EXHIBIT NO. ___(HVS-1T)
DOCKET NO. PG-041624
WITNESS: HARRY V. SHAPIRO

BEFORE THE
WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION, **Complainant,** **v.** **PUGET SOUND ENERGY, INC.,** **Respondent.**	**Docket No. PG-041624**

PREFILED DIRECT TESTIMONY OF HARRY V. SHAPIRO ON BEHALF OF PUGET SOUND ENERGY, INC.

AUGUST 15, 2005

PUGET SOUND ENERGY, INC.

PREFILED DIRECT TESTIMONY OF HARRY SHAPIRO

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Exhibit No. _____ (HVS-2)	WAC 480-93-185, 186, and 18601
Exhibit No. _____ (HVS-3)	WUTC Staff's Answer to PSE Data Request No. 1
Exhibit No. _____ (HVS-4)	WUTC Staff's Answer to PSE Data Request No. 6

PUGET SOUND ENERGY, INC.

PREFILED DIRECT TESTIMONY OF HARRY SHAPIRO

I. INTRODUCTION

Q. Please state your name, business address and present position with Puget Sound Energy, Inc.

A. My name is Harry V. Shapiro. My business address is 10885 N.E. Fourth Street, P.O. Box 97034, Bellevue, Washington 98009-9734. I am the Director of Gas Operations for Puget Sound Energy, Inc. ("PSE" or "the Company").

Q. What is your educational and professional experience?

A. I have a Bachelor of Science in Mechanical Engineering from the University of Washington, a Masters of Business Administration from Pacific Lutheran University and am a graduate of the University of Idaho Utility Executive Course. I have been the Director of Gas Operations at PSE since April 2005. Prior to becoming Director of Gas Operations, I was the Manager of Contract Management responsible for the implementation of PSE's two service provider contracts. I have been with PSE for 23 years, and have also held the position of Contract Manager, Manager of System Control and Protection, Director of Operational Performance, Area Supervisor (South Snohomish County), Project Manager (THCGS), Distribution Engineer and Maintenance Engineer. I am a member of the American Gas Association (AGA) Distribution Construction and Maintenance Committee.

Q. What are your duties as the Director of Gas Operations?

A. I oversee a staff of over 330 personnel in 11 departments who are responsible for the day-to-day operation and maintenance of the PSE gas distribution system. This covers everything from emergency response, implementation of the various inspection and maintenance programs, and nomination of daily gas supply needs to Williams Pipeline, our gas supplier.

II. SCOPE OF TESTIMONY

Q. What is the scope of your testimony in this proceeding?

A. I will provide testimony regarding: 1) PSE's gas distribution system; 2) how PSE uses and monitors cathodic protection; 3) the monitoring of the Vasa Park Rectifier prior to the incident and the temporary cross-wiring of the Vasa Park Rectifier; 4) the unusual circumstances of Mrs. Schmitz's home that contributed to the explosion; and 5) the extraordinary leak surveys that PSE is performing and that WUTC Staff is recommending.

III. SUMMARY OF TESTIMONY

Q. Please summarize your testimony.

A. PSE operates a large gas distribution system that is constantly monitored for leaks in compliance with applicable federal and state regulations. The regulations anticipate that gas distribution systems will suffer from leaks, and provide a classification system under which leaks are to be repaired or monitored. In addition, PSE monitors its cathodic protection systems in compliance with applicable regulations. PSE maintains a safe gas distribution system. In particular, PSE's monitoring of the area served by the Vasa Park Rectifier (the "Rectifier") prior to the incident showed neither unusual corrosion nor a

significant amount of leaks. The tragic explosion on September 2, 2004 was the result of the unique circumstances of Mrs. Schmitz's home, and does not indicate that larger problems exist either in the Spiritridge neighborhood or system-wide.

III. BACKGROUND ON PSE'S GAS DISTRIBUTION SYSTEM

Q. Have you reviewed the testimony of Sue McLain in this matter?

A. Yes.

Q. Do you agree with her description of PSE's gas distribution system?

A. Yes.

Q. Is there a gas distribution system anywhere in the country that does not have gas leaks?

A. No. Gas distribution systems are large, complex and usually cover very large geographic areas. Gas leaks are a recognized part of delivering the service and that fact has always been acknowledged by the state regulators charged with monitoring our gas system's safety. In fact, the Washington Administrative Code ("WAC") categorizes gas system leaks as Grade 1 (or Grade "A"), Grade 2 (or Grade "B") and Grade 3 (or Grade "C"). The gas distribution system operator is given the discretion to grade a leak based on conditions found in the field. Concentration of the gas (% gas or %LEL), spread and proximity to structures are the major factors considered when grading a leak. Grade "1" leaks are hazardous and require urgent action to immediately address the hazardous condition. Grade "2" leaks are not hazardous at the time of detection but justify scheduled repair based on potential future hazard. Grade "3" leaks are not hazardous at the time of detection and can reasonably be expected to stay that way. They are very minor and need only be monitored. Grade 3 leaks are generally just monitored and not repaired because no real risk is posed. In fact, it may be very difficult to

even find the exact point of the leak. The most recent version of WAC 480-93-185, 186, and 18601 are attached as Exhