/g)	0.035	0.031	0.04	0.028	0.028	0.039	0.033
Interfacial Tens.(dynes/cm)	30.4	36.7	33.5	40.4	41.6	32.1	27
ASTM Color	L1.5	L1.5	1	1	1	L1.0	L1.0
Visual Inspection	*Fail	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.87	0.869	0.8605	0.867	0.868	0.8665	0.876
OPERATING CONDITIONS							
AmbientTemp.	50F%	65C	75C	70F	80F	70F	80F
Winding Temp.							
Liquid Temp.	30C	30C	25C	39C	35C	25C	35C
Pressure	3	4	4	4	4	4	0
Liquid Level	low	low	low	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	1-0-0-2	1-0-0-2	1-0-0-2	1-0-0-2			
Cellulose Ratio (CO2/CO)	4.18	5.14	5.55	6.14			
IEEE/ANSI (C57.104-1991)							

COMMENTS

check oil level

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/8/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Building 73	MVA:	0.5
Transformer No.:	PAT80910101	Gallons:	141
Manufacturer:	West	PCB's	Cert-Non
Voltage:	12470/480	% Imp.	5.77

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	11/8/2006	10/18/2005	6/29/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000
Acetylene	0	0	0	0	0	0	0
Hydrogen	11	16	13	8	17	16	42
Ethylene	0	0	0	0	1	0	2
Methane	17	15	17	13	14	16	56
Ethane	2	2	1	0	0	1	8
Carbon Monoxide	822	800	732	509	640	759	1391
Carbon Dioxide	3239	3666	3833	3027	3746	4828	6001
Oxygen	595	199	923	956	1604	3059	3564
Total Combustibles	852	833	763	531	672	792	1499
Total Gas	8.89%	6.29%	8.36%	5.51%	76411	93274	76157
OIL QUALITY							
Dielectric Break (kV)	48.3	46.9	39.9	45.5	42.4	43.6	35
Water in Fluid (ppm)	1.7	3.4	6	6.3	6.3	4.5	8
Acid Number (mg KOH/g)	0.027	0.031	0.037	0.023	0.023	0.031	0.027
Interfacial Tens.(dynes/cm)	32.4	36.6	37	35.1	33.2	35.7	28
ASTM Color	L1.5	L1.5	L1.5	1	1	1	L1.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.87	0.8695	0.8665	0.8675	0.868	0.8675	0.873
OPERATING CONDITIONS							
AmbientTemp.	55F	65F	75F	70F	80F	70F	80F
Winding Temp.							
Liquid Temp.	30C	30C	31C	39C	40C	35C	40C
Pressure	3	4	4	4	5	4	0
Liquid Level	low	low	low	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	1-0-0-2	0-0-0-2	1-0-0-2	1-0-0-2			
Cellulose Ratio (CO2/CO)	3.94	4.68	5.24	5.95			
IEEE/ANSI (C57.104-1991)							

COMMENTS

check oil level

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/8/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 8A	MVA:	2
Transformer No.:	PQH-0714	Gallons:	451
Manufacturer:	NP	PCB's	Rtemp
Voltage:	12470/460	% Imp.	5.4

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	11/8/2006	10/11/2005	6/16/2004	8/12/2002	8/12/2002	9/11/2001	8/24/2000
Acetylene	0	0	0	0	0	0	0
Hydrogen	2	51	4	5	6	5	5
Ethylene	4	5	5	6	6	6	19
Methane	9	9	12	13	13	14	30
Ethane	4	7	8	6	5	6	18
Carbon Monoxide	440	415	336	597	611	635	885
Carbon Dioxide	1722	2136	2340	2995	3178	4654	4642
Oxygen	1572	62	113	67	106	62	4325
Total Combustibles	459	438	365	627	641	666	957
Total Gas	3.91%	3%	5.30%	52463	52986	59232	57139
OIL QUALITY							
Dielectric Break (kV)	47.1	43.9	43.7	42.5	39	39.5	34
Water in Fluid (ppm)	11	19.8	20.3	23.3	27.3	20.1	5
Acid Number (mg KOH/g)	0.033	0.016	0.014	0.014	0.014	0.022	0.02
Interfacial Tens.(dynes/cm)	41.1	44.2	44	44.5	45.1	45	38
ASTM Color	L2.5	L2.5	L2.5	L2.5	L2.5	L2.5	L2.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.865	0.874	0.875	0.8745	0.875	0.8745	0.883
OPERATING CONDITIONS							
AmbientTemp.	50F%	65F	75F	71F	80F	70F	80F
Winding Temp.							
Liquid Temp.	38C	42C	35C	48C	50C	45C	45C
Pressure	0	0					
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio							
Cellulose Ratio (CO2/CO)	3.91	5.15	6.96				
IEEE/ANSI (C57.104-1991)							

COMMENTS

no pressure - add N2

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/9/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 5	MVA:	1
Transformer No.:	PO14476	Gallons:	240
Manufacturer:	GE	PCB's	Silicone
Voltage:	12470/460	% Imp.	5.5

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	11/9/2006	10/12/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000
Acetylene	0	0	0	0	0	0	0
Hydrogen	27	58	60	7	61	60	91
Ethylene	0	0	0	0	0	0	1
Methane	18	23	23	11	21	22	45
Ethane	2	2	2	1	2	2	6
Carbon Monoxide	676	981	984	267	861	903	1027
Carbon Dioxide	3265	4274	4490	3355	3986	3935	2846
Oxygen	11026	4210	8032	23275	5442	10752	9121
Total Combustibles	723	1064	1069	286	945	987	1170
Total Gas	10.72%	9.82%	11.78%	11.39%	102305	122087	74431
OIL QUALITY							
Dielectric Break (kV)	37.7	40.8	48.5	39.6	42	46.1	30
Water in Fluid (ppm)	4.7	6.8	7.8	25	14.4	5.7	12
Acid Number (mg KOH/g)	0.005	0.003	0.003	0.003	0.006	0.006	0.002
Interfacial Tens.(dynes/cm)							
ASTM Color	0	0	0	0	0	0	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.9665	0.9625	0.963	0.9712	0.9635	0.9622	0.971
OPERATING CONDITIONS							
AmbientTemp.		65F	75F	71F	80F	70F	80F
Winding Temp.							
Liquid Temp.	18C	28C	33C	30C	40C	38C	40C
Pressure						npg	npg
Liquid Level	low	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0-0-0-2	0-0-0-2	0-0-0-2	1-0-0-2			
Cellulose Ratio (CO2/CO)	4.83	4.82	4.56	12.57			
IEEE/ANSI (C57.104-1991)							

COMMENTS

check oil level

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/9/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 5	MVA:	1.5
Transformer No.:	PO14490	Gallons:	315
Manufacturer:	GE	PCB's	Silicone
Voltage:	12470/460	% Imp.	5.54

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	11/9/2006	10/18/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000
Acetylene	0	0	0	0	0	0	0
Hydrogen	7	14	19	17	23	31	53
Ethylene	0	1	0	1	1	0	2
Methane	52	67	81	83	81	100	183
Ethane	4	5	4	4	4	4	16
Carbon Monoxide	250	340	367	360	367	452	659
Carbon Dioxide	1757	2042	2048	2060	1691	1894	1306
Oxygen	14830	5669	15938	1419	10942	14571	9079
Total Combustibles	313	427	471	465	476	587	913
Total Gas	10.03%	8.03%	11.89%	11.12%	110157	124866	74179
OIL QUALITY							
Dielectric Break (kV)	45.4	44.8	37.9	39.5	50.9	47.1	37
Water in Fluid (ppm)	4.2	6.8	6.8	12	9.8	6.3	19
Acid Number (mg KOH/g)	0.008	0.003	0.003	0.003	0.006	0.006	0.002
Interfacial Tens.(dynes/cm)							
ASTM Color	0	0	0	0	0	0	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.964	0.965	0.963	0.9672	0.9612	0.9632	0.959
OPERATING CONDITIONS							
AmbientTemp.	40F%	65F	75F	71F	80F	70F	80F
Winding Temp.							
Liquid Temp.	18C	30C	29C	31C	39C	39C	35C
Pressure	npg		npg	npg	npg	npg	npg
Liquid Level	low	low	ok	ok	ok	low	low
GAS DIAGNOSTICS							
Rogers Ratio	2-0-0-2	2-0-0-0	2-0-0-2	2-0-0-0			
Cellulose Ratio (CO2/CO)	7.03	6.01	6.01	5.72			
IEEE/ANSI (C57.104-1991)							

COMMENTS

check oil level

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/6/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 4	MVA:	1
Transformer No.:	PCT2521-0101	Gallons:	200
Manufacturer:	West	PCB's	Silicone
Voltage:	12470/460	% Imp.	5.94

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	11/6/2006	10/18/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/25/1999
Acetylene	0	0	0	0	0	0	0
Hydrogen	27	51	6	30	32	46	21
Ethylene	0	0	0	0	0	0	0
Methane	73	86	42	79	78	82	53
Ethane	4	5	4	4	4	3	0
Carbon Monoxide	1637	2328	496	1655	1648	2037	1612
Carbon Dioxide	4709	7609	6951	6794	7421	11838	9722
Oxygen	946	510	25599	1245	2864	3384	10872
Total Combustibles	1741	2470	548	1768	1762	2168	1686
Total Gas	11.13%	11.78	13.68%	11.33%	125571	158357	125843
OIL QUALITY							
Dielectric Break (kV)	39.3	36.6	36.3	43.9	37.1	45.5	36
Water in Fluid (ppm)	5.7	12.5	27.1	8.3	12.4	7.8	14
Acid Number (mg KOH/g)	0.005	0.005	0.006	0.003	0.006	0.008	0.003
Interfacial Tens.(dynes/cm)							
ASTM Color	0	0	0	0	0	0	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Clear	Pass
Specific Gravity	0.967	0.9655	0.962	0.969	0.963	0.962	0.974
OPERATING CONDITIONS							
AmbientTemp.	65F	65F	75F	80F	80F		
Winding Temp.							
Liquid Temp.	45C	50C	53C	50C	50C		50C
Pressure	3	4	4	4	4		-0.25
Liquid Level	ok	ok	ok	ok	ok		
GAS DIAGNOSTICS							
Rogers Ratio	1-0-0-2	1-0-0-2	2-0-0-2	1-0-0-2			
Cellulose Ratio (CO2/CO)	2.88	3.27	14.02	4.11			
IEEE/ANSI (C57.104-1991)							

COMMENTS

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/6/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 3	MVA:	1.5
Transformer No.:	R277558	Gallons:	321
Manufacturer:	NP	PCB's	Silicone
Voltage:	12470/480	% Imp.	

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	11/6/2006	10/18/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/25/2000
Acetylene	0	0	0	0	0	0	19
Hydrogen	42	50	40	35	33	46	100
Ethylene	0	0	0	0	1	0	13
Methane	27	27	27	27	26	29	83
Ethane	3	3	3	3	3	2	13
Carbon Monoxide	730	742	613	583	563	681	1046
Carbon Dioxide	4721	6157	6108	6355	6341	9382	8934
Oxygen	7699	2640	8673	8771	8119	13861	13060
Total Combustibles	802	822	883	648	626	758	1274
Total Gas	11.80%	9.2%	11.42%	11.30%	11.5%	15.2%	10.2%
OIL QUALITY							
Dielectric Break (kV)	41.8	40.6	39.3	39.7	47.7	46.1	36
Water in Fluid (ppm)	22.4	30.2	30.2	35.4	42.8	36.5	38
Acid Number (mg KOH/g)	0.005	0.003	0.003	0.003	0.006	0.006	0.005
Interfacial Tens.(dynes/cm)							
ASTM Color	0	0	0	0	0	0	L0.5
Visual Inspection	*Fail	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.968	0.9655	0.9625	0.9695	0.8638	0.9625	0.969
OPERATING CONDITIONS							
AmbientTemp.	64F	65C	75F	75F	80F	70F	80F
Winding Temp.							
Liquid Temp.	35C	40C	40C	43C	45C	44C	40C
Pressure	1	1	1.2	1.8	2	3	1.5
Liquid Level	ok	ok	ok	high	high	high	high
GAS DIAGNOSTICS							
Rogers Ratio	0-0-0-2	0-0-0-2	0-0-0-2	0-0-0-2			
Cellulose Ratio (CO2/CO)	6.47	8.30	9.96	10.9			
IEEE/ANSI (C57.104-1991)							

COMMENTS

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/6/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 3	MVA:	1
Transformer No.:	R277557	Gallons:	268
Manufacturer:	NP	PCB's	Silicone
Voltage:	12470/480	% Imp.	6

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	11/6/2006	10/18/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000
Acetylene	0	0	0	0	0	0	0
Hydrogen	37	30	26	19	13	10	0
Ethylene	0	0	0	0	0	0	0
Methane	10	9	7	5	4	3	0
Ethane	1	2	1	1	1	0	0
Carbon Monoxide	385	333	240	184	131	78	22
Carbon Dioxide	4141	4635	4423	3503	2626	1671	580
Oxygen	16101	6105	22150	21138	20870	32373	24101
Total Combustibles	433	374	274	209	149	91	24
Total Gas	12.09%	7.9%	12.32%	11.34%	11.7%	14%	9.2%
OIL QUALITY							
Dielectric Break (kV)	45.8	45.7	50.2	39.7	50.9	43.6	29
Water in Fluid (ppm)	28.1	36.5	37	42.7	48.5	42.8	49
Acid Number (mg KOH/g)	0.005	0.003	0.003	0.003	0.006	0.008	0.005
Interfacial Tens.(dynes/cm)							
ASTM Color	0	0	0	0	0	0	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.97	0.965	0.962	0.969	0.9628	0.963	0.967
OPERATING CONDITIONS							
AmbientTemp.	64F	65F	75F	75F	80F	70F	80F
Winding Temp.							
Liquid Temp.	35C	35C	38C	42C	42C	41C	40C
Pressure	-0.75	0.5	-0.5	0	0	0	0
Liquid Level	ok	ok	ok	high	high	high	high
GAS DIAGNOSTICS							
Rogers Ratio	0-0-0-2	0-0-0-2	0-0-0-2	0-0-0-2			
Cellulose Ratio (CO2/CO)	10.76	13.92	18.43	19.04			
IEEE/ANSI (C57.104-1991)							

COMMENTS

negative pressure - add N2

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/9/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 1	MVA:	1.5
Transformer No.:	910396-A1	Gallons:	345
Manufacturer:	Square D	PCB's	Rtemp
Voltage:	12470/480	% Imp.	6.3

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	11/9/2006	10/18/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000
Acetylene	0	0	0	0	0	0	0
Hydrogen	1	4	4	4	5	4	7
Ethylene	12	14	14	15	18	19	81
Methane	13	14	14	14	16	17	46
Ethane	2	3	2	3	3	3	13
Carbon Monoxide	314	321	290	287	323	342	685
Carbon Dioxide	1557	1949	2025	2159	2610	2584	3022
Oxygen	52	33	53	68	131	63	1677
Total Combustibles	342	356	324	323	365	385	812
Total Gas	4.92%	4.06%	5.40%	54216	62288	67529	42953
OIL QUALITY							
Dielectric Break (kV)	46.3	39.9	40.5	40.6	41.1	40.8	41
Water in Fluid (ppm)	4.1	4.7	13.4	4.7	9.9	5.2	8
Acid Number (mg KOH/g)	0.033	0.026	0.025	0.023	0.02	0.042	0.029
Interfacial Tens.(dynes/cm)	40.2	41.8	42.4	42.3	43.4	43.1	36
ASTM Color	L3.5	L3.5	L3.5	L3.5	L3.5	L3.5	L3.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.872	0.879	0.879	0.8781	0.879	0.8784	0.888
OPERATING CONDITIONS							
AmbientTemp.	53F	65F	75F	71F	80F	70F	80F
Winding Temp.							
Liquid Temp.	30C	40C	40C	39C	41C	40c	40c
Pressure	1.5	2	2.5	2	2.9	2.5	0
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio							
Cellulose Ratio (CO2/CO)	4.96	6.07	6.98				
IEEE/ANSI (C57.104-1991)							
COMMENTS							

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/9/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 1	MVA:	2
Transformer No.:	910398-B1	Gallons:	390
Manufacturer:	Square D	PCB's	rtemp
Voltage:	12470/480	% imp.	6.05

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	11/9/2006	10/18/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000
Acetylene	0	0	0	0	0	0	0
Hydrogen	0.	4	2	3	6	4	5
Ethylene	2	2	2	2	2	2	9
Methane	12	15	15	12	14	15	36
Ethane	3	4	4	3	3	3	13
Carbon Monoxide	333	411	337	323	375	412	654
Carbon Dioxide	1669	2552	2379	2419	3021	4192	4147
Oxygen	37	19	57	68	73	74	1711
Total Combustibles	350	436	360	343	400	438	717
Total Gas	4.30%	4.04%	4.60%	45628	52232	58144	39997
OIL QUALITY							
Dielectric Break (kV)	44.3	42.1	39.4	40.3	44.4	43	39
Water in Fluid (ppm)	5.8	3.5	10.5	5.8	19.8	5.2	5
Acid Number (mg KOH/g)	0.035	0.023	0.022	0.023	0.023	0.02	0.028
Interfacial Tens.(dynes/cm)	42.3	44.3	48.4	42	44.3	44.2	35
ASTM Color	L3.5	3	3	3	3	3	L3.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.872	0.87	0.877	0.877	0.877	0.8765	0.885
OPERATING CONDITIONS							
AmbientTemp.	50F	65C	75F	71F	80F	70F	80F
Winding Temp.							
Liquid Temp.	30C	40C	40C	38C	41C	38C	40c
Pressure	0	0	0	-0.8	-0.2	0	0
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio							
Cellulose Ratio (CO2/CO)	5.01	6.21	7.06				
IEEE/ANSI (C57.104-1991)							

COMMENTS

no pressure - add N2

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/9/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 1	MVA:	2
Transformer No.:	910396-C1	Gallons:	390
Manufacturer:	Square D	PCB's	Rtemp
Voltage:	12470/480	% Imp.	5.75

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	11/9/2006	10/18/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000
Acetylene	0	0	0	0	0	0	0
Hydrogen	17	16	19	21	27	26	44
Ethylene	1	2	1	1	2	1	6
Methane	10	10	11	9	10	12	24
Ethane	2	2	2	2	2	3	9
Carbon Monoxide	275	278	285	278	3005	310	550
Carbon Dioxide	1620	2007	2263	2379	2853	3629	3540
Oxygen	50	14	36	68	209	57	1640
Total Combustibles	305	308	318	311	346	352	633
Total Gas	4.25%	3.22%	4.50%	45310	50073	52887	36014
OIL QUALITY							
Dielectric Break (kV)	48.1	40.1	41	46.1	42.7	42.8	34
Water in Fluid (ppm)	4.1	4.7	14	7	12.8	8.6	2
Acid Number (mg KOH/g)	0.03	0.023	0.022	0.023	0.025	0.025	0.027
Interfacial Tens.(dynes/cm)	41.4	41.6	42.3	42	42.2	42.3	36
ASTM Color	L3.5	3	3	3	3	3	L3.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.871	0.878	0.878	0.8776	0.879	0.8785	0.884
OPERATING CONDITIONS							
AmbientTemp.	55F	65F	75F	81F	80F	70F	80F
Winding Temp.							
Liquid Temp.	30C	40C	40	39	43C	40c	40c
Pressure	0	0	0	-0.5	0	0	-1
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio							
Cellulose Ratio (CO2/CO)	5.89	7.22	7.94				
IEEE/ANSI (C57.104-1991)							

COMMENTS

no pressure - add N2

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/9/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 7	MVA:	0.75
Transformer No.:	M590624TLPA	Gallons:	230
Manufacturer:	GE	PCB's	No Data
Voltage:	12470/480	% Imp.	5.75

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	11/9/2006	10/12/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000
Acetylene	0	0	0	1	0	0	0
Hydrogen	32	29	36	34	40	41	73
Ethylene	4	5	4	5	5	5	15
Methane	12	13	12	12	14	15	37
Ethane	3	4	3	3	3	3	13
Carbon Monoxide	563	611	478	517	604	656	917
Carbon Dioxide	2091	2430	2136	2574	3089	4176	3797
Oxygen	2689	10	81	62	1080	166	3874
Total Combustibles	614	672	533	572	688	720	1055
Total Gas	5.71%	3.96%	4.38%	4.82%	58424	62867	46226
OIL QUALITY							
Dielectric Break (kV)	44.3	46.1	47.3	51.3	48.4	45.8	46
Water in Fluid (ppm)	3.4	5.1	11.7	12.5	11.4	8.5	7
Acid Number (mg KOH/g)	0.022	0.013	0.017	0.011	0.011	0.014	0.02
Interfacial Tens.(dynes/cm)	36.1	42.7	44.2	36.9	37.1	37.1	31
ASTM Color	L0.5	0.5	0.5	L0.5	L0.5	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.891	0.884	0.891	0.8918	0.8924	0.8925	0.902
OPERATING CONDITIONS							
AmbientTemp.		65F	75F	75F	80F	70F	80F
Winding Temp.							
Liquid Temp.	18C	30C	25C	25C	35C	26C	25C
Pressure	0	0	-2	-3	0	-1.5	0
Liquid Level	ok	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS							
Rogers Ratio	0-0-1-0	0-0-1-0	0-0-1-0	0-0-1-0			
Cellulose Ratio (CO2/CO)	3.71	3.98	4.47	4.98			
IEEE/ANSI (C57.104-1991)							

COMMENTS

no pressure- add N2

SUBSTATION TECHNICAL RESOURCES, INC.

3701 SE Naef Rd.
Milwaukie, Oregon
(503) 654-7231

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	11/10/2006
Address:	5555 N Channel Blvd. PDX	Report by:	KH
Phone:	503-247-1667	STR Job No:	1258
Contact:	Ken Swingle	Class:	NP
Substation/Site:	Sub 8	MVA:	0.75
Transformer No.:	M590823TLPA	Gallons:	230
Manufacturer:	GE	PCB's	No Data
Voltage:	12470/480	% Imp.	5.75

Lab Used	JACO	JACO	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	11/10/2006	10/11/2005	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000
Acetylene	0	0	0	0	0	0	0
Hydrogen	27	35	42	36	38	38	62
Ethylene	3	3	3	3	3	3	8
Methane	13	12	16	11	13	15	34
Ethane	3	3	4	2	3	3	11
Carbon Monoxide	539	516	614	477	538	609	836
Carbon Dioxide	1982	1976	2616	2246	2529	3217	2748
Oxygen	693	11	73	65	79	114	3386
Total Combustibles	585	569	679	529	595	668	951
Total Gas	5.93%	5.91%	5.91%	4.67%	53457	60959	44515
OIL QUALITY							
Dielectric Break (kV)	47.2	43.5	53.2	50.9	46.9	41.5	36
Water in Fluid (ppm)	4	4	7	6.3	8	13	5
Acid Number (mg KOH/g)	0.014	0.013	0.011	0.011	0.014	0.017	0.02
Interfacial Tens.(dynes/cm)	34.2	42.1	42.1	41.1	43	38.7	30
ASTM Color	L0.5	0.5	0.5	0.5	0.5	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.891	0.8945	0.89	0.8915	0.8919	0.8925	0.898
OPERATING CONDITIONS							
AmbientTemp.	55F	65F	75F	69F	80F	70F	80F
Winding Temp.							
Liquid Temp.	18C	24C	35C	30C	35C	27C	25C
Pressure	0	0	-0.5	0	0	0	
Liquid Level	ok			NO LG	NO LG	NA	ok
GAS DIAGNOSTICS							
Rogers Ratio	0-0-1-0	0-0-1-0	0-0-0-0	0-0-1-0			
Cellulose Ratio (CO2/CO)	3.66	3.83	4.24	4.71			
IEEE/ANSI (C57.104-1991)							

COMMENTS

no pressure - add N2

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	8/21/2003
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Dry Dock 3	MVA:	1
Transformer No.:	16121-1	Gallons:	415
Manufacturer:	Sierra	PCB's	cert.non
Voltage:	12470/480	% Imp.	

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0
Hydrogen	4	5	5	6	8	2
Ethylene	2	3	3	3	9	1
Methane	2	2	2	2	5	1
Ethane	0	0	0	1	2	0
Carbon Monoxide	196	241	236	271	463	167
Carbon Dioxide	1849	2608	2634	3000	2522	1597
Oxygen	3871	7647	8019	14222	10690	18258
Total Combustibles	204	251	246	283	487	170
Total Gas	4.23%	5.69%	60171	80888	60062	84526
OIL QUALITY						
Dielectric Break (kV)	47	51.3	49.4	43.8	41	51
Water in Fluid (ppm)	4.5	9.7	11.4	10.3	4	5
Acid Number (mg KOH/g)	0.006	0.003	0.003	0.006	0.008	0.002
Interfacial Tens.(dynes/cm)	44.1	38.8	36.7	42.3	36	38
ASTM Color	L1.0	L1.0	1	1	L1.5	L1.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.876	0.877	0.877	0.0876	0.882	0.887
OPERATING CONDITIONS						
AmbientTemp.	75F	79F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	30C	36C	43C	36C	30c	35
Pressure	-1.5	-1	-0.2	0	-1	-0.5
Liquid Level	low	ok	ok	ok	ok	
GAS DIAGNOSTICS						
Rogers Ratio	0-0-2-0					
Cellulose Ratio (CO2/CO)	9.43					
IEEE/ANSI (C57.104-1991)						

COMMENTS Needs pressure. Has broken valve.
Low oil.

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	6/29/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Dry Dock 3	MVA:	1.5
Transformer No.:	16745-1	Gallons:	327
Manufacturer:	Sierra	PCB's	cert.non
Voltage:	12470/480	% Imp.	

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/19/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0
Hydrogen	12	2	8	11	14	4
Ethylene	16	13	16	59	44	10
Methane	5	3	5	5	12	1
Ethane	1	1	1	1	2	0
Carbon Monoxide	520	149	499	606	817	435
Carbon Dioxide	2850	2951	3524	5669	4774	3862
Oxygen	1019	11059	3753	3488	6444	8625
Total Combustibles	544	168	529	682	889	450
Total Gas	5.25%	5.74%	60238	68142	57266	71595
OIL QUALITY						
Dielectric Break (kV)	49	50.8	46.8	44.5	48	39
Water in Fluid (ppm)	6.3	18.2	15.3	15.3	16	4
Acid Number (mg KOH/g)	0.008	0.008	0.008	0.008	0.011	0.005
Interfacial Tens.(dynes/cm)	46.2	39	39.2	37.6	35	33
ASTM Color	L1.5	1	1	1	L1.5	L1.0
Visual Inspection	pass	pass	pass	pass	pass	pass
Specific Gravity	0.876	0.876	0.8774	0.08755	0.883	0.882
OPERATING CONDITIONS						
AmbientTemp.	75F	79F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	40C	52C	52c	54C	45c	50c
Pressure	-1	-0.5	-0.5	-1	-1.5	-1
Liquid Level	ok	ok	ok	ok	ok	
GAS DIAGNOSTICS						
Rogers Ratio	0-0-2-0					
Cellulose Ratio (CO2/CO)	5.48					
IEEE/ANSI (C57.104-1991)						

COMMENTS Need nitrogen. Has broken valve.

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	6/29/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Dry Dock 3	MVA:	1
Transformer No.:	16121-3	Gallons:	415
Manufacturer:	Sierra	PCB's	cert.non
Voltage:	12470/480	% Imp.	

Lab Used	JACO	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/19/2004	8/5/2003	11/14/2002	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	1	1	0	35	16	23	0
Hydrogen	0	2	2	86	53	60	10
Ethylene	11	9	0	758	472	463	80
Methane	2	2	0	284	177	161	34
Ethane	1	1	1	93	53	103	6
Carbon Monoxide	33	16	2	274	282	489	220
Carbon Dioxide	866	471	346	2815	2846	2660	1525
Oxygen	11042	10706	1989	7615	11160	10060	16273
Total Combustibles	48	31	5	1530	1053	1319	350
Total Gas	7.17%	5.8%	46791	66940	72780	60122	83135
OIL QUALITY							
Dielectric Break (kV)	45.2	48.2	42.5	30	40	32	48
Water in Fluid (ppm)	14.2	27.3	6	39.8	22.2	22	16
Acid Number (mg KOH/g)	0.008	0.003	0.003	0.006	0.0008	0.005	0.003
Interfacial Tens.(dynes/cm)	49.4	39.8	49.2	41.7	39.1	36	35
ASTM Color	L0.5	L1.0	0	1	1	L1.5	L1.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.885	0.885	0.8938	0.876	0.8754	0.884	0.877
OPERATING CONDITIONS							
AmbientTemp.	75F	79F	60F	80F	70F	80F	
Winding Temp.							
Liquid Temp.	28C	40C	40C	40C	35C	30c	35c
Pressure	1.5	2.5	1	0.5	0	-1	0
Liquid Level	ok	ok	ok	ok	ok	ok	

GAS DIAGNOSTICS

Rogers Ratio	2-0-2-0
Cellulose Ratio (CO2/CO)	26.24
IEEE/ANSI (C57.104-1991)	

COMMENTS Valve leaks.

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	6/30/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	32-1	MVA:	2.5
Transformer No.:	79F835	Gallons:	488
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	11400/480	% Imp.	6.4

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	2	3	1	1	2	0
Hydrogen	21	7	6	4	3	3
Ethylene	35	48	31	34	72	42
Methane	5	11	7	11	8	1
Ethane	5	6	4	5	17	3
Carbon Monoxide	140	83	93	84	180	76
Carbon Dioxide	1937	1127	967	1044	1348	1132
Oxygen	1778	5282	4756	79	11213	14614
Total Combustibles	208	158	142	139	282	125
Total Gas	4.53%	44005	46558	44186	54217	64396
OIL QUALITY						
Dielectric Break (kV)	41.2	29.7	37.8	37.8	39	44
Water in Fluid (ppm)	73.8	27.9	26.2	26.5	19	19
Acid Number (mg KOH/g)	0.044	0.042	0.04	0.042	0.047	0.038
Interfacial Tens.(dynes/cm)	34.1	34	34.4	34	27	28
ASTM Color	5.5	5.5	5.5	5.5	G8.0	L5.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.8778	0.8778	0.878	0.8775	0.894	0.888
OPERATING CONDITIONS						
AmbientTemp.	75F	74F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	42C	42C	54C	50C	50c	45c
Pressure	0	0	0	0	1.5	2
Liquid Level	HIGH	ok	HIGH	HIGH	ok	
GAS DIAGNOSTICS						
Rogers Ratio	0-1-2-0					
Cellulose Ratio (CO2/CO)	13.84					
IEEE/ANSI (C57.104-1991)						

COMMENTS

High moisture, possible leak, should be filtered.
Needs pressure.

TC27

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	7/1/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-5	MVA:	0.33
Transformer No.:	79F6705	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/16/2004	5/27/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	29	29	0	0	0	0
Hydrogen	71	32	5	4	12	4
Ethylene	16	14	1	2	9	1
Methane	31	9	6	9	17	5
Ethane	23	2	6	11	19	4
Carbon Monoxide	54	30	77	66	243	117
Carbon Dioxide	987	963	1354	1217	2594	2384
Oxygen	224	1928	116	62	4640	2316
Total Combustibles	224	116	95	92	300	131
Total Gas	4.00%	4.86%	39000	33439	50838	57961
OIL QUALITY						
Dielectric Break (kV)	43.1	38.4	38	38.7	39	46
Water in Fluid (ppm)	61.6	19	20.9	21.3	12	27
Acid Number (mg KOH/g)	0.028	0.037	0.023	0.025	0.029	0.029
Interfacial Tens.(dynes/cm)	39.2	39	37.8	37	29	28
ASTM Color	6	5.5	6	6	G8.0	L5.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.882	0.8815	0.883	0.883	0.899	0.899
OPERATING CONDITIONS						
AmbientTemp.	75F	60F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	22C		40C	38C	35c	35c
Pressure	0	0	0	0	0	0.5
Liquid Level	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS						
Rogers Ratio						
Cellulose Ratio (CO2/CO)						
IEEE/ANSI (C57.104-1991)						

COMMENTS

Unit has suspect history - was not sampled in 2003.
Mositure is high - consider filtering.

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	7/1/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-2	MVA:	0.33
Transformer No.:	7916702	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	6	0	0	0	0	0
Hydrogen	11	9	15	2	0	1
Ethylene	15	1	1	1	2	0
Methane	1	5	5	7	2	0
Ethane	0	5	6	9	3	0
Carbon Monoxide	88	74	41	42	92	38
Carbon Dioxide	1062	967	638	577	1005	922
Oxygen	73	68	97	77	10084	4099
Total Combustibles	121	94	68	61	96	39
Total Gas	4.10%	41103	41682	32969	52215	47305
OIL QUALITY						
Dielectric Break (kV)	41.5	42.7	44.8	44.9	32	50
Water in Fluid (ppm)	40.1	18	19.8	17.8	14	21
Acid Number (mg KOH/g)	0.022	0.025	0.025	0.025	0.02	0.02
Interfacial Tens.(dynes/cm)	32.6	32.1	32.7	32.6	26	39
ASTM Color	5.5	5.5	5.5	5.5	L5.0	L5.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.8825	0.883	0.884	0.8835	0.892	0.896
OPERATING CONDITIONS						
AmbientTemp.	75F	79F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	30C	38C	29C	18C	35c	35c
Pressure	0	2	1	0	0	0.5
Liquid Level	low	ok	ok	ok	ok	ok
GAS DIAGNOSTICS						
Rogers Ratio						
Cellulose Ratio (CO2/CO)						
IEEE/ANSI (C57.104-1991)						

COMMENTS Increase in moisture - needs pressure - possible leaks.
Evidence of Acetylene is a concern - investigate - consider resampling.

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	6/30/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-4	MVA:	0.33
Transformer No.:	79F6704	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/16/2004	8/12/2002	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	1	1	0	3	0
Hydrogen	5	4	7	0	7	4
Ethylene	17	22	21	2	96	26
Methane	3	3	4	1	17	7
Ethane	3	3	3	1	21	6
Carbon Monoxide	88	112	111	5	326	251
Carbon Dioxide	1614	1853	1931	113	2730	2011
Oxygen	64	122	97	2	4460	3101
Total Combustibles	116	117	147	9	470	294
Total Gas	3.58%	38024	39378	1542	51053	69452
OIL QUALITY						
Dielectric Break (kV)	42.2	40	34.8	37.8	38	41
Water in Fluid (ppm)	93.6	18	22.7	19	9	23
Acid Number (mg KOH/g)	0.025	0.025	0.02	0.028	0.022	0.018
Interfacial Tens.(dynes/cm)	36.9	37	37.7	38	29	31
ASTM Color	L5.5	5.5	5.5	5.5	L5.0	L5.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.88	0.8828	0.883	0.8825	0.895	0.889
OPERATING CONDITIONS						
AmbientTemp.	75F	78F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	30C	38C	36C	38C	35c	35c
Pressure	0	0.5	0	0	0	0.5
Liquid Level	ok	ok	ok	ok	ok	ok

GAS DIAGNOSTICS	
Rogers Ratio	0-1-2-0
Cellulose Ratio (CO2/CO)	18.34
IEEE/ANSI (C57.104-1991)	

COMMENTS

High moisture, possible leak, should be filtered.
Needs Pressure.

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	6/30/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-11	MVA:	0.33
Transformer No.:	79F6701	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0
Hydrogen	20	5	12	15	22	10
Ethylene	4	4	5	5	19	3
Methane	14	7	10	16	28	5
Ethane	17	6	10	14	21	2
Carbon Monoxide	109	96	75	113	262	145
Carbon Dioxide	1872	1965	2061	2727	3118	2688
Oxygen	51	69	62	70	4220	1774
Total Combustibles	164	118	112	163	372	165
Total Gas	3.94%	40811	41897	50768	52072	52491
OIL QUALITY						
Dielectric Break (kV)	40.6	26	33.8	30	34	39
Water in Fluid (ppm)	36	22.1	14.5	22.4	8	14
Acid Number (mg KOH/g)	0.022	0.023	0.02	0.02	0.02	0.021
Interfacial Tens.(dynes/cm)	33	32.2	33	33.9	28	31
ASTM Color	L6.0	L6.0	5.5	5.5	G8.0	L6.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.882	0.882	0.886	0.886	0.897	0.892
OPERATING CONDITIONS						
AmbientTemp.	75F	70F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	30C	30C	40C	40C	35c	35c
Pressure	0	0	1	0	0	0.5
Liquid Level	low	low	low	ok	ok	ok

GAS DIAGNOSTICS	
Rogers Ratio	0-1-0-0
Cellulose Ratio (CO2/CO)	17.17
IEEE/ANSI (C57.104-1991)	

COMMENTS Needs nitrogen & oil.

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	6/30/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 12-2	MVA:	1
Transformer No.:	79F67112	Gallons:	316
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.5

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0
Hydrogen	5	5	3	4	6	9
Ethylene	2	4	1	4	10	1
Methane	3	1	0	5	4	0
Ethane	1	0	3	4	1	0
Carbon Monoxide	68	71	56	93	194	49
Carbon Dioxide	560	633	496	604	710	666
Oxygen	86	96	1051	67	5171	6757
Total Combustibles	79	81	63	110	215	59
Total Gas	3.69%	38210	36570	39427	56258	55096
OIL QUALITY						
Dielectric Break (kV)	42.5	35.8	40.9	42.9	35	37
Water In Fluid (ppm)	80.8	30.2	43.6	27	8	20
Acid Number (mg KOH/g)	0.022	0.023	0.023	0.042	0.023	0.034
Interfacial Tens.(dynes/cm)	32	32.2	32	32.7	26	29
ASTM Color	L6.0	L6.0	L6.0	6	G8.0	L6.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.88	0.882	0.882	0.882	0.899	0.888
OPERATING CONDITIONS						
AmbientTemp.	75F	70F	70F	70F	80F	
Winding Temp.						
Liquid Temp.	32C	30C	40C	45C	40c	40c
Pressure	0	0	0	0	0	0.5
Liquid Level	High	ok	ok	ok	ok	ok
GAS DIAGNOSTICS						
Rogers Ratio	0-0-1-0					
Cellulose Ratio (CO2/CO)	8.24					
IEEE/ANSI (C57.104-1991)						

COMMENTS

High moisture, possible leak, unit should be filtered.
Needs pressure.

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	6/16/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-3	MVA:	0.33
Transformer No.:	79F9703	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	10	11	12	15	54	0
Hydrogen	11	11	13	24	19	4
Ethylene	26	30	32	40	131	0
Methane	11	11	13	16	35	1
Ethane	5	4	5	7	10	0
Carbon Monoxide	165	156	146	139	216	118
Carbon Dioxide	1643	1820	1840	1982	1642	2229
Oxygen	67	118	200	71	7397	3642
Total Combustibles	228	223	221	241	465	123
Total Gas	40616	42329	45308	50705	51409	66089
OIL QUALITY						
Dielectric Break (kV)	41.5	45.6	41.8	42.7	35	43
Water in Fluid (ppm)	20.3	19.8	22.1	20.1	6	25
Acid Number (mg KOH/g)	0.022	0.023	0.023	0.022	0.03	0.023
Interfacial Tens.(dynes/cm)	32.7	32	32.8	32.9	27	28
ASTM Color	5	5	5	5	L5.0	L5.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.882	0.889	0.881	0.881	0.894	0.89
OPERATING CONDITIONS						
AmbientTemp.	75F	69F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	33C	34C	43C	42C	30c	40c
Pressure	0.7	0.5	1.6	1.5	0	1
Liquid Level	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS						
Rogers Ratio						
Cellulose Ratio (CO2/CO)						
IEEE/ANSI (C57.104-1991)						

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	7/1/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-1	MVA:	0.33
Transformer No.:	79F9701	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0
Hydrogen	8	5	9	33	15	1
Ethylene	1	3	2	3	9	1
Methane	2	2	2	3	7	0
Ethane	1	0	0	2	4	0
Carbon Monoxide	47	66	57	75	173	50
Carbon Dioxide	429	571	463	733	716	519
Oxygen	98	42	56	105	711	6527
Total Combustibles	59	76	70	116	208	52
Total Gas	4%	40436	32463	42632	27904	60866
OIL QUALITY						
Dielectric Break (kV)	41.5	46.7	42	42.5	44	43
Water in Fluid (ppm)	18.6	29.7	26.7	25.9	26	16
Acid Number (mg KOH/g)	0.028	0.031	0.031	0.028	0.031	0.024
Interfacial Tens.(dynes/cm)	33.2	33.5	33.5	33.4	25	28
ASTM Color	6	6	6	6	G8.0	L5.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.882	0.8815	0.881	0.8808	0.893	0.896
OPERATING CONDITIONS						
AmbientTemp.	75F	65F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	30C	30C	42C	40c	40c	35c
Pressure	0	0	0	0	0	0
Liquid Level	ok	ok	ok	ok	ok	ok
GAS DIAGNOSTICS						
Rogers Ratio						
Cellulose Ratio (CO2/CO)						
IEEE/ANSI (C57.104-1991)						

COMMENTS

needs pressure

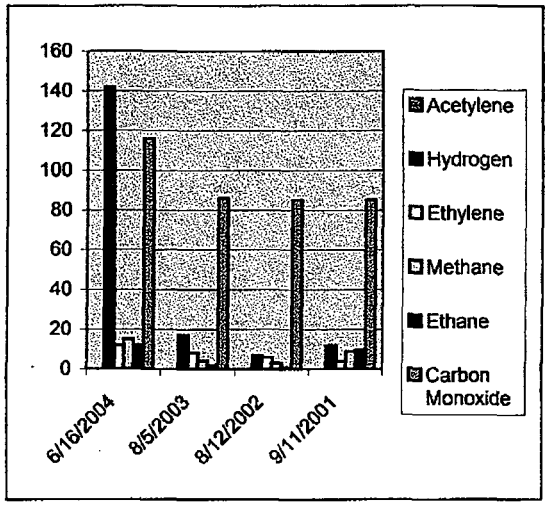
ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	6/30/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-12	MVA:	0.33
Transformer No.:	79F97012	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0
Hydrogen	142	17	7	12	4	2
Ethylene	12	8	6	4	3	0
Methane	15	4	3	9	4	0
Ethane	12	2	1	10	2	0
Carbon Monoxide	116	86	85	85	137	42
Carbon Dioxide	2117	1503	1173	987	518	1128
Oxygen	74	122	233	94	5742	2699
Total Combustibles	297	117	102	120	150	44
Total Gas	4.52%	38024	40806	41520	48742	56710
OIL QUALITY						
Dielectric Break (kV)	39.7	38	38.5			
Water in Fluid (ppm)	107	69.7	38.4			
Acid Number (mg KOH/g)	0.022	0.023	0.023			
Interfacial Tens.(dynes/cm)	32.2	32.4	32			
ASTM Color	5.5	5.5	5.5			
Visual Inspection	Pass	Pass	Pass			
Specific Gravity	0.8815	0.8825	0.883			
OPERATING CONDITIONS						
AmbientTemp.	75F	78F	80F			
Winding Temp.						
Liquid Temp.	30C	38C	40C			
Pressure	0	0	0			
Liquid Level	low	low	low			
GAS DIAGNOSTICS						
Rogers Ratio	0-0-1-0					
Cellulose Ratio (CO2/CO)	18.25					
IEEE/ANSI (C57.104-1991)						



COMMENTS Moisture level continuing to increased considerably - possible leak - needs filtering.
Needs pressure and oil.
Gas trend, possible electrolysis based on Hydrogen level and moisture content.

ENGINEERED SUBSTATION SERVICES INC.

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(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	7/1/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 12-4	MVA:	1
Transformer No.:	79F6714	Gallons:	316
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/460	% Imp.	5.5

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	1	1	1	1	4	0
Hydrogen	6	5	6	5	7	4
Ethylene	40	42	45	39	145	38
Methane	27	24	30	28	82	25
Ethane	28	29	35	31	154	34
Carbon Monoxide	389	345	388	373	667	381
Carbon Dioxide	2337	2381	2763	3506	4173	3077
Oxygen	95	79	109	61	4595	2461
Total Combustibles	491	446	505	477	1059	482
Total Gas	4.30%	42413	46588	46289	54942	65175
OIL QUALITY						
Dielectric Break (kV)	44.1	34	39.2	38.8	37	46
Water in Fluid (ppm)	84.9	18.6	21.5	23.1	21	26
Acid Number (mg KOH/g)	0.02	0.02	0.017	0.022	0.025	0.019
Interfacial Tens.(dynes/cm)	35.6	31.1	37.5	37.6	31	42
ASTM Color	5.5	5.5	5.5	5.5	G8.0	L5.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.88	0.881	0.881	0.8805	0.897	0.89
OPERATING CONDITIONS						
AmbientTemp.	75F	65F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	41C	36C	48C	42C	40c	35c
Pressure	0.5	1	2	1	0	0
Liquid Level	ok	ok	ok	ok	ok	
GAS DIAGNOSTICS						
Rogers Ratio						
Cellulose Ratio (CO2/CO)						
IEEE/ANSI (C57.104-1991)						

COMMENTS

considerable Increase in moisture - consider filtering

ENGINEERED SUBSTATION SERVICES INC.

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(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	7/1/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-9	MVA:	0.33
Transformer No.:	79F6709	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/460	% Imp.	5.1

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0
Hydrogen	9	20	13	21	52	27
Ethylene	3	3	3	3	14	2
Methane	10	11	11	14	40	7
Ethane	7	8	7	7	23	1
Carbon Monoxide	116	145	149	193	581	297
Carbon Dioxide	1903	2281	2358	3430	4425	2964
Oxygen	52	59	119	80	4863	3123
Total Combustibles	145	187	183	238	710	334
Total Gas	4.4%	44146	43114	54048	59075	72144
OIL QUALITY						
Dielectric Break (kV)	37.7	41.7	40.8	40.4	39	39
Water in Fluid (ppm)	16.9	21.5	22.7	17.2	9	6
Acid Number (mg KOH/g)	0.022	0.023	0.023	0.02	0.022	0.017
Interfacial Tens.(dynes/cm)	37.1	37	37	37.1	31	32
ASTM Color	5.5	5.5	5.5	5.5	L5.0	L5.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.882	0.882	0.881	0.881	0.895	0.894
OPERATING CONDITIONS						
AmbientTemp.	75F	60F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	30C	36C	50C	40C	35c	35c
Pressure	0	0	0	0.5	0	0.25
Liquid Level	ok	Low	ok	ok	ok	
GAS DIAGNOSTICS						
Rogers Ratio						
Cellulose Ratio (CO2/CO)						
IEEE/ANSI (C57.104-1991)						

COMMENTS

needs pressure

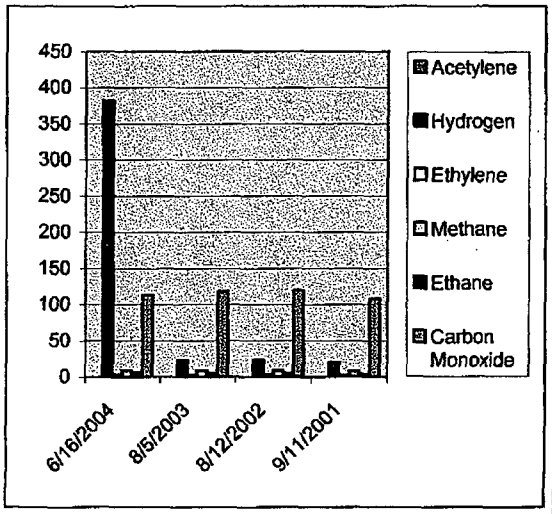
ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	6/30/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-10	MVA:	0.33
Transformer No.:	79F67010	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/460	% Imp.	5.1

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/1999	8/25/1999
Acetylene	0	0	0	0	0	0
Hydrogen	382	23	23	20	24	6
Ethylene	3	3	3	2	10	1
Methane	9	9	9	8	23	5
Ethane	6	5	5	4	20	4
Carbon Monoxide	113	118	119	108	280	135
Carbon Dioxide	1312	1152	1188	999	1260	1049
Oxygen	68	91	83	73	5009	1404
Total Combustibles	513	158	159	142	357	151
Total Gas	4.77%	50412	51019	45638	48483	53449
OIL QUALITY						
Dielectric Break (kV)	42.8	34.3	34.9			
Water in Fluid (ppm)	68.6	11.6	10.5			
Acid Number (mg KOH/g)	0.02	0.02	0.011			
Interfacial Tens.(dynes/cm)	35.1	34	36			
ASTM Color	L5.0	L5.0	L5.0			
Visual Inspection	Pass	Pass	Pass			
Specific Gravity	0.881	0.881	0.883			
OPERATING CONDITIONS						
AmbientTemp.	75F	78F	80F			
Winding Temp.						
Liquid Temp.	35C	40C	40C			
Pressure	0	0.1	1			
Liquid Level	low	ok	ok			



GAS DIAGNOSTICS	
Rogers Ratio	5-0-0-0
Cellulose Ratio (CO2/CO)	11.61
IEEE/ANSI (C57.104-1991)	

COMMENTS

Moisture level increased considerably - possible leak - needs filtering.

Needs pressure and oil.

Gas trend, possible electrolysis based on Hydrogen level and moisture content.

ENGINEERED SUBSTATION SERVICES INC.

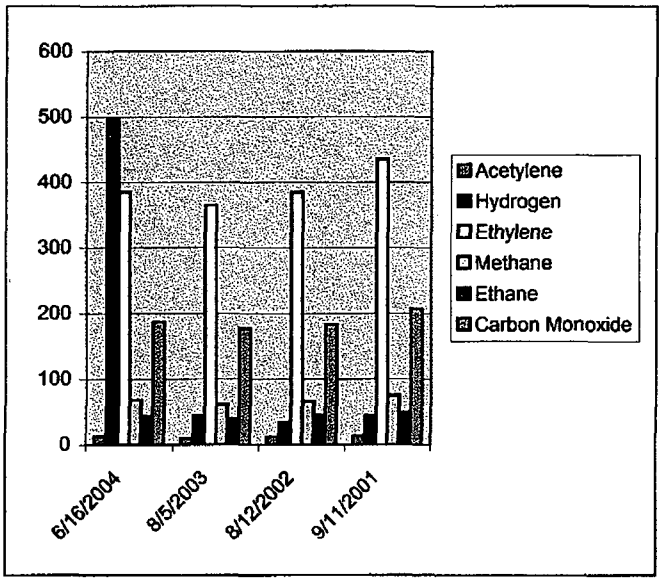
1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	7/1/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-8	MVA:	0.33
Transformer No.:	79F6708	Gallons:	176
Manufacturer:	Elect. Tech	PCB's	rtemp
Voltage:	12470/460	% Imp.	5.1

Lab Used	JACO	JACO	JACO	JACO	ACTI	ATCI
DISSOLVED GASES PPM	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	12	10	12	13	43	14
Hydrogen	497	44	34	44	56	7
Ethylene	385	365	385	435	793	318
Methane	68	61	66	75	176	58
Ethane	43	39	45	49	168	40
Carbon Monoxide	187	177	183	207	478	195
Carbon Dioxide	1925	1875	1852	1995	2010	1375
Oxygen	136	71	178	81	4556	1634
Total Combustibles	1192	696	725	823	1716	632
Total Gas	5%	47066	51420	63741	52831	56461

OIL QUALITY		
Dielectric Break (kV)	32.9	34.3
Water in Fluid (ppm)	36	20.9
Acid Number (mg KOH/g)	0.031	0.031
Interfacial Tens.(dynes/cm)	35.1	34.7
ASTM Color	L2.0	L2.0
Visual Inspection	Pass	Pass
Specific Gravity	0.881	0.881
OPERATING CONDITIONS		
AmbientTemp.	75F	70F
Winding Temp.		
Liquid Temp.	33C	30C
Pressure	0	0
Liquid Level	ok	ok
GAS DIAGNOSTICS		
Rogers Ratio		
Cellulose Ratio (CO2/CO)		
IEEE/ANSI (C57.104-1991)		



COMMENTS

needs pressure - slight moisture

evident gas trend - investigate

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
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(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	7/1/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 12-1	MVA:	1
Transformer No.:	79F6711	Gallons:	316
Manufacturer:	Elect. Tech.	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.5

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2001	8/25/2001
Acetylene	36	0	0	0	0	0
Hydrogen	3	6	9	6	6	0
Ethylene	0	1	1	1	0	0
Methane	1	1	2	6	2	0
Ethane	0	0	0	6	0	0
Carbon Dioxide	1390	589	575	63	77	458
Carbon Monoxide	67	55	57	577	669	42
Oxygen	35310	3968	708	68	12705	3557
Total Combustibles	108	63	69	82	85	42
Total Gas	4%	42571	36986	40883	58336	43495
OIL QUALITY TESTS						
Dielectric Break	39.4	37	32.2	33.6	35	42
Water in Fluid	99.4	41.3	43	41.1	21	20
Acid Number	0.022	0.025	0.025	0.025	0.027	0.02
Interfacial Tens.	41.1	40	41.5	41.5	31	37
ASTM Color	L3.0	L3.0	L3.0	L3.0	L2.5	L2.5
Visual Inspection	PASS	PASS	PASS	PASS	PASS	PASS
Specific Gravity	0.874	0.8725	0.874	0.8735	0.883	0.879
OPERATING CONDITIONS						
AmbientTemp.	75F	78F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	37C	41C	41C	37C	40C	
Pressure	0	0	0	0	0	
Liquid Level	low	OK	OK	LOW	OK	
GAS DIAGNOSTICS						
Rogers Ratio						
Cellulose Ratio (CO2/CO)						
IEEE/ANSI (C57.104-1991)						

COMMENTS

Acetylene is a concern - investigate - consider resampling

High moisture - consider filtering

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
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(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	6/29/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Dry Dock	MVA:	1
Transformer No.:	771382	Gallons:	310
Manufacturer:		PCB's	cert-non
Voltage:		% Imp.	

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	23	23	25	25	96	23
Hydrogen	38	34	36	34	45	9
Ethylene	9	8	8	7	23	2
Methane	23	21	21	20	29	8
Ethane	4	4	4	4	14	0
Carbon Monoxide	557	509	473	437	604	240
Carbon Dioxide	3173	3489	3652	4637	3964	2148
Oxygen	829	4328	4645	8500	9375	10799
Total Combustibles	654	599	567	527	811	282
Total Gas	6.06%	6.2%	65953	74225	62356	74852
OIL QUALITY						
Dielectric Break (kV)	53.5	51.4	46.9	45.4	44	50
Water in Fluid (ppm)	7.4	13.1	20.5	12.5	5	13
Acid Number (mg KOH/g)	0.006	0.003	0.003	0.011	0.002	0.002
Interfacial Tens.(dynes/cm)	51.5	44.4	45.9	48.6	41	38
ASTM Color	L0.5	L0.5	0.5	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.8765	0.8775	0.8785	0.8785	0.886	0.883
OPERATING CONDITIONS						
AmbientTemp.	75F	70F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	40C	45C	54C	47C	40C	50C
Pressure	0	0.25	0	0	0	0.25
Liquid Level	ok	ok	ok	ok	ok	
GAS DIAGNOSTICS						
Rogers Ratio	0-0-1-1					
Cellulose Ratio (CO2/CO)	5.7					
IEEE/ANSI (C57.104-1991)						

COMMENTS

needs pressure

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	6/29/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	C.U.S.	MVA:	1.5
Transformer No.:	SBV567601	Gallons:	259
Manufacturer:	West.	PCB's	cert-non
Voltage:	12470/240	% Imp.	5.5

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/19/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0
Hydrogen	11	8	8	11	15	5
Ethylene	18	18	17	19	67	20
Methane	12	10	10	11	25	4
Ethane	2	2	1	2	6	0
Carbon Monoxide	481	326	381	492	765	375
Carbon Dioxide	3467	2764	3077	3569	3399	2534
Oxygen	141	266	613	517	4625	3174
Total Combustibles	524	364	417	535	878	404
Total Gas	9.25%	5.72%	73521	92883	67637	67637
OIL QUALITY						
Dielectric Break (kV)	43.7	50.4	43.2	45.1	42	49
Water in Fluid (ppm)	6	8.5	7.4	4	2	8
Acid Number (mg KOH/g)	0.022	0.014	0.017	0.025	0.028	0.02
Interfacial Tens.(dynes/cm)	38.9	36.1	35.9	37.1	31	32
ASTM Color	L2.0	1.5	1.5	L2.0	L2.0	L1.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.871	0.872	0.8725	0.8715	0.881	0.883
OPERATING CONDITIONS						
AmbientTemp.	75F	70F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	15	32C	45C	35C	40c	40C
Pressure	3.5	4.5	5	4.5	0	0.25
Liquid Level	low	ok	ok	ok	ok	
GAS DIAGNOSTICS						
Rogers Ratio	1-0-2-0					
Cellulose Ratio (CO2/CO)	7.21					
IEEE/ANSI (C57.104-1991)						

COMMENTS low oil

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	6/29/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	C.U.S.	MVA:	1.5
Transformer No.:	SBV567602	Gallons:	259
Manufacturer:	West.	PCB's	cert-non
Voltage:	12470/240	% Imp.	5.47

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/19/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0
Hydrogen	11	11	9	11	25	7
Ethylene	31	33	28	33	113	24
Methane	10	10	9	11	30	3
Ethane	2	2	1	2	6	24
Carbon Monoxide	678	678	555	750	1204	719
Carbon Dioxide	3955	4472	4150	8100	8179	6154
Oxygen	2158	3730	4461	4819	7605	8665
Total Combustibles	732	734	602	807	1378	753
Total Gas	6.79%	6.93%	64303	80854	67258	82842
OIL QUALITY						
Dielectric Break (kV)	47.6	52.3	43.6	45.6	39	49
Water in Fluid (ppm)	6	7.4	8.5	2.3	5	10
Acid Number (mg KOH/g)	0.025	0.011	0.014	0.008	0.023	0.018
Interfacial Tens.(dynes/cm)	38.3	34.4	34.3	34.3	30	30
ASTM Color	L2.0	1.5	1.5	L1.5	L1.5	L1.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.8715	0.872	0.8725	0.8715	0.875	0.887
OPERATING CONDITIONS						
AmbientTemp.	75F	70F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	31C	40C	45C	40C	40c	40C
Pressure	0	0	1	0.5	0	0.5
Liquid Level	ok	ok	ok	ok	ok	
GAS DIAGNOSTICS						
Rogers Ratio	0-0-2-0					
Cellulose Ratio (CO2/CO)	5.83					
IEEE/ANSI (C57.104-1991)						

COMMENTS

needs nitrogen

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	6/29/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	C.U.S.	MVA:	1.5
Transformer No.:	SBV567604	Gallons:	259
Manufacturer:	West.	PCB's	cert-non
Voltage:	12470/240	% Imp.	5.47

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/19/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0
Hydrogen	13	8	10	13	38	6
Ethylene	25	26	21	27	124	23
Methane	12	11	10	12	43	4
Ethane	2	2	2	2	9	0
Carbon Monoxide	616	477	559	659	1273	479
Carbon Dioxide	3647	3274	3659	4586	6061	3031
Oxygen	247	572	540	758	4599	4430
Total Combustibles	668	524	602	713	1487	512
Total Gas	8.64%	6.24%	74196	90658	76736	68186
OIL QUALITY						
Dielectric Break (kV)	40.9	45.9	44.6	43.5	45	50
Water in Fluid (ppm)	11.9	9.1	5.1	4.5	2	7
Acid Number (mg KOH/g)	0.022	0.02	0.023	0.025	0.021	0.021
Interfacial Tens.(dynes/cm)	38.2	44	44.6	35.4	31	30
ASTM Color	L2.0	L1.5	1.5	L2.0	L2.0	L1.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.871	0.871	0.8725	0.872	0.882	0.876
OPERATING CONDITIONS						
AmbientTemp.	75F	70F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	30C	39C	45C	37C	35c	40C
Pressure	2	3	4.2	4	-0.5	0
Liquid Level	ok	ok	ok	ok	ok	
GAS DIAGNOSTICS						
Rogers Ratio	0-0-2-0					
Cellulose Ratio (CO2/CO)	5.92					
IEEE/ANSI (C57.104-1991)						

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	6/29/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	C.U.S.	MVA:	1.5
Transformer No.:	SBV567603	Gallons:	259
Manufacturer:	West.	PCB's	cert-non
Voltage:	12470/240	% Imp.	5.51

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/19/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0
Hydrogen	13	8	11	13	12	8
Ethylene	21	22	24	22	62	20
Methane	11	10	11	11	24	7
Ethane	2	2	2	2	5	0
Carbon Monoxide	685	486	542	673	846	624
Carbon Dioxide	3864	3221	3609	4435	3542	3828
Oxygen	206	501	556	853	5320	2350
Total Combustibles	732	528	590	721	949	659
Total Gas	9.53%	6.15%	73422	93460	54653	69074
OIL QUALITY						
Dielectric Break (kV)	43	46.6	49.4	40.4	40	47
Water in Fluid (ppm)	2.3	8	5.7	8	6	9
Acid Number (mg KOH/g)	0.031	0.02	0.023	0.022	0.03	0.019
Interfacial Tens.(dynes/cm)	39.4	35.8	35.7	36.9	31	37
ASTM Color	L2.0	L1.5	1.5	L2.0	L2.0	L1.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.871	0.871	0.8732	0.8725	0.88	0.877
OPERATING CONDITIONS						
AmbientTemp.	75F	70F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	15	31C	42C	33C	30c	35c
Pressure	4	4.5	5.2	5	-1	-0.75
Liquid Level	low	ok	ok	ok	ok	
GAS DIAGNOSTICS						
Rogers Ratio	0-0-2-0					
Cellulose Ratio (CO2/CO)	5.64					
IEEE/ANSI (C57.104-1991)						

COMMENTS

low oil

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	6/29/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	C.U.S.	MVA:	1
Transformer No.:	PAT716001	Gallons:	224
Manufacturer:	West.	PCB's	cert-non
Voltage:	12470/480	% Imp.	5.81

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/19/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0
Hydrogen	18	10	15	12	19	8
Ethylene	15	16	15	17	48	14
Methane	15	12	11	11	26	6
Ethane	5	4	2	2	5	0
Carbon Monoxide	579	448	488	536	827	595
Carbon Dioxide	3672	3185	3315	3834	3024	3116
Oxygen	150	158	182	230	5555	2541
Total Combustibles	632	490	531	578	925	623
Total Gas	8.98%	6.39%	72997	79845	57173	75150
OIL QUALITY						
Dielectric Break (kV)	45.6	50.2	45.6	39.4	48	49
Water in Fluid (ppm)	2	2.8	6.8	3.4	4	10
Acid Number (mg KOH/g)	0.037	0.02	0.023	0.034	0.028	0.022
Interfacial Tens.(dynes/cm)	38.6	34.5	34.3	35.4	31	29
ASTM Color	L2.0	L1.5	1.5	2	L1.5	L1.5
Visual Inspection	Pass	Pass	Pass	2	Pass	Pass
Specific Gravity	0.872	0.872	0.8725	0.873	0.878	0.876
OPERATING CONDITIONS						
AmbientTemp.	75F	70F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	15C	21C	36C	21C	30C	20C
Pressure	2.8	3	4	3	-1	-0.5
Liquid Level	ok	ok	ok	ok	ok	
GAS DIAGNOSTICS						
Rogers Ratio	0-0-2-0					
Cellulose Ratio (CO2/CO)	6.34					
IEEE/ANSI (C57.104-1991)						

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	6/30/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4-7	MVA:	0.33
Transformer No.:	79F670-71	Gallons:	176
Manufacturer:	Elect. Tech.	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.1

Lab Used	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/25/2000
Acetylene	0	0	0	0	0
Hydrogen	22	23	31	6	3
Ethylene	0	1	1	1	0
Methane	5	5	4	11	14
Ethane	6	5	3	13	13
Carbon Dioxide	395	492	605	513	1129
Carbon Monoxide	37	54	62	56	88
Oxygen	56	59	81	113	2829
Total Combustibles	70	88	101	87	118
Total Gas	3.05	33022	38021	40723	59313
OIL QUALITY TESTS					
Dielectric Break	47.5	42.7	41.8	41.6	46
Water in Fluid	33.1	29.7	36.6	29.9	26
Acid Number	0.022	0.023	0.023	0.036	0.024
Interfacial Tens.	34.6	34.7	34.9	34.6	28
ASTM Color	L5.5	5.5	5.5	5.5	L5.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.882	0.882	0.883	0.883	0.891
OPERATING CONDITIONS					
AmbientTemp.	75F	79F	90F	70F	
Winding Temp.					
Liquid Temp.	30C	36C	40C	35C	
Pressure	0	0	0	0	
Liquid Level	Low			OK	
GAS DIAGNOSTICS					
Rogers Ratio	0-1-0-2				
Cellulose Ratio (CO2/CO)	10.68				
IEEE/ANSI (C57.104-1991)					

COMMENTS

Apply pressure.
Minor moisture.

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	6/29/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4	MVA:	1.5
Transformer No.:	P008188	Gallons:	295
Manufacturer:	GE	PCB's	silicone
Voltage:	12470/480	% Imp.	

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/19/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0
Hydrogen	53	52	56	65	70	35
Ethylene	1	1	1	1	4	0
Methane	31	30	30	32	57	25
Ethane	2	2	2	2	6	0
Carbon Monoxide	886	852	879	980	963	887
Carbon Dioxide	4163	4339	4254	4672	2850	4012
Oxygen	2264	2510	1409	4772	5509	6046
Total Combustibles	973	937	968	1080	1100	947
Total Gas	10.63%	10.57%	105420	128402	65012	1211804
OIL QUALITY						
Dielectric Break (kV)	46.8	38.7	50.4	44.2	33	38
Water in Fluid (ppm)	8.3	15.1	13.4	10.9	12	16
Acid Number (mg KOH/g)	0.006	0.003	0.006	0.008	0.01	0.003
Interfacial Tens.(dynes/cm)			43.7	43.7		
ASTM Color	0	0	0	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.963	0.972	0.9618	0.9615	0.977	0.975
OPERATING CONDITIONS						
AmbientTemp.	75F	80F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	40C	42C	45C	42C	40C	35C
Pressure				npg	npg	npg
Liquid Level	ok	high	high	high	high	
GAS DIAGNOSTICS						
Rogers Ratio	0-0-0-0					
Cellulose Ratio (CO2/CO)	4.7					
IEEE/ANSI (C57.104-1991)						

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	*Cascade General Shipyard*	**Date:**	*6/30/2004*
Address:	5555 N Channel Blvd. PDX	**Report by**	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	**Class:**	
Substation/Site:	Sub 6	**MVA:**	1
Transformer No.:	836002311	**Gallons:**	392
Manufacturer:	RTE	**PCB's**	rtemp
Voltage:	12470/460	**% Imp.**	5.6

Lab Used	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/25/1999
Acetylene	0	0	0	0	0
Hydrogen	7	7	9	7	4
Ethylene	2	3	3	3	1
Methane	10	11	12	12	2
Ethane	6	6	6	6	1
Carbon Monoxide	314	383	394	421	1657
Carbon Dioxide	1972	2269	2522	2676	299
Oxygen	97	78	64	71	8657
Total Combustibles	339	410	424	449	307
Total Gas	4.30%	49887	50280	54662	78081
OIL QUALITY					
Dielectric Break (kV)	48.3	43.7	34.9	41	47
Water in Fluid (ppm)	27.9	29.1	15.1	21.3	9
Acid Number (mg KOH/g)	0.022	0.02	0.02	0.018	0.011
Interfacial Tens.(dynes/cm)	34.8	37.7	40.5	37.2	34
ASTM Color	3	3	3	3	L3.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.873	0.8715	0.873	0.873	0.879
OPERATING CONDITIONS					
AmbientTemp.	75F	70F	80F	70F	
Winding Temp.					
Liquid Temp.	35C	46C	50C	52C	
Pressure				*NG*	
Liquid Level	OK	OK	OK		
GAS DIAGNOSTICS					
Rogers Ratio	1-0-0-0				
Cellulose Ratio (CO2/CO)	6.28				
IEEE/ANSI (C57.104-1991)					

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	6/30/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 6	MVA:	1.5
Transformer No.:	836002464	Gallons:	540
Manufacturer:	RTE	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.6

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/2000
Acetylene	0	0	0	0	0	0
Hydrogen	5	5	13	5	8	4
Ethylene	3	4	4	4	13	2
Methane	12	12	14	15	34	10
Ethane	4	4	4	4	16	0
Carbon Monoxide	326	315	353	377	620	363
Carbon Dioxide	1655	1604	1849	1703	1809	1652
Oxygen	189	70	126	60	4814	2059
Total Combustibles	350	340	388	405	691	379
Total Gas	4.71%	42300	46392	51137	49768	58373
OIL QUALITY						
Dielectric Break (kV)	44.8	41.5	34.9	45.2	33	42
Water in Fluid (ppm)	29.1	22.1	16.3	21.3	18	7
Acid Number (mg KOH/g)	0.017	0.017	0.011	0.02	0.017	0.012
Interfacial Tens.(dynes/cm)	36.5	36.8	39.1	36.5	35	35
ASTM Color	L3.0	L3.5	3	3	L3.5	L3.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.8718	0.8725	0.872	0.872	0.882	0.88
OPERATING CONDITIONS						
AmbientTemp.	75F	70F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	30C	36C	40C	37C	40c	40c
Pressure	npg	npg	npg	npg	npg	npg
Liquid Level	ok	ok	ok	ok	ok	
GAS DIAGNOSTICS						
Rogers Ratio	1-0-0-0					
Cellulose Ratio (CO2/CO)	5.08					
IEEE/ANSI (C57.104-1991)						

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	6/29/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Berth 307	MVA:	0.3
Transformer No.:	H425084M68	Gallons:	122
Manufacturer:	GE	PCB's	no data
Voltage:	12470/480	% Imp.	1.71

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/19/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/26/1999
Acetylene	0	0	0	0	0	0
Hydrogen	7	9	10	11	26	5
Ethylene	6	7	7	7	27	4
Methane	26	23	26	28	84	23
Ethane	6	5	5	5	27	1
Carbon Monoxide	663	636	745	812	1307	666
Carbon Dioxide	2791	3050	3539	4614	4962	3833
Oxygen	139	85	81	106	5119	2245
Total Combustibles	708	680	793	863	1466	699
Total Gas	5.91%	5.69%	67149	71820	73149	69390
OIL QUALITY						
Dielectric Break (kV)	45.5	53.4	52.2	44.7	43	53
Water in Fluid (ppm)	6	6.8	6.3	3.4	11	10
Acid Number (mg KOH/g)	0.014	0.008	0.011	0.014	0.011	0.009
Interfacial Tens.(dynes/cm)	40.4	38.5	38.5	37.2	31	32
ASTM Color	L1.5	L1.5	1	L1.5	L1.5	L1.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.8785	0.879	0.8804	0.88	0.885	0.885
OPERATING CONDITIONS						
AmbientTemp.	75F	71F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	20C	38C	46C	36C	40C	35C
Pressure				npg	npg	npg
Liquid Level	low	ok	ok	ok	ok	
GAS DIAGNOSTICS						
Rogers Ratio	2-0-1-0					
Cellulose Ratio (CO2/CO)	4.21					
IEEE/ANSI (C57.104-1991)						

COMMENTS

low oil

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	6/29/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Berth 306	MVA:	0.3
Transformer No.:	H425082M68	Gallons:	122
Manufacturer:	GE	PCB's	no data
Voltage:	13200/480	% Imp.	1.71

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0
Hydrogen	4	2	0	1	0	0
Ethylene	0	3	2	2	4	0
Methane	1	1	1	1	3	0
Ethane	0	0	0	0	0	0
Carbon Monoxide	25	35	30	33	133	46
Carbon Dioxide	530	990	884	884	1018	688
Oxygen	13687	16303	15456	22095	18404	20235
Total Combustibles	30	41	33	37	140	46
Total Gas	6.35%	6.34%	65542	74661	73320	73481
OIL QUALITY						
Dielectric Break (kV)	44.9	54.2	49.9	43.7	34	38
Water in Fluid (ppm)	6.8	29	35.8	25	26	29
Acid Number (mg KOH/g)	0.014	0.011	0.008	0.014	0.012	0.018
Interfacial Tens.(dynes/cm)	41	37.8	37.9	38.2	24	33
ASTM Color	L1.5	L1.5	L1.5	L1.5	L1.0	L1.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.8726	0.873	0.8735	0.874	0.878	0.877
OPERATING CONDITIONS						
AmbientTemp.	75F	72F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	20C	42C	51C	40C	45C	36C
Pressure				npg	npg	npg
Liquid Level	ok	ok	high	high	high	
GAS DIAGNOSTICS						
Rogers Ratio	0-0-2-2					
Cellulose Ratio (CO2/CO)	21.2					
IEEE/ANSI (C57.104-1991)						

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	7/1/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 7A	MVA:	2
Transformer No.:	PQH0715	Gallons:	415
Manufacturer:		PCB's	rtemp
Voltage:	12470/460	% Imp.	5.4

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0
Hydrogen	7	9	7	6	14	5
Ethylene	8	7	8	7	32	6
Methane	15	14	15	15	43	7
Ethane	6	6	6	5	27	2
Carbon Monoxide	739	767	777	856	1346	811
Carbon Dioxide	2783	3076	3401	5619	7301	4227
Oxygen	59	85	55	81	4656	2748
Total Combustibles	775	803	813	889	1462	831
Total Gas	5%	50933	51306	59219	64487	66375
OIL QUALITY						
Dielectric Break (kV)	40.8	43.5	39.5	39.2	32	43
Water in Fluid (ppm)	16.3	17.4	12.8	14.4	24	8
Acid Number (mg KOH/g)	0.022	0.023	0.02	0.014	0.033	0.022
Interfacial Tens.(dynes/cm)	37.5	37.1	37.7	37.6	38	36
ASTM Color	L3.0	L3.0	L3.0	L3.0	L3.0	L3.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.873	0.873	0.873	0.8725	0.881	0.884
OPERATING CONDITIONS						
AmbientTemp.	75F	79F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	35C	45C	55C	44C	45c	42c
Pressure	npg	npg	npg	npg	npg	npg
Liquid Level	ok	ok	ok		high	
GAS DIAGNOSTICS						
Rogers Ratio						
Cellulose Ratio (CO2/CO)						
IEEE/ANSI (C57.104-1991)						
COMMENTS						

ENGINEERED SUBSTATION SERVICES INC.

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(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	6/29/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Crane #14	MVA:	0.75
Transformer No.:	L243297	Gallons:	142
Manufacturer:		PCB's	silicone
Voltage:	2400/480	% Imp.	5.7

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/19/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0
Hydrogen	170	163	168	174	208	501
Ethylene	0	1	1	1	4	0
Methane	56	52	51	56	122	41
Ethane	5	5	5	6	20	1
Carbon Monoxide	1019	948	941	1054	1224	853
Carbon Dioxide	4434	4550	4392	4861	3758	3068
Oxygen	969	1617	1018	1881	4803	4504
Total Combustibles	1250	1169	1166	1291	1578	1396
Total Gas	11.09%	10.75%	107320	118776	79103	115933
OIL QUALITY						
Dielectric Break (kV)	42.4	47.8	47.3	46.7	33	34
Water in Fluid (ppm)	7.3	9.4	21.6	11	11	26
Acid Number (mg KOH/g)	0.006	0.003	0.008	0.008	0.006	0.001
Interfacial Tens.(dynes/cm)						
ASTM Color	0	0	0	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.9625	0.9696	0.9638	0.963	0.967	0.969
OPERATING CONDITIONS						
AmbientTemp.	75F	78F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	30C	39C	39C	40C	35C	35C
Pressure	-0.5	-0.3	-0.3	-0.5	0	-0.5
Liquid Level	ok	ok	ok	ok	ok	
GAS DIAGNOSTICS						
Rogers Ratio	0-0-0-2					
Cellulose Ratio (CO2/CO)	4.35					
IEEE/ANSI (C57.104-1991)						

COMMENTS

needs pressure

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	6/29/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Crane #17	MVA:	0.5
Transformer No.:	L243299B	Gallons:	125
Manufacturer:		PCB's	silicone
Voltage:	2400/480	% Imp.	

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0
Hydrogen	152	119	126	170	203	198
Ethylene	0	0	0	0	3	1
Methane	81	71	72	78	166	51
Ethane	7	7	7	7	31	0
Carbon Monoxide	1168	991	1009	1200	1473	889
Carbon Dioxide	6030	5630	5743	7642	7095	5679
Oxygen	1001	976	701	1228	6358	5654
Total Combustibles	1408	1188	1214	1455	1876	1139
Total Gas	13%	11.07%	111859	140295	94624	119876
OIL QUALITY						
Dielectric Break (kV)	38.1	39.6	49.6	43.8	36	36
Water in Fluid (ppm)	11.5	17.2	19.6	13	27	21
Acid Number (mg KOH/g)	0.006	0.008	0.008	0.008	0.008	0.001
Interfacial Tens.(dynes/cm)						
ASTM Color	0	0	0	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.962	0.969	0.9625	0.9615	0.969	0.971
OPERATING CONDITIONS						
AmbientTemp.	75F	70F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	35C	38C	41C	40C	35C	40C
Pressure	0.2	0.9	1.2	1	1	1.25
Liquid Level	ok	ok	ok	ok	ok	
GAS DIAGNOSTICS						
Rogers Ratio	0-0-0-2					
Cellulose Ratio (CO2/CO)	5.16					
IEEE/ANSI (C57.104-1991)						

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

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Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	6/29/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Crane #16	MVA:	0.5
Transformer No.:	L243299C	Gallons:	125
Manufacturer:	GE	PCB's	silicone
Voltage:	2400/480	% Imp.	

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/19/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/24/1999
Acetylene	0	0	0	1	9	0
Hydrogen	137	124	181	172	231	55
Ethylene	1	1	2	1	7	0
Methane	56	44	56	52	131	24
Ethane	6	4	6	5	21	0
Carbon Monoxide	1165	923	1231	1288	1557	845
Carbon Dioxide	5484	4756	5961	7054	6117	5087
Oxygen	2600	2257	802	1381	6293	12063
Total Combustibles	1365	1096	1476	1524	1956	924
Total Gas	12.2%	9.8%	125501	130421	92128	129232
OIL QUALITY						
Dielectric Break (kV)	40.6	40.8	49.1	45	33	46
Water in Fluid (ppm)	8.3	9.9	14.4	11	25	20
Acid Number (mg KOH/g)	0.008	0.006	0.006	0.006	0.01	0.005
Interfacial Tens.(dynes/cm)						
ASTM Color	0	0	0	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.963	0.97	0.9625	0.9675	0.968	0.974
OPERATING CONDITIONS						
AmbientTemp.	75F	72F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	35C	39C	41C	30C	40C	45C
Pressure	0	-0.1	0.3	0	0	0.5
Liquid Level	ok	ok	ok	ok	ok	

GAS DIAGNOSTICS	
Rogers Ratio	0-0-0-0
Cellulose Ratio (CO2/CO)	4.71
IEEE/ANSI (C57.104-1991)	

COMMENTS

needs nitrogen

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	6/29/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Crane #15	MVA:	0.5
Transformer No.:	L243299A	Gallons:	125
Manufacturer:	GE	PCB's	silicone
Voltage:	2400/480	% Imp.	5.18

Lab Used	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	6/19/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000
Acetylene	0	0	0	0	0
Hydrogen	207	200	210	213	265
Ethylene	0	1	1	1	4
Methane	47	43	45	48	113
Ethane	7	6	7	7	27
Carbon Monoxide	1205	1110	1177	1279	1473
Carbon Dioxide	5083	5104	5351	7016	5545
Oxygen	1022	1269	751	2297	4649
Total Combustibles	1466	1360	1440	1548	1882
Total Gas	11.02%	10.48%	109825	124508	79505
OIL QUALITY					
Dielectric Break (kV)	43.1	43.8	51	47.9	37
Water in Fluid (ppm)	7.8	10.4	15.5	12	13
Acid Number (mg KOH/g)	0.006	0.003	0.008	0.008	0.007
Interfacial Tens.(dynes/cm)					
ASTM Color	0	0	0	0	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.9625	0.9695	0.9635	0.9745	0.968
OPERATING CONDITIONS					
AmbientTemp.	75F	73F	80F	70F	80F
Winding Temp.					
Liquid Temp.	35C	39C	40C	40C	35C
Pressure	-1	-0.5	-0.5	0	0
Liquid Level	ok	ok	ok	ok	ok
GAS DIAGNOSTICS					
Rogers Ratio	0-0-0-2				
Cellulose Ratio (CO2/CO)	4.22				
IEEE/ANSI (C57.104-1991)					

COMMENTS

needs pressure

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	6/29/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Crane #12	MVA:	0.75
Transformer No.:	L243298	Gallons:	125
Manufacturer:	GE	PCB's	silicone
Voltage:	2400/480	% Imp.	5.64

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/19/2004	8/6/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0
Hydrogen	173	179	185	197	243	109
Ethylene	1	1	1	1	4	0
Methane	66	63	61	68	138	43
Ethane	6	6	6	6	22	2
Carbon Monoxide	1056	1034	1019	1157	1309	995
Carbon Dioxide	4219	4455	4351	4895	3751	3893
Oxygen	1511	1979	1554	2323	6243	6584
Total Combustibles	1302	1283	1272	1429	1716	1149
Total Gas	10.57%	10.71%	107397	118691	78350	123954
OIL QUALITY						
Dielectric Break (kV)	42	46.4	43.9	47.3	33	37
Water in Fluid (ppm)	7.3	9.4	18.6	9.4	12	22
Acid Number (mg KOH/g)	0.003	0.003	0.006	0.006	0.005	0.002
Interfacial Tens.(dynes/cm)						
ASTM Color	0	0	0	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.9615	0.9711	0.9625	0.9615	0.971	0.973
OPERATING CONDITIONS						
AmbientTemp.	75F	70F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	30C	36C	37C	34C	35C	
Pressure	-1	-0.1	-0.2	0	0	0.5
Liquid Level	ok	ok	ok	ok	ok	
GAS DIAGNOSTICS						
Rogers Ratio	0-0-0-0					
Cellulose Ratio (CO2/CO)	4					
IEEE/ANSI (C57.104-1991)						

COMMENTS

needs pressure

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	6/29/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Building 73	MVA:	0.5
Transformer No.:	PCT83390101	Gallons:	141
Manufacturer:	West.	PCB's	cert.non
Voltage:	12470/480	% Imp.	5.86

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0
Hydrogen	21	13	16	17	37	9
Ethylene	0	0	1	0	2	9
Methane	18	16	16	16	51	5
Ethane	2	1	0	1	6	0
Carbon Monoxide	815	617	714	824	1347	680
Carbon Dioxide	4524	3788	4455	6681	6940	4699
Oxygen	210	379	882	2328	3837	8862
Total Combustibles	856	647	747	858	1443	694
Total Gas	8.41%	5.97%	76069	95351	71804	86182
OIL QUALITY						
Dielectric Break (kV)	44.1	49	42.1	42.2	43	49
Water in Fluid (ppm)	1.7	4	8.5	3.4	6	16
Acid Number (mg KOH/g)	0.04	0.028	0.028	0.039	0.033	0.038
Interfacial Tens.(dynes/cm)	33.5	40.4	41.6	32.1	27	27
ASTM Color	1	1	1	L1.0	L1.0	L1.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.8605	0.867	0.868	0.8665	0.876	0.871
OPERATING CONDITIONS						
AmbientTemp.	75C	70F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	25C	39C	35C	25C	35C	40C
Pressure	4	4	4	4	0	0.5
Liquid Level	low	ok	ok	ok	ok	

GAS DIAGNOSTICS	
Rogers Ratio	0-0-0-2
Cellulose Ratio (CO2/CO)	5.55
IEEE/ANSI (C57.104-1991)	

COMMENTS

low oil

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	6/29/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Building 73	MVA:	0.5
Transformer No.:	PAT80910101	Gallons:	141
Manufacturer:	West	PCB's	cert.non
Voltage:	12470/480	% Imp.	5.77

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/29/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0
Hydrogen	13	8	17	16	42	7
Ethylene	0	0	1	0	2	0
Methane	17	13	14	16	56	6
Ethane	1	0	0	1	8	0
Carbon Monoxide	732	509	640	759	1391	645
Carbon Dioxide	3833	3027	3746	4828	6001	3473
Oxygen	923	956	1604	3059	3564	11258
Total Combustibles	763	531	672	792	1499	658
Total Gas	8.36%	5.51%	76411	93274	76157	96744
OIL QUALITY						
Dielectric Break (kV)	39.9	45.5	42.4	43.6	35	47
Water In Fluid (ppm)	6	6.3	6.3	4.5	8	11
Acid Number (mg KOH/g)	0.037	0.023	0.023	0.031	0.027	0.028
Interfacial Tens.(dynes/cm)	37	35.1	33.2	35.7	28	28
ASTM Color	L1.5	1	1	1	L1.5	L1.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.8665	0.8675	0.868	0.8675	0.873	0.871
OPERATING CONDITIONS						
AmbientTemp.	75F	70F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	31C	39C	40C	35C	40C	40C
Pressure	4	4	5	4	0	0
Liquid Level	low	ok	ok	ok	ok	
GAS DIAGNOSTICS						
Rogers Ratio	1-0-0-2					
Cellulose Ratio (CO2/CO)	5.24					
IEEE/ANSI (C57.104-1991)						

COMMENTS

low oil

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	6/29/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	BWTP	MVA:	0.75
Transformer No.:	PCT786301	Gallons:	179
Manufacturer:	West.	PCB's	cert.non
Voltage:	12470/480	% Imp.	6.24

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0
Hydrogen	6	6	3	2	0	0
Ethylene	2	2	1	1	1	0
Methane	3	3	2	2	2	0
Ethane	0	0	0	0	0	0
Carbon Monoxide	205	161	109	73	38	0
Carbon Dioxide	2449	2351	1688	1236	553	412
Oxygen	11070	12764	12730	20698	17164	22184
Total Combustibles	216	172	115	78	41	0
Total Gas	7.06%	6.68%	68553	89368	65417	68858
OIL QUALITY						
Dielectric Break (kV)	44.9	44.2	45.3	47.9	30	53
Water in Fluid (ppm)	4	7.4	9.7	5.1	8	24
Acid Number (mg KOH/g)	0.054	0.041	0.043	0.053	0.047	0.041
Interfacial Tens.(dynes/cm)	35.3	31	29.7	31.1	26	25
ASTM Color	L1.5	L1.5	L1.5	L1.5	L1.5	L1.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.879	0.879	0.8796	0.88	0.885	0.887
OPERATING CONDITIONS						
AmbientTemp.	75F	69F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	30C	28C	34C	32C	30C	40C
Pressure	2.5	2.5	3.2	3.5	0	0
Liquid Level	ok	ok	ok	ok	ok	
GAS DIAGNOSTICS						
Rogers Ratio	0-0-2-0					
Cellulose Ratio (CO2/CO)	11.95					
IEEE/ANSI (C57.104-1991)						

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	7/1/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 8A	MVA:	2
Transformer No.:	PQH-0714	Gallons:	451
Manufacturer:		PCB's	rtemp
Voltage:	12470/460	% Imp.	5.4

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/16/2004	8/12/2002	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0
Hydrogen	4	5	6	5	5	3
Ethylene	5	6	6	6	19	1
Methane	12	13	13	14	30	2
Ethane	8	6	5	6	18	1
Carbon Monoxide	336	597	611	635	885	574
Carbon Dioxide	2340	2995	3178	4654	4642	3431
Oxygen	113	67	106	62	4325	3520
Total Combustibles	365	627	641	666	957	581
Total Gas	5.3%	52463	52986	59232	57139	71043
OIL QUALITY						
Dielectric Break (kV)	43.7	42.5	39	39.5	34	50
Water in Fluid (ppm)	20.3	23.3	27.3	20.1	5	16
Acid Number (mg KOH/g)	0.014	0.014	0.014	0.022	0.02	0.017
Interfacial Tens.(dynes/cm)	44	44.5	45.1	45	38	38
ASTM Color	L2.5	L2.5	L2.5	L2.5	L2.5	L2.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.875	0.8745	0.875	0.8745	0.883	0.887
OPERATING CONDITIONS						
AmbientTemp.	75F	71F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	35C	48C	50C	45C	45C	46c
Pressure						0
Liquid Level	ok	ok	ok	ok	ok	
GAS DIAGNOSTICS						
Rogers Ratio						
Cellulose Ratio (CO2/CO)						
IEEE/ANSI (C57.104-1991)						

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	6/29/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Portable 32-5	MVA:	1
Transformer No.:	PO15676	Gallons:	240
Manufacturer:	GE	PCB's	silicone
Voltage:	12470/460	% Imp.	5.5

Lab Used	JACO	JACO	JACO	JACO
DISSOLVED GASES PPM	6/16/2004	8/5/2003	8/12/2002	9/11/2001
Acetylene	0	0	0	0
Hydrogen	46	21	47	52
Ethylene	0	0	0	0
Methane	28	29	42	42
Ethane	3	2	3	0
Carbon Monoxide	662	728	1236	1254
Carbon Dioxide	5433	5225	5567	5849
Oxygen	17946	14219	5220	3851
Total Combustibles	739	780	1328	1351
Total Gas	11.89%	11.12%	114823	103110
OIL QUALITY				
Dielectric Break (kV)	41.1	38.4	46.7	43.5
Water in Fluid (ppm)	6.8	9.4	13.9	6.8
Acid Number (mg KOH/g)	0.006	0.008	0.006	0.011
Interfacial Tens.(dynes/cm)				
ASTM Color	0	0	0	0
Visual Inspection	Pass	Pass	Pass	Pass
Specific Gravity	0.964	0.9626	0.9644	0.9628
OPERATING CONDITIONS				
AmbientTemp.	75F	66F	80f	70F
Winding Temp.				
Liquid Temp.	30C	35C	48C	32C
Pressure				npg
Liquid Level	ok	ok	ok	ok
GAS DIAGNOSTICS				
Rogers Ratio	0-0-0-2			
Cellulose Ratio (CO2/CO)	8.21			
IEEE/ANSI (C57.104-1991)				

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	7/1/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Portable 32-3	MVA:	2
Transformer No.:	87V1243	Gallons:	600
Manufacturer:	Vantram	PCB's	rtemp
Voltage:	12470/460	% Imp.	5.7

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0
Hydrogen	17	16	16	7	18	6
Ethylene	17	14	1	18	75	14
Methane	17	13	16	16	48	10
Ethane	4	4	0	5	16	1
Carbon Monoxide	608	479	714	333	962	4501
Carbon Dioxide	3603	3372	4455	4915	6055	596
Oxygen	111	81	882	82	4850	1900
Total Combustibles	663	526	747	319	1119	627
Total Gas	5.3%	51075	76069	60933	61085	65369
OIL QUALITY						
Dielectric Break (kV)	41.6	39.2	32.5	39.1	33	49
Water in Fluid (ppm)	15.7	29.7	15.7	21.3	7	13
Acid Number (mg KOH/g)	0.011	0.011	0.008	0.014	0.015	0.008
Interfacial Tens.(dynes/cm)	46	45.7	46.2	46.5	39	42
ASTM Color	1.5	1.5	1.5	1.5	L2.0	L2.0
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.875	0.875	0.87	0.8705	0.88	0.883
OPERATING CONDITIONS						
AmbientTemp.	75F	69F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	45C	68C	48C	40c	40c	42c
Pressure	0	0	0	0	npg	
Liquid Level	ok	ok	ok	ok	ok	
GAS DIAGNOSTICS						
Rogers Ratio						
Cellulose Ratio (CO2/CO)						
IEEE/ANSI (C57.104-1991)						

COMMENTS

nneds pressure

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	6/29/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 5	MVA:	1
Transformer No.:	PO14476	Gallons:	240
Manufacturer:	GE	PCB's	silicone
Voltage:	12470/460	% Imp.	5.5

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0
Hydrogen	60	7	61	60	91	28
Ethylene	0	0	0	0	1	0
Methane	23	11	21	22	45	6
Ethane	2	1	2	2	6	0
Carbon Monoxide	984	267	861	903	1027	730
Carbon Dioxide	4490	3355	3985	3935	2846	2858
Oxygen	8032	23275	5442	10752	9121	15323
Total Combustibles	1069	286	945	987	1170	764
Total Gas	11.78%	11.39%	102305	122087	74431	114837
OIL QUALITY						
Dielectric Break (kV)	48.5	39.6	42	46.1	30	32
Water in Fluid (ppm)	7.8	25	14.4	5.7	12	26
Acid Number (mg KOH/g)	0.003	0.003	0.006	0.006	0.002	0.003
Interfacial Tens.(dynes/cm)						
ASTM Color	0	0	0	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.963	0.9712	0.9635	0.9622	0.971	0.976
OPERATING CONDITIONS						
AmbientTemp.	75F	71F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	33C	30C	40C	38C	40C	33C
Pressure				npg	npg	
Liquid Level	ok	ok	ok	ok	ok	
GAS DIAGNOSTICS						
Rogers Ratio	0-0-0-2					
Cellulose Ratio (CO2/CO)	4.56					
IEEE/ANSI (C57.104-1991)						

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

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OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	6/29/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 5	MVA:	1.5
Transformer No.:	PO14490	Gallons:	315
Manufacturer:	GE	PCB's	silicone
Voltage:	12470/460	% Imp.	5.54

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/2000
Acetylene	0	0	0	0	0	0
Hydrogen	19	17	23	31	53	28
Ethylene	0	1	1	0	2	0
Methane	81	83	81	100	183	76
Ethane	4	4	4	4	16	1
Carbon Monoxide	367	360	367	452	659	458
Carbon Dioxide	2048	2060	1691	1894	1306	1455
Oxygen	15938	1419	10942	14571	9079	13837
Total Combustibles	471	465	476	587	913	563
Total Gas	11.89%	11.12%	110157	124866	74179	126025
OIL QUALITY						
Dielectric Break (kV)	37.9	39.5	50.9	47.1	37	38
Water in Fluid (ppm)	6.8	12	9.8	6.3	19	9
Acid Number (mg KOH/g)	0.003	0.003	0.006	0.006	0.002	0.001
Interfacial Tens.(dynes/cm)						
ASTM Color	0	0	0	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.963	0.9672	0.9612	0.9632	0.969	0.973
OPERATING CONDITIONS						
AmbientTemp.	75F	71F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	29C	31C	39C	39C	35C	33C
Pressure	npg	npg	npg	npg	npg	
Liquid Level	ok	ok	ok	low	low	
GAS DIAGNOSTICS						
Rogers Ratio	2-0-0-2					
Cellulose Ratio (CO2/CO)	5.58					
IEEE/ANSI (C57.104-1991)						

COMMENTS

ENGINEERED SUBSTATION SERVICES INC.

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Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	6/29/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 4	MVA:	1
Transformer No.:	PCT2521-0101	Gallons:	200
Manufacturer:	West	PCB's	silicone
Voltage:	12470/460	% Imp.	5.94

Lab Used	JACO	JACO	JACO	JACO	ACTI
DISSOLVED GASES PPM	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/25/1999
Acetylene	0	0	0	0	0
Hydrogen	6	30	32	46	21
Ethylene	0	0	0	0	0
Methane	42	79	78	82	53
Ethane	4	4	4	3	0
Carbon Monoxide	496	1655	1648	2037	1612
Carbon Dioxide	6951	6794	7421	11838	9722
Oxygen	25599	1245	2864	3384	10872
Total Combustibles	548	1768	1762	2168	1686
Total Gas	13.68%	11.33%	125571	158357	125843
OIL QUALITY					
Dielectric Break (kV)	36.3	43.9	37.1	45.5	36
Water in Fluid (ppm)	27.1	8.3	12.4	7.8	14
Acid Number (mg KOH/g)	0.006	0.003	0.006	0.008	0.003
Interfacial Tens.(dynes/cm)					
ASTM Color	0	0	0	0	L0.5
Visual Inspection	Pass	Pass	Pass	Clear	Pass
Specific Gravity	0.962	0.969	0.963	0.962	0.974
OPERATING CONDITIONS					
AmbientTemp.	75F	80F	80F		
Winding Temp.					
Liquid Temp.	53C	50C	50C		50C
Pressure	4	4	4		-0.25
Liquid Level	ok	ok	ok		
GAS DIAGNOSTICS					
Rogers Ratio	2-0-0-2				
Cellulose Ratio (CO2/CO)	14.01				
IEEE/ANSI (C57.104-1991)					

COMMENTS

evident moisture rise - inspect

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	6/29/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 3	MVA:	1.5
Transformer No.:	R277558	Gallons:	321
Manufacturer:		PCB's	silicone
Voltage:	12470/480	% Imp.	

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/25/2000	2/7/2000
Acetylene	0	0	0	0	19	0
Hydrogen	40	35	33	46	100	18
Ethylene	0	0	1	0	13	0
Methane	27	27	26	29	83	7
Ethane	3	3	3	2	13	0
Carbon Monoxide	613	583	563	681	1046	535
Carbon Dioxide	6108	6355	6341	9382	8934	730
Oxygen	8673	8771	8119	13861	13060	20371
Total Combustibles	883	648	626	758	1274	560
Total Gas	11.42%	11.3%	114538	151671	101936	130420
OIL QUALITY						
Dielectric Break (kV)	39.3	39.7	47.7	46.1	36	37
Water in Fluid (ppm)	30.2	35.4	42.8	36.5	38	34
Acid Number (mg KOH/g)	0.003	0.003	0.006	0.006	0.005	0.003
Interfacial Tens.(dynes/cm)						
ASTM Color	0	0	0	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	*0.9625*	*0.9695*	*0.8638*	*0.9625*	*0.969*	*0.973*
OPERATING CONDITIONS						
AmbientTemp.	75F	75F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	40C	43C	45C	44C	40C	42C
Pressure	1.2	1.8	2	3	1.5	1.5
Liquid Level	ok	high	high	high	high	
GAS DIAGNOSTICS						
Rogers Ratio	*0-0-0-2*					
Cellulose Ratio (CO2/CO)	9.96					
IEEE/ANSI (C57.104-1991)						

COMMENTS

slight moisture

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	6/29/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 3	MVA:	1
Transformer No.:	R277557	Gallons:	268
Manufacturer:		PCB's	silicone
Voltage:	12470/480	% Imp.	6

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0
Hydrogen	26	19	13	10	0	0
Ethylene	0	0	0	0	0	0
Methane	7	5	4	3	0	0
Ethane	1	1	1	0	0	0
Carbon Monoxide	240	184	131	78	22	0
Carbon Dioxide	4423	3503	2626	1671	580	460
Oxygen	22150	21138	20870	32373	24101	43478
Total Combustibles	274	209	149	91	24	0
Total Gas	12.32%	11.34%	117158	139818	91355	141319
OIL QUALITY						
Dielectric Break (kV)	50.2	39.7	50.9	43.6	29	31
Water in Fluid (ppm)	37	42.7	48.5	42.8	49	42
Acid Number (mg KOH/g)	0.003	0.003	0.006	0.008	0.005	0.002
Interfacial Tens.(dynes/cm)						
ASTM Color	0	0	0	0	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.962	0.969	0.9628	0.963	0.967	0.981
OPERATING CONDITIONS						
AmbientTemp.	75F	75F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	38C	42C	42C	41C	40C	42C
Pressure	-0.5	0	0	0	0	-0.25
Liquid Level	ok	high	high	high	high	

GAS DIAGNOSTICS	
Rogers Ratio	0-0-0-2
Cellulose Ratio (CO2/CO)	18.42
IEEE/ANSI (C57.104-1991)	

COMMENTS

needs pressure
slight moisture

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	7/1/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 1	MVA:	1.5
Transformer No.:	910396-A1	Gallons:	345
Manufacturer:	Square D	PCB's	rtemp
Voltage:	12470/480	% Imp.	6.3

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0
Hydrogen	4	4	5	4	7	3
Ethylene	14	15	18	19	81	5
Methane	14	14	16	17	46	3
Ethane	2	3	3	3	13	0
Carbon Monoxide	290	287	323	342	665	237
Carbon Dioxide	2025	2159	2610	2584	3022	1378
Oxygen	53	68	131	63	1677	3503
Total Combustibles	324	323	365	385	812	248
Total Gas	5.4%	54216	62288	67529	42953	57834
OIL QUALITY						
Dielectric Break (kV)	40.5	40.6	41.1	40.8	41	41
Water in Fluid (ppm)	13.4	4.7	9.9	5.2	8	7
Acid Number (mg KOH/g)	0.025	0.023	0.02	0.042	0.029	0.027
Interfacial Tens.(dynes/cm)	42.4	42.3	43.4	43.1	36	35
ASTM Color	L3.5	L3.5	L3.5	L3.5	L3.5	L3.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.879	0.8781	0.879	0.8784	0.888	0.892
OPERATING CONDITIONS						
AmbientTemp.	75F	71F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	40C	39C	41C	40c	40c	42c
Pressure	2.5	2	2.9	2.5	0	0.25
Liquid Level	ok	ok	ok	ok	ok	
GAS DIAGNOSTICS						
Rogers Ratio						
Cellulose Ratio (CO2/CO)						
IEEE/ANSI (C57.104-1991)						
COMMENTS						

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
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(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	7/1/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 1	MVA:	2
Transformer No.:	910396-B1	Gallons:	390
Manufacturer:	Square D	PCB's	rtemp
Voltage:	12470/480	% Imp.	6.05

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0
Hydrogen	2	3	6	4	5	3
Ethylene	2	2	2	2	9	0
Methane	15	12	14	15	36	3
Ethane	4	3	3	3	13	0
Carbon Monoxide	337	323	375	412	654	190
Carbon Dioxide	2379	2419	3021	4192	4147	1703
Oxygen	57	68	73	74	1711	16668
Total Combustibles	360	343	400	436	717	196
Total Gas	4.6%	45628	52232	58144	39997	103832
OIL QUALITY						
Dielectric Break (kV)	39.4	40.3	44.4	43	39	34
Water in Fluid (ppm)	10.5	5.8	19.8	5.2	5	11
Acid Number (mg KOH/g)	0.022	0.023	0.023	0.02	0.028	0.028
Interfacial Tens.(dynes/cm)	48.4	42	44.3	44.2	35	36
ASTM Color	3	3	3	3	L3.5	L3.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.877	0.877	0.877	0.8765	0.885	0.889
OPERATING CONDITIONS						
AmbientTemp.	75F	71F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	40C	38C	41C	38C	40c	42c
Pressure	0	-0.8	-0.2	0	0	-1
Liquid Level	ok	ok	ok	ok	ok	
GAS DIAGNOSTICS						
Rogers Ratio						
Cellulose Ratio (CO2/CO)						
IEEE/ANSI (C57.104-1991)						

COMMENTS

needs pressure

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	7/1/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 1	MVA:	2
Transformer No.:	910396-C1	Gallons:	390
Manufacturer:	Square D	PCB's	rtemp
Voltage:	12470/480	% Imp.	5.75

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0
Hydrogen	19	21	27	26	44	17
Ethylene	1	1	2	1	6	0
Methane	11	9	10	12	24	6
Ethane	2	2	2	3	9	0
Carbon Monoxide	285	278	3005	310	550	296
Carbon Dioxide	2263	2379	2853	3629	3540	3125
Oxygen	36	68	209	57	1640	1306
Total Combustibles	318	311	346	352	633	319
Total Gas	4.5%	45310	50073	52887	36014	56537
OIL QUALITY						
Dielectric Break (kV)	41	46.1	42.7	42.8	34	45
Water in Fluid (ppm)	14	7	12.8	8.6	2	29
Acid Number (mg KOH/g)	0.022	0.023	0.025	0.025	0.027	0.028
Interfacial Tens.(dynes/cm)	42.3	42	42.2	42.3	36	37
ASTM Color	3	3	3	3	L3.5	L3.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.878	0.8776	0.879	0.8785	0.884	0.885
OPERATING CONDITIONS						
AmbientTemp.	75F	81F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	40	39	43C	40c	40c	43c
Pressure	0	-0.5	0	0	-1	-1
Liquid Level	ok	ok	ok	ok	ok	
GAS DIAGNOSTICS						
Rogers Ratio						
Cellulose Ratio (CO2/CO)						
IEEE/ANSI (C57.104-1991)						

COMMENTS

need pressure

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

Customer:	Cascade General Shipyard	Date:	6/29/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 7	MVA:	0.75
Transformer No.:	M590624TLPA	Gallons:	230
Manufacturer:	GE	PCB's	no data
Voltage:	12470/480	% Imp.	5.75

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	1	0	0	0	0
Hydrogen	36	34	40	41	73	19
Ethylene	4	5	5	5	15	1
Methane	12	12	14	15	37	5
Ethane	3	3	3	3	13	1
Carbon Monoxide	478	517	604	656	917	531
Carbon Dioxide	2136	2574	3089	4176	3797	3035
Oxygen	81	62	1080	166	3874	3583
Total Combustibles	533	572	688	720	1055	557
Total Gas	4.38%	4.82%	58424	62867	46226	65891
OIL QUALITY						
Dielectric Break (kV)	47.3	51.3	48.4	45.6	46	37
Water in Fluid (ppm)	11.7	12.5	11.4	8.5	7	17
Acid Number (mg KOH/g)	0.017	0.011	0.011	0.014	0.02	0.014
Interfacial Tens.(dynes/cm)	44.2	36.9	37.1	37.1	31	32
ASTM Color	0.5	L0.5	L0.5	L0.5	L0.5	L0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.891	0.8918	0.8924	0.8925	0.902	0.901
OPERATING CONDITIONS						
AmbientTemp.	75F	75F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	25C	25C	35C	26C	25C	32C
Pressure	-2	-3	0	-1.5	0	0
Liquid Level	ok	ok	ok	ok	ok	

GAS DIAGNOSTICS

Rogers Ratio	0-0-1-0
Cellulose Ratio (CO2/CO)	4.47
IEEE/ANSI (C57.104-1991)	

COMMENTS

needs pressure

ENGINEERED SUBSTATION SERVICES INC.

1131 SE 2nd Ave.
Canby, Oregon 97013
(503) 266-7173

OIL ANALYSIS TEST RESULTS

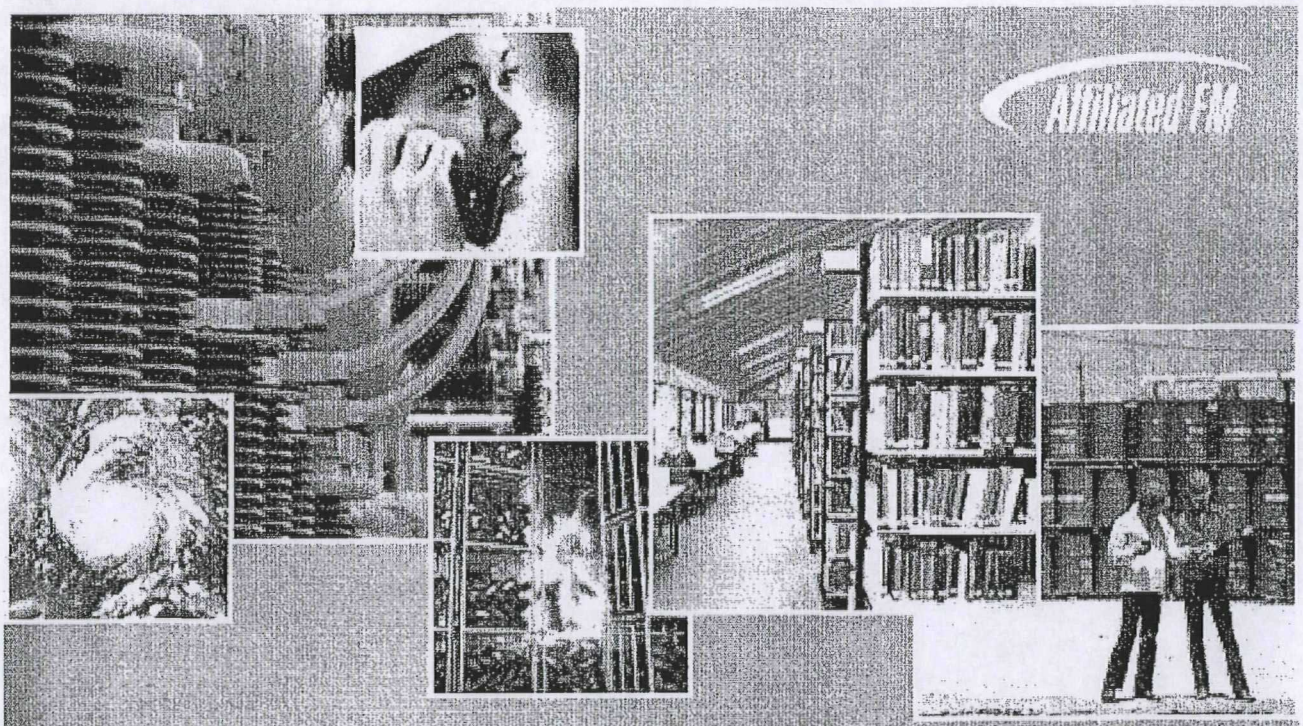
Customer:	Cascade General Shipyard	Date:	6/29/2004
Address:	5555 N Channel Blvd. PDX	Report by	KH
Phone:	503-247-1667		
Contact:	Ken Swingle	Class:	
Substation/Site:	Sub 8	MVA:	0.75
Transformer No.:	M590623TLPA	Gallons:	230
Manufacturer:	GE	PCB's	no data
Voltage:	12470/480	% Imp.	5.75

Lab Used	JACO	JACO	JACO	JACO	ACTI	ACTI
DISSOLVED GASES PPM	6/16/2004	8/5/2003	8/12/2002	9/11/2001	8/24/2000	8/25/1999
Acetylene	0	0	0	0	0	0
Hydrogen	42	36	38	38	62	20
Ethylene	3	3	3	3	8	1
Methane	16	11	13	15	34	8
Ethane	4	2	3	3	11	0
Carbon Monoxide	614	477	538	609	836	502
Carbon Dioxide	2616	2246	2529	3217	2748	2269
Oxygen	73	65	79	114	3386	3246
Total Combustibles	679	529	595	668	951	531
Total Gas	5.91%	4.67%	53457	60959	44515	64744
OIL QUALITY						
Dielectric Break (kV)	53.2	50.9	46.9	41.5	36	39
Water in Fluid (ppm)	7	6.3	8	13	5	20
Acid Number (mg KOH/g)	0.011	0.011	0.014	0.017	0.02	0.014
Interfacial Tens.(dynes/cm)	42.1	41.1	43	38.7	30	31
ASTM Color	0.5	0.5	0.5	L0.5	L0.5	0.5
Visual Inspection	Pass	Pass	Pass	Pass	Pass	Pass
Specific Gravity	0.89	0.8915	0.8919	0.8925	0.898	0.898
OPERATING CONDITIONS						
AmbientTemp.	75F	69F	80F	70F	80F	
Winding Temp.						
Liquid Temp.	35C	30C	35C	27C	25C	27C
Pressure	-0.5	0	0	0		
Liquid Level		NO LG	NO LG	NA	ok	

GAS DIAGNOSTICS	
Rogers Ratio	0-0-0-0
Cellulose Ratio (CO2/CO)	4.26
IEEE/ANSI (C57.104-1991)	

COMMENTS

needs pressure



Affiliated FM Risk Report

Location Findings
Cascade General Inc.

Pier C (berths 312-314) - Building #4 - Fabrication - Building #72 - Shops & Office - Ballast Water Treatment Lab - Central Utilities - Pier A (berths 301-305) - Finger Pier (berths 309 & 310) - Berth 315
5555 North Channel Avenue
Portland, Oregon 97217
USA

All in One
Interim Risk Evaluation

Visit by: Andrew J Young
Visit date: 30 May 2006
Conference with: Mr. Ken Swingle, Facilities Maint. Manager

Index: 077501.02-20 / Account: 23-39523 / Order ID: 846650-2

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Principal Site Activity

This is a ship repair facility.

Understanding the Hazards at this Facility

The most significant and common hazards exposing the shipbuilding and ship repair industry (involving large steel hulls) are centered on damage to cranes, rendering them inoperable. This damage could stem from windstorm; improper rigging that could lead to impact damage; or overloading, which could result in structural damage or overturning. In addition to the physical damage, the loss of a crane can result in significant interruption to production.

This knowledge of the common hazards and our loss experience show that the following areas should be considered most important:

For indoor cranes, in addition to routine maintenance, provide proper training for both operators and riggers. Ensure cranes are equipped with safeguards such as load indicators, brakes, and rail clamps. Sling and hook maintenance and testing programs should be instituted and closely followed. For outdoor cranes, in addition to training for both operators and riggers, routine maintenance should include all braking systems. Safeguards such as wind-velocity indicating devices, rail clamps, stowage pins and load indicators should be provided. Wind securement procedures should be in writing and periodically reviewed. Wind and hail accounts for over 70 percent of the damage in this occupancy.

At this facility, the high wind hazard to the cranes is understood and procedures are in place for securing cranes during a windstorm; however, these procedures are not readily available in writing other than to state that use of cranes with winds above 35 mph would be extremely limited.

Also discussed during this visit, was the seismic (earthquake) hazard common to the west coast, which can damage gas piping systems releasing natural gas into buildings. The gas will often be ignited by nearby electrical energy resulting in a fire and/or explosion. Often sprinkler piping will have been damaged by the same seismic event and rendered ineffective allowing fire to spread unabated. The presence of natural gas in Building Nos. 4, 10, 43, 72, 73, and Central Utilities provides for this hazard at this facility. Provision of seismic gas shut off valves for each gas service (exterior) or a remote seismic sensor tied to close a safety shut-off valve and open a down stream vent valve was discussed. Management has agreed to look into providing this equipment to mitigate the fire following earthquake hazard.

"Key Exposures" are those that can most directly impact loss experience. Associated recommendations are flagged as "Key" since they address the hazards that are most likely to lead to a serious loss.

This report is strictly informational and is intended to reduce the possibility of loss to property insured by the Affiliated FM Insurance Company by bringing to your attention certain potential hazards and/or conditions. It does not imply that all other hazards or conditions are under control. You must make the decision on whether and how to address any hazard or condition. The liability of Affiliated FM Insurance Company is limited to that contained in its insurance policies. No liability or policy coverage is created by reason of this report or the inspection upon which it is based.

Management of Exposures

Certain potential hazards and conditions were evaluated at this facility. Completion of the following items will help lower both the frequency and severity of losses and minimize the possibility of costly interruptions to your business.

Key Exposures

Experience shows that the majority of all losses in this type of facility can be prevented or minimized by addressing the **Key Exposures**, which are flagged below.

06-05-001

Key

Provide a high wind procedure to include securing all cranes.

A high wind contingency plan should be developed and formalized at this facility. Appropriate actions should be taken at specific time intervals prior to an oncoming storm to include crane securement in accordance with FM Global Property Loss Prevention Data Sheet 1-62, *Cranes* (forwarded to Jerry Hunt). Any required materials should be ready on hand and/or contractor services on retainer.

The Hazard	Approximately 90 percent of the time, cranes and stacker/reclaimers have sufficient protection against accidental (horizontal) movement by the friction load and the holding power of their drive wheel brakes. However, the critical ten percent of the time, when wind velocities exceed about 35 mph or the rails are wet or greasy, it is necessary to provide positive anchorage to avoid accidental movement and costly damage. Most traveling machines, with brakes in good working order, have a sufficient holding force through friction between the drive wheels and rails to resist sliding due to wind velocities of at least 35 mph. A means to adequately secure cranes against accidental movement with wind speed above 35 mph would reduce the potential for windstorm damage.
Status	According to Mr. Jerry Hunt, the recommendation will be completed by September 2006.

05-03-001

Key

Reinforce sprinkler protection over Building No. 72 Rack Storage.

The existing automatic sprinkler system should be reinforced to protect for twenty foot high rack storage of ordinary combustibles and noncombustible materials in combustible containers. The protection should be capable of providing a density of 0.36 gpm per sq. ft. over the hydraulically most remote 2,600 sq. ft. including a hose stream allowance of 500 gpm. The design should be based on a water supply of 75 psi static and 50 psi residual pressure with 1,483 gpm flowing. Plastic storage of poly rolls and tarps should not be stored in racks without the provision of in-rack sprinkler protection for the location of this storage in the racks.

05-03-001 continued

The Hazard	Hydraulic calculations were ran for the existing sprinkler protection. Only a minimum density of 0.09 gpm per sq. ft. over the hydraulically most remote 2,568 sq. ft. was found to be available. This will not allow protection of this warehousing operation and a fire originating here would be expected to spread throughout this bay. Spread of the fire would be stopped by the combination of the existing sprinkler protection, fire department response and provision of walls separating the warehouse from the rest of the building.
Status	The recommendation will be studied for possible completion.

05-03-002 Key

Provide an automatic seismic shut-off of natural gas supplies to all buildings.

The Hazard	A severe fire and/or explosion could occur following serious earthquake, resulting from rupture of the gas lines supplying the boilers and other gas users. This seismic event could also result impaired sprinkler protection due to a lack of complete seismic bracing which would than allow the fire to spread to where ever combustibles are present in either the construction or occupancy.
Technical Detail	An in line seismic gas shut-off valves which meets the requirements of ASCE 25-97 or listed with the State of California/ City of LA should be installed per manufacturers instructions, at the supply side to each individual building utilizing fuel. Install seismic gas shut-off valves outside buildings, downstream of the pressure regulator, and in a clearly marked and accessible location. Size valves in accordance with applicable local gas plumbing code or the International Fuel Gas Code to the maximum gas demand and allowable pressure drops in the system, so that the supply pressure at any equipment is greater than the minimum required for proper equipment operation. Mount seismic gas shut-off valves, including the sensing means, in accordance with the manufacturer's instructions and in a manner that the valve sensing device responds to earthquake ground motions and not to motions that may result from the dynamic response of structures, equipment or their accessories. Attach valves and sensing means to rigid mountings only. As an alternative provide a remote seismic sensor and safety shut-off valves arranged to shut off the gas supply to the entire gas supply system and vent the gas down stream of the safety shut-off valve at a safe location away from buildings and equipment.
Status	The recommendation will be studied for possible completion.

06-05-002 Conduct regular infrared thermographic surveys.

The Hazard	Through early discovery of loose electrical connections, the potential for these connections overheating to the point that they result in fire or circuit damage can be greatly reduced.
Status	The recommendation will be studied for possible completion.

06-05-003 *Begin an electrical switch and breaker inspection and exercise program.*

All low voltage switches and molded case circuit breakers should be visually inspected and exercised periodically in accordance with FM Global Property Loss Prevention Data Sheet 5-20, *Electrical Testing*. Records of such testing should be kept onsite for future reference.

The Hazard	FM Global loss statistics show that electrical failures account for more industrial dollar losses than any other peril. By recognizing and preventing such losses, the potential for fires and electrical systems damage will be substantially reduced.
Status	According to Mr. Ken Swingle, the recommendation will be studied for possible completion.

06-05-004 Submit the emergency response and hot work plans to FM Global for review.

The written plan should define the scope and duties of all members. Members should include a person-in-charge, a person designated to call the fire department, a sprinkler control valve operator, personnel trained in the use of fire extinguishers, small hose and salvage techniques, and a person designated to shut down fuel and electric supplies to the affected area.

The Hazard	A thoroughly documented emergency plan would reduce the magnitude of a loss to this facility if once should occur, by providing for prompt action to effectively minimize the impact and extent of the loss event.
Status	The recommendation will be completed by July 2006.

05-03-004 Sheet rock the combustible walls and roof structure of Substation 4.

Provide a layer of gypsum board wall covering over the plywood walls and on the underside of the wooden roof trusses of this substation.

The Hazard	An electrical failure could result in sparks igniting the several boxes of light bulbs stored which in turn would ignite the wooden walls and hence the wooden roof structure. Roof collapse would result causing impact and thermal damage to the electrical distribution equipment within this room. This would result in a lack of electrical power to Building Nos. 10, 43 and 80.
Status	Per Mr. Single, future plans may include relocating this substation at which time the combustible construction would be eliminated.

05-03-005 **Provide automatic sprinkler protection for Building No. 71.**

Adequate automatic sprinkler protection should be provided.

The Hazard	While smoke detection is provided in this office building, a fire developing within the combustible portions of the occupancy, consisting of office furniture and data processing equipment, could reach the wooden roof or second floor wooden floor before the fire department could respond and deploy fire fighting equipment effectively.
Status	This would not likely be accomplished unless the building is significantly remodelled.

05-03-006 **Improve seismic protection of sprinkler systems.**

The sprinkler protection seismic protection should be up graded to meet the intent of FM Global Property Loss Prevention Data Sheet 2-8, *Earthquake Protection for Water-Based Fire Protection.*

The Hazard	The present lack of adequate seismic protection exposes the sprinkler piping to damage in the event of an earthquake. The result of which would be the wetting of the contents of these buildings and the impairment of this sprinkler protection until repairs can be made. The typical sprinkler system at this location is provided lateral but not longitudinal braces.
Technical Detail	The needed upgrade consists of the following general areas of improvement: a. Longitudinal bracing should be provided on all feedmains and crossmains, spaced at no greater than eighty feet. Lateral bracing should be provided on all feedmains and crossmains, spaced at no greater than forty feet. Each should be provided at all elbows and tees. Where flexible couplings are found in horizontal pipe runs, every other coupling should be provided a lateral brace. The existing earthquake braces that are attached to two inch wooden roof members should be re-attached to wooden members having at least a four inch nominal thickness, or to concrete or steel. Those members tied to lightweight metal purlins should be re-attached to structural steel. Bracing attached to bottom chord of truss joists should be re-attached to the top chord. b. Open U-hangers used to hang branch lines should be equipped to prevent vertical movement of the branch lines. This includes the end of lines and at any location where the sprinkler is within two inches of the roof or other objects. c. Flexible couplings should be provided within twenty four inches of the tops and bottoms of risers. d. Flexible couplings should be provided within twenty four inches of the tops of pipe drops serving more than two sprinkler heads. e. Where flexible couplings are found in horizontal pipe runs, every other coupling should be provided a lateral brace. Where rigid couplings are used, location of the brace will be according to the forty foot rule per item b. above.

05-03-006 continued

Technical Detail	f. The existing earthquake braces that are attached to two inches of wooden roof members should be re-attached to wooden members having at least a four inches of nominal thickness, or to concrete or steel. Those members tied to lightweight metal purlins should be re-attached to structural steel. g. Suspended ceilings should be braced in accordance with UBC requirements for Seismic Zone 3.
Status	The final conference did not focus on this recommendation.

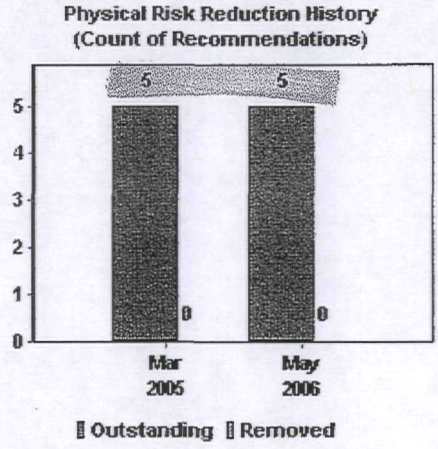
Risk Reduction

Recommendations that have been completed or otherwise removed are summarized in this section. **Human Element Recommendations** that have been completed often do not have an associated loss estimate since they usually serve to lower the frequency and/or severity of a loss. For this reason, we quantify them by counting the number of such items that have been completed.

The "counts" of recommendations referenced in this section include each part of multi-part recommendations except in cases where each part represents optional ways to address a single hazard. In such cases, the recommendation is only counted once.

Physical Recommendations

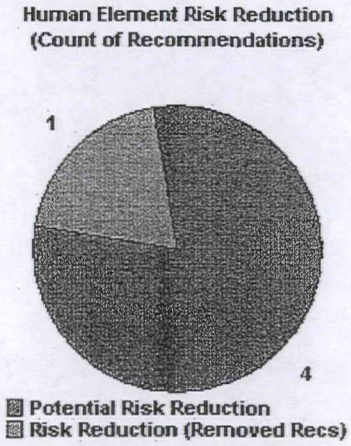
No **Physical** recommendations have been completed or removed since our last evaluation.

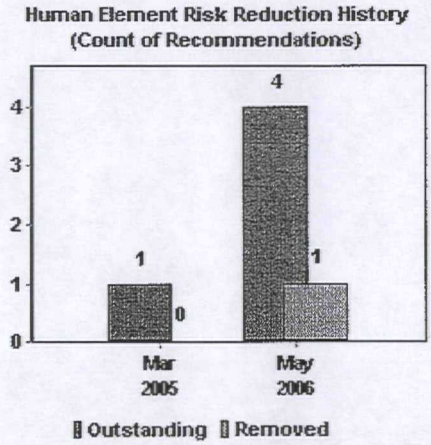


Human Element Recommendations

The following **Human Element** recommendation has been completed or removed as a result of this evaluation:

Rec Number	Recommendation Synopsis *Reason for Deletion*	Removal Method
05-03-003	Provide regularly recorded testing of the boiler burner management (flame safeguard) systems.	Completed 30 May 06





Comments

Plans have been proposed to establish an ample space for construction of new vessels. This is presently being reviewed by senior management with a decision as to implementation expected within about one month. This would result in relocation of Sub 4, along with demolition of about half of Building Nos. 10 and 43.

The sprinkler system maintenance crew has actively conducted flushing investigations over the past 18 months in Building No. 4. Results are considered acceptable for all bays except for No. 11 for which several cups of scale were collected. Mr. Nick Peters, Maintenance Supervisor has agreed to provide for a second flushing investigation of this system to include branch lines this coming summer to verify that all obstructive materials are now removed.

Ongoing Services

FM Global is available to provide support in all areas of property loss prevention. These services include:

- Development of specifications for projects such as new construction, automatic protection systems, and process safeguards
- Review of related project plans
- Assistance in implementing and managing loss prevention programs
- On site review and acceptance of completed projects
- Assistance in managing impaired protection systems

For access to these services, contact one of the following:

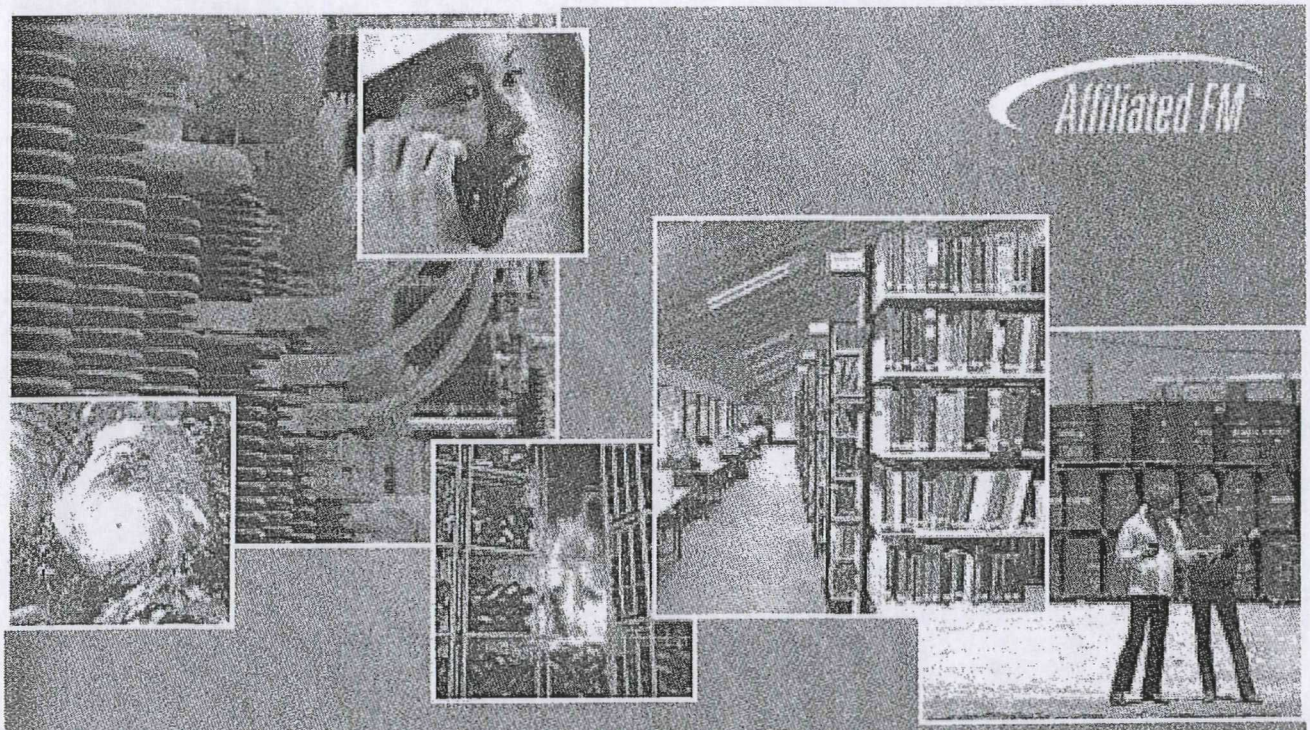
Seattle Office:
Key Center
601 108th Avenue, N.E.
Suite 1400
Bellevue, WA 98004
USA
[1] (425) 455 5333

Brandon S Dominguez, Account Engineer:
Affiliated FM Insurance Company
Portland Office
1000 SW Broadway
Suite 1150
Portland, OR 97205
USA
[1] (503) 228 3650

Reference Information

still there?

Site Contact:	Mr. Gene Caudill, Operations Director at +1 503 2471545
Final Conference Attendees:	Mr. Nick Peters, Maintenance Supervisor; Mr. Ken Swingle, Facilities Maint. Manager; Mr. Jerry Hunt, Facility Project Manager
Location Index Number:	077501.02-20
Account Number:	23-39523



Affiliated FM Risk Report

Location Findings
Vigor Industrial LLC

Building No 61 Paint Shop
5555 North Channel Avenue
Portland, Oregon 97217
USA

All in One
Interim Risk Evaluation

Visit by: Andrew J. Young
Visit date: 16 August 2007
Conference with: Mr. Bruce A. Dummer, Senior V.P. Finance & Administration

Index: 077501.02-20 / Account: 23-39523 / Order ID: 846650-3

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Principal Site Activity

This is a ship repair facility.

Understanding the Hazards at this Facility

The most significant and common hazards exposing the shipbuilding and ship repair industry (involving large steel hulls) are centered on damage to cranes, rendering them inoperable. This damage could stem from windstorm; improper rigging that could lead to impact damage; or overloading, which could result in structural damage or overturning. In addition to the physical damage, the loss of a crane can result in significant interruption to production.

This knowledge of the common hazards and our loss experience show that the following areas should be considered most important:

For indoor cranes, in addition to routine maintenance, provide proper training for both operators and riggers. Ensure cranes are equipped with safeguards such as load indicators, brakes, and rail clamps. Sling and hook maintenance and testing programs should be instituted and closely followed. For outdoor cranes, in addition to training for both operators and riggers, routine maintenance should include all braking systems. Safeguards such as wind-velocity indicating devices, rail clamps, stowage pins and load indicators should be provided. Wind securement procedures should be in writing and periodically reviewed. Wind and hail accounts for over 70 percent of the damage in this occupancy.

Presently the shut down procedures are in place for high wind, but they are lacking the proper means to do so in writing. These are now being sought.

Also discussed during this visit, was the seismic (earthquake) hazard common to the West coast, which can damage gas piping systems releasing natural gas into buildings. The gas will often be ignited by nearby electrical energy resulting in a fire and/or explosion. Often sprinkler piping will have been damaged by the same seismic event and rendered ineffective allowing fire to spread unabated. The presence of natural gas in Building Nos 4, 10, 72, 73, and Central Utilities provides for this hazard at this facility. Provision of seismic gas shut off valves are now planned and they will be installed over the next two months.

Management of Exposures

Certain potential hazards and conditions were evaluated at this facility. Completion of the following items will help lower both the frequency and severity of losses and minimize the possibility of costly interruptions to your business.

Affiliated FM Insurance Company (Affiliated FM) has developed this report for insurance underwriting purposes. The report is provided to you for informational purposes only to reduce the possibility of loss to property by bringing to your attention certain potential hazards or conditions. You must make the decision whether to take any action. Affiliated FM undertakes no duty to any party by providing this report or performing the activities on which it is based. The liability of Affiliated FM is limited to that contained in its insurance policies.

06-05-001 Provide a documented high wind procedure to include securing all cranes.

A high wind contingency plan should be developed, formalized and documented at this facility. Appropriate actions should be taken at specific time intervals prior to an oncoming storm to include crane securement in accordance with FM Global Property Loss Prevention Data Sheet 1-62, *Cranes* (forwarded to Jerry Hunt). Any required materials should be ready on hand and/or contractor services on retainer.

The Hazard	Approximately 90 percent of the time, cranes and stacker/reclaimers have sufficient protection against accidental (horizontal) movement by the friction load and the holding power of their drive wheel brakes. However, the critical ten percent of the time, when wind velocities exceed about 35 mph or the rails are wet or greasy, it is necessary to provide positive anchorage to avoid accidental movement and costly damage. Most traveling machines, with brakes in good working order, have a sufficient holding force through friction between the drive wheels and rails to resist sliding due to wind velocities of at least 35 mph. A means to be documented for adequately secure cranes against accidental movement with wind speed above 35 mph would reduce the potential for windstorm damage.
Status	According to Mr. Ken Swingle, the recommendation will be completed by October 2007.

05-03-002 Provide an automatic seismic shut-off of natural gas supplies to all buildings.

The Hazard	A severe fire and/or explosion could occur following serious earthquake, resulting from rupture of the gas lines supplying the boilers and other gas users. This seismic event could also result impaired sprinkler protection due to a lack of complete seismic bracing which would than allow the fire to spread to where ever combustibles are present in either the construction or occupancy.
Technical Detail	An in line seismic gas shut-off valves which meets the requirements of ASCE 25-97 or listed with the State of California/ City of LA should be installed per manufacturers instructions, at the supply side to each individual building utilizing fuel. Install seismic gas shut-off valves outside buildings, downstream of the pressure regulator, and in a clearly marked and accessible location. Size valves in accordance with applicable local gas plumbing code or the International Fuel Gas Code to the maximum gas demand and allowable pressure drops in the system, so that the supply pressure at any equipment is greater than the minimum required for proper equipment operation. Mount seismic gas shut-off valves, including the sensing means, in accordance with the manufacturer's instructions and in a manner that the valve sensing device responds to earthquake ground motions and not to motions that may result from the dynamic response of structures, equipment or their accessories. Attach valves and sensing means to rigid mountings only. As an alternative provide a remote seismic sensor and safety shut-off valves arranged to shut off the gas supply to the entire gas supply system and vent the gas down stream of the safety shut-off valve at a safe location away from

05-03-002 continued

Technical Detail	buildings and equipment.
Status	The recommendation will be completed by October 2007.

05-03-001 Reinforce sprinkler protection over Building No 72 Rack Storage.

The existing automatic sprinkler system should be reinforced to protect for twenty foot high rack storage of ordinary combustibles and noncombustible materials in combustible containers. The protection should be capable of providing a density of 0.36 gpm per sq. ft. over the hydraulically most remote 2 600 sq. ft. including a hose stream allowance of 500 gpm. The design should be based on a water supply of 75 psi static and 50 psi residual pressure with 1 483 gpm flowing. Plastic storage of poly rolls and tarps should not be stored in racks without the provision of in-rack sprinkler protection for the location of this storage in the racks.

The Hazard	Hydraulic calculations were ran for the existing sprinkler protection. Only a minimum density of 0.09 gpm per sq. ft. over the hydraulically most remote 2 568 sq. ft. was found to be available. This will not allow protection of this warehousing operation and a fire originating here would be expected to spread throughout this bay. Spread of the fire would be stopped by the combination of the existing sprinkler protection, fire department response and provision of walls separating the warehouse from the rest of the building.
Status	The recommendation will be studied for possible completion.

07-08-001 Replace light bands in Building No 4 or provide evidence of fire retardant in the panels.

The fiberglass reinforced plastic light bands on the end walls of Building No 4 should be replaced with a noncombustible material (metal or glass) or FM approved plastic material.

The Hazard	Fiberglass reinforced plastic panels have been shown to rapidly burn and often out race the operation of the automatic sprinklers resulting in complete panel combustion. Building No 4 has 4 of these panels used as horizontal light bands in the end wall, much of which would be consumed if ignited by fire. Automatic sprinkler protection at roof level would activate preventing involvement of the roof to any large extent, but all of the outside wall panels would need to be replaced.
Status	The recommendation will be studied for possible completion.

05-03-005 Provide automatic sprinkler protection for Building No 71.

Adequate automatic sprinkler protection should be provided.

The Hazard	While smoke detection is provided in this office building, a fire developing within the combustible portions of the occupancy, consisting of office furniture and data processing equipment, could reach the wooden roof or second floor wooden floor before the Fire Department could respond and deploy fire fighting equipment effectively.

05-03-005 continued

Status	This would not likely be accomplished unless the building is significantly remodelled.

06-05-002 Conduct regular infrared thermographic surveys.

The Hazard	Through early discovery of loose electrical connections, the potential for these connections overheating to the point that they result in fire or circuit damage can be greatly reduced.
Status	The recommendation will be studied for possible completion.

05-03-004 Sheet rock the combustible walls and roof structure of Substation 4.

Provide a layer of gypsum board wall covering over the plywood walls and on the underside of the wooden roof trusses of this substation.

The Hazard	An electrical failure could result in sparks igniting the several boxes of light bulbs stored which in turn would ignite the wooden walls and hence the wooden roof structure. Roof collapse would result causing impact and thermal damage to the electrical distribution equipment within this room. This would result in a lack of electrical power to Building Nos 10, 43 and 80.
Status	Per Mr. Swingle, future plans may include relocating this substation at which time the combustible construction would be eliminated.

05-03-006 Improve seismic protection of sprinkler systems.

The sprinkler protection seismic protection should be up graded to meet the intent of FM Global Property Loss Prevention Data Sheet 2-8, *Earthquake Protection for Water-Based Fire Protection.*

The Hazard	The present lack of adequate seismic protection exposes the sprinkler piping to damage in the event of an earthquake. The result of which would be the wetting of the contents of these buildings and the impairment of this sprinkler protection until repairs can be made. The typical sprinkler system at this location is provided lateral but not longitudinal braces.
Technical Detail	The needed upgrade consists of the following general areas of improvement:

05-03-006 continued

Technical Detail	a. Longitudinal bracing should be provided on all feedmains and crossmains, spaced at no greater than eighty feet. Lateral bracing should be provided on all feedmains and crossmains, spaced at no greater than forty feet. Each should be provided at all elbows and tees. Where flexible couplings are found in horizontal pipe runs, every other coupling should be provided a lateral brace. The existing earthquake braces that are attached to two inch wooden roof members should be re-attached to wooden members having at least a four inch nominal thickness, or to concrete or steel. Those members tied to lightweight metal purlins should be re-attached to structural steel. Bracing attached to bottom chord of truss joists should be re-attached to the top chord. b. Open U-hangers used to hang branch lines should be equipped to prevent vertical movement of the branch lines. This includes the end of lines and at any location where the sprinkler is within two inches of the roof or other objects. c. Flexible couplings should be provided within twenty four inches of the tops and bottoms of risers. d. Flexible couplings should be provided within twenty four inches of the tops of pipe drops serving more than two sprinkler heads. e. Where flexible couplings are found in horizontal pipe runs, every other coupling should be provided a lateral brace. Where rigid couplings are used, location of the brace will be according to the forty foot rule per item b. above. f. The existing earthquake braces that are attached to two inches of wooden roof members should be re-attached to wooden members having at least a four inches of nominal thickness, or to concrete or steel. Those members tied to lightweight metal purlins should be re-attached to structural steel. g. Suspended ceilings should be braced in accordance with UBC requirements for Seismic Zone 3.
Status	The final conference did not focus on this recommendation.

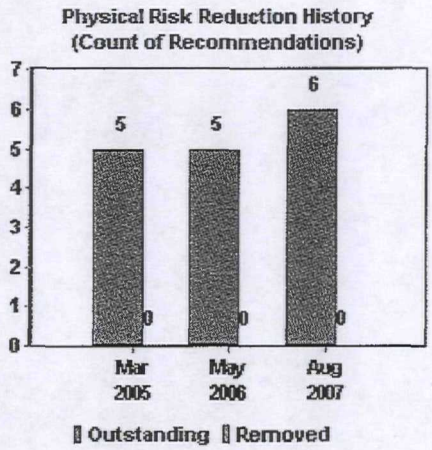
Risk Reduction

Recommendations that have been completed or otherwise removed are summarized in this section. **Human Element Recommendations** that have been completed often do not have an associated loss estimate since they usually serve to lower the frequency and/or severity of a loss. For this reason, we quantify them by counting the number of such items that have been completed.

The "counts" of recommendations referenced in this section include each part of multi-part recommendations except in cases where each part represents optional ways to address a single hazard. In such cases, the recommendation is only counted once.

Physical Recommendations

No **Physical** recommendations have been completed or removed since our last evaluation.

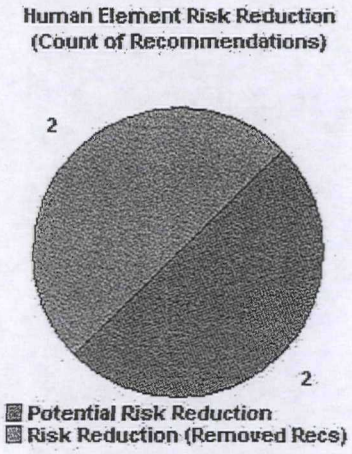


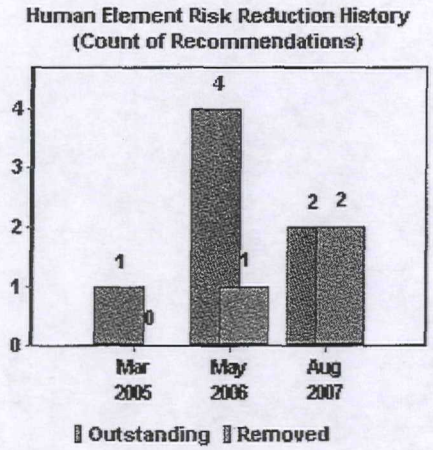
Human Element Recommendations

The following **Human Element** recommendations have been completed or removed as a result of this evaluation:

Rec Number	Recommendation Synopsis *Reason for Deletion/Completion*	Removal Method
06-05-003	Begin an electrical switch and breaker inspection and exercise program. *A PM program to exercise main breakers is in place.*	Completed 16 Aug 07
06-05-004	Submit the emergency response and hot work plans to FM Global for review. *Plans were submitted during this visit.*	Completed 16 Aug 07

Human Element Recommendations continued





Comments

Plans are going forward to establish an ample space for construction of new vessels. This will result in relocation of Substation No 4, along with demolition of about half of Building No 10. Building No 43 has now been raised.

Trip testing and flushing investigations were limited in 2006 to Building No 72 only. This was discussed with Management during this visit and plans are to dry trip test all systems in 2007 and resume the flushing investigation program.

Cathodic protection has now been provided on all buried natural gas and oxygen piping.

Transformer oil analysis is being completed annually for all transformers. This has resulted in a need to presently rewind one transformer found with high levels of gasses dissolved in the oil.

One bay of rack storage in Building No 72 has been eliminated, thereby limiting the potential for loss due to a lack of adequate sprinkler protection to protect rack storage to 20 ft high. Only two rows of high rack storage remain.

Ongoing Services

FM Global is available to provide support in all areas of property loss prevention. These services include:

- Development of specifications for projects such as new construction, automatic protection systems, and process safeguards
- Review of related project plans
- Assistance in implementing and managing loss prevention programs
- On site review and acceptance of completed projects
- Assistance in managing impaired protection systems

For access to these services, contact one of the following:

Seattle Office:
Key Center
601 108th Avenue, N.E.
Suite 1400
Bellevue, WA 98004
USA
[1] (425) 455 5333

Brandon S. Dominguez, Account Engineer:
Affiliated FM Insurance Company
Portland Office
1000 SW Broadway
Suite 1150
Portland, OR 97205
USA
[1] (503) 228 3650

Reference Information

Location Findings

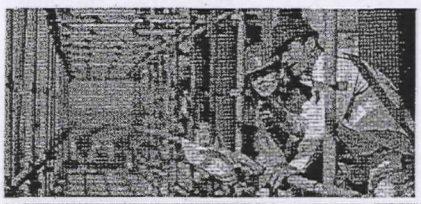
Vigor Industrial LLC
Building No 61 Paint Shop
5555 North Channel Avenue
Portland, Oregon 97217
USA

All in One
Interim Risk Evaluation

Visit by:	Andrew J. Young
Visit date:	16 August 2007
Site Contact:	Mr. Bruce A. Dummer, Senior V.P. Finance & Administration at +1 503 2471801, bdummer@casgen.com

Reference Information continued

Final Conference Attendees:	Mr. Ken Swingle, Facilities Maint. Manager; Mr. Bruce A. Dummer, Senior V.P. Finance & Administration
Location Index Number:	077501.02-20
Account Number:	23-39523



Risk Report

Location Findings

Affiliated FM

Cascade General Inc.
Pier C (berths 312-314) - Building #4 - Fabrication - Building #72 - Shops & Office - Ballast Water Treatment Lab - Central Utilities - Pier A (berths 301-305) - Finger Pier (berths 309 & 310) - Berth 315
5555 North Channel Avenue
Portland, Oregon 97217
USA

Fire & Natural Hazards
First Baseline Risk Evaluation
Visit by Andrew J. Young on
02 March 2005 in conference with
Mr. Bruce A. Dummer, Senior V.P. Finance & Administration

Understanding the Hazards at this Facility

The most significant and common hazards exposing the shipbuilding and ship repair industry (involving large steel hulls) are centered on damage to cranes, rendering them inoperable. This damage could stem from windstorm; improper rigging that could lead to impact damage; or overloading, which could result in structural damage or overturning. In addition to the physical damage, the loss of a crane can result in significant interruption to production.

This knowledge of the common hazards and our loss experience show that the following areas should be considered most important:

For indoor cranes, in addition to routine maintenance, provide proper training for both operators and riggers. Ensure cranes are equipped with safeguards such as load indicators, brakes, and rail clamps. Sling and hook maintenance and testing programs should be instituted and closely followed. For outdoor cranes, in addition to training for both operators and riggers, routine maintenance should include all braking systems. Safeguards such as wind-velocity indicating devices, rail clamps, stowage pins and load indicators should be provided. Wind securement procedures should be in writing and periodically reviewed. Wind and hail accounts for over 70 percent of the damage in this occupancy.

At this facility, the high wind hazard to the cranes is understood and procedures are in place for securing cranes during a windstorm. However, these procedures are not readily available in writing. Mr. Gene Caudill, Operations Manager is currently accessing the written version of these procedures from the training coordinator (who was not available during this visit). These procedures will than be forwarded to the writer for review.

Also discussed during this visit, was the seismic (earthquake) hazard common to the west coast, which can damage gas piping systems releasing natural gas into buildings. The gas will often be ignited by nearby electrical energy resulting in a fire and/or explosion. Often sprinkler piping will have been damaged by the same seismic event and rendered ineffective allowing fire to spread unabated. The presence of natural gas in Building Nos. 4, 10, 43, 72, 73, and Central Utilities provides for this hazard at this facility. Provision of seismic gas shut

This report is strictly informational and is intended to reduce the possibility of loss to property insured by the Affiliated FM Insurance Company by bringing to your attention certain potential hazards and/or conditions. It does not imply that all other hazards or conditions are under control. You must make the decision on whether and how to address any hazard or condition. The liability of Affiliated FM Insurance Company is limited to that contained in its insurance policies. No liability or policy coverage is created by reason of this report or the inspection upon which it is based.

Understanding the Hazards at this Facility (continued)

off valves for each gas service (exterior) or a remote seismic sensor tied to close a safety shut off valve and open a down stream vent valve was discussed. Management has agreed to look into providing this equipment to mitigate the fire following earthquake hazard.

"Key Exposures" are those that can most directly impact loss experience. Associated recommendations are flagged as "Key" since they address the hazards that are most likely to lead to a serious loss.

Management of Exposures

Certain potential hazards and conditions were evaluated at this facility. Completion of the following items will help lower both the frequency and severity of losses and minimize the possibility of costly interruptions to your business.

Key Exposures

Experience shows that the majority of all losses in this type of facility can be prevented or minimized by addressing the **Key Exposures**, which are flagged below.

05-03-001 *Key Exposure*	**Reinforce sprinkler protection over Building No. 72 Rack Storage.** The existing automatic sprinkler system should be reinforced to protect for 20 ft. high rack storage of ordinary combustibles and noncombustible materials in combustible containers. The protection should be capable of providing a density of 0.36 gpm per sq. ft. over the hydraulically most remote 2,600 sq. ft. including a hose stream allowance of 500 gpm. The design should be based on a water supply of 75 psi static and 50 psi residual pressure with 1483 gpm flowing. Plastic storage of poly rolls and tarps should not be stored in racks without the provision of in-rack sprinkler protection for the location of this storage in the racks.
The Hazard	Hydraulic calculations were ran for the existing sprinkler protection. Only a minimum density of 0.09 gpm per sq. ft. over the hydraulically most remote 2568 sq. ft. was found to be available. This will not allow protection of this warehousing operation and a fire originating here would be expected to spread throughout this bay. Spread of the fire would be stopped by the combination of the existing sprinkler protection, fire department response and provision of walls separating the warehouse from the rest of the building.
Status	The recommendation will be studied for possible completion.

05-03-002 *Key Exposure*	**Provide an automatic seismic shut-off of natural gas supplies to all buildings.**
The Hazard	A severe fire and/or explosion could occur following serious earthquake, resulting from rupture of the gas lines supplying the boilers and other gas users. This seismic event could also result impaired sprinkler protection due to a lack of complete seismic bracing which would than allow the fire to spread to where ever combustibles are present in either the construction or occupancy.
Technical Detail	An in line seismic gas shut-off valves which meets the requirements of ASCE 25-97 or listed with the State of California/ City of LA should be installed per manufacturers instructions, at the supply side to each individual building utilizing fuel. Install seismic gas shut-off valves outside buildings, downstream of the pressure regulator, and in a clearly marked and accessible location. Size valves in accordance with applicable local gas plumbing code or the International Fuel Gas Code to the maximum gas demand and allowable pressure drops in the system, so that the supply pressure at any equipment is greater than the minimum required for proper equipment operation. Mount seismic gas shut-off valves, including the sensing means, in accordance with the manufacturer's instructions and in a manner that the valve sensing device responds to earthquake ground motions and not to motions that may result from the dynamic response of structures, equipment or their accessories. Attach valves and sensing means to rigid mountings only. As an alternative provide a remote seismic sensor and safety shut-off valves arranged to shut off the gas supply to the entire gas supply system and vent the gas down stream of the safety shut-off valve at a safe location away from buildings and equipment.
Status	The recommendation will be studied for possible completion.

05-03-003	**Provide regularly recorded testing of the boiler burner management (flame safeguard) systems.** Inspect and test fuel burner combustion safety controls according to manufacturers' recommendations. This procedure should include tests, performed at prescribed intervals, for tightness of gas safety shut-off valves, for response to flame failure, and for proper action of fuel-air interlocks. Tests should be recorded on a safety-control inspection and testing report, listing the date, controls tested, their condition, and the proper sequence and methods of performing the tests.

05-03-003 (continued)	
The Hazard	The fuel burner safety controls are provided to prevent unstable firing or flame failure to occur without automatic shutdown of the firing system. Without which, the unstable flame could result in accumulation of unburned products of combustion which could accumulate within the boiler or flue gas system and become ignited resulting in an explosion and damage to the unit. Without the flame failure detection in service, raw unburned fuel would accumulate upon flame out, resulting in possible explosion.
Status	According to Mr. Gene Caudill, the recommendation will be completed by May 2005.

05-03-004	**Sheet rock the combustible walls and roof structure of Substation 4.** Provide a layer of gypsum board wall covering over the plywood walls and on the underside of the wooden roof trusses of this substation.
The Hazard	An electrical failure could result in sparks igniting the several boxes of light bulbs stored which in turn would ignite the wooden walls and hence the wooden roof structure. Roof collapse would result causing impact and thermal damage to the electrical distribution equipment within this room. This would result in a lack of electrical power to Building Nos. 10, 43 and 80.
Status	The recommendation will be studied for possible completion.

05-03-005	**Provide automatic sprinkler protection for Building No. 71.** Adequate automatic sprinkler protection should be provided.
The Hazard	While smoke detection is provided in this office building, a fire developing within the combustible portions of the occupancy, consisting of office furniture and data processing equipment, could reach the wooden roof or 2nd floor wooden floor before the fire department could respond and deploy fire fighting equipment effectively.
Status	The final conference did not focus on this recommendation.

05-03-006	**Improve seismic protection of sprinkler systems.** The sprinkler protection seismic protection should be up graded to meet the intent of FM Global Data Sheet 2-8.

05-03-006
(continued)

The Hazard	The present lack of adequate seismic protection exposes the sprinkler piping to damage in the event of an earthquake. The result of which would be the wetting of the contents of these buildings and the impairment of this sprinkler protection until repairs can be made. The typical sprinkler system at this location is provided lateral but not longitudinal braces.
Technical Detail	The needed upgrade consists of the following general areas of improvement: a. Longitudinal bracing should be provided on all feedmains and crossmains, spaced at no greater than 80 ft. Lateral bracing should be provided on all feedmains and crossmains, spaced at no greater than 40 ft. Each should be provided at all elbows and tees. Where flexible couplings are found in horizontal pipe runs, every other coupling should be provided a lateral brace. The existing earthquake braces that are attached to 2 in. wooden roof members should be re-attached to wooden members having at least a 4 in. nominal thickness, or to concrete or steel. Those members tied to lightweight metal purlins should be re-attached to structural steel. Bracing attached to bottom chord of truss joists should be re-attached to the top chord. b. Open U-hangers used to hang branch lines should be equipped to prevent vertical movement of the branch lines. This includes the end of lines and at any location where the sprinkler is within 2 in. of the roof or other objects. c. Flexible couplings should be provided within 24 in. of the tops and bottoms of risers. d. Flexible couplings should be provided within 24 in. of the tops of pipe drops serving more than two sprinkler heads. e. Where flexible couplings are found in horizontal pipe runs, every other coupling should be provided a lateral brace. Where rigid couplings are used, location of the brace will be according to the 40 ft. rule per item b. above. f. The existing earthquake braces that are attached to 2 in. wooden roof members should be re-attached to wooden members having at least a 4 in. nominal thickness, or to concrete or steel. Those members tied to lightweight metal purlins should be re-attached to structural steel. g. Suspended ceilings should be braced in accordance with UBC requirements for Seismic Zone 3.
Status	The final conference did not focus on this recommendation.

Comments

Building No. 73 was found to contain storage of paint in about 75 5-gallon metal cans much of which contained a red label indicating flammability. The lack of adequate sprinkler protection at this portion of the warehouse for this storage in racks to about 7 ft. in height was discussed with Mr. Gene Caudill, Operations Manager. It was recommended that the paint be relocated to adjacent to the sprinkler riser where adequate sprinkler protection is available. Mr. Caudill stated that he would prefer moving it from the building entirely and into the unsprinklered storage shed used for this purpose. He added that this would be done within the next several days.

Ongoing Services

FM Global is available to provide support in all areas of property loss prevention. These services include:

- Development of specifications for projects such as new construction, automatic protection systems, and process safeguards
- Review of related project plans
- Assistance in implementing and managing loss prevention programs
- On site review and acceptance of completed projects
- Assistance in managing impaired protection systems

For access to these services, contact one of the following:

- Seattle Office:
  Key Center
  601 108th Avenue, N.E.
  Suite 1400
  Bellevue, WA 98004
  USA
  [1] (425) 455 5333

- Greg W. Garland, Account Engineer:
  Affiliated FM Insurance Company
  Seattle Office
  Key Center
  601 108th Avenue N.E.
  Suite 1400
  Bellevue, WA 98004
  USA
  [1] (425) 455 5333

Reference Information

Site Contact: Mr. Gene Caudill, Operations Director at +1 (1) 503 2471545
Final Conference Attendees: Mr. Bruce A. Dummer, Senior V.P. Finance & Administration; Mr. Nick Peters, Maintenance Supervisor; Mr. Gene Caudill, Operations Director
Location Index Number: 077501.02-20
Account Number: 23-39523

Removed USTs

*UST #	Capacity (Gallons)	Contents	Location	Installation Date	Removal Information
2	12,700	Diesel	Berth 305	Unknown	Removed in 1989 and 190 cubic yards of soil were removed. The tank received a no further action determination from DEQ (Oregon DEQ, 1992)
5	500	Diesel	SW Corner of Bldg 10	Unknown	Removed by 1992; 12 cubic yards of soil removed. The tank received a no further action determination from DEQ (Oregon DEQ, 1992).
6	500	Diesel	Between Buildings 43 and 50	1978	It was removed by 1992 and received a no further action determination from DEQ ((Oregon DEQ, 1992).
7	1,000	Diesel	Between Buildings 43 and 50	1976	It was removed by 1992 and received a no further action determination from DEQ, 1992).
8	2,000	Gasoline	Between Buildings 43 and 50	1976	It was removed by 1992 and received a no further action determination from DEQ, 1992).
9	10,000	Fuel Oil	Between Buildings 58 and 64	1961	Removed in 1989 and 228 cubic yards of soil removed. At DEQ's request, further investigation conducted in 1991. Groundwater monitoring conducted and detected concentrations of petroleum deemed acceptable. Petroleum hydrocarbons found in soil, but the soil extended beneath structures. Tank received a no further action determination from DEQ (Oregon DEQ, 1992).
10	250	Diesel	East of Building 58	Unknown	The tank was removed in 1991. Groundwater monitoring was conducted and the site was closed (Oregon DEQ, 1992).
11	1,000	Gasoline	SW Corner of Building 64	1966	The tank was removed by 1992 and received a no further action determination from DEQ (Oregon DEQ, 1992).
14	1,200	Glycol	North of Building 73	1978	Removed in 1992 and no contamination was found.
17	300	Diesel	North side of Building 4	Unknown	Removed by 1992 and tank received a no further action determination from DEQ (Oregon DEQ, 1992).

*** UST # refers to 13l. attachment drawing "Active and Inactive UST Locations."**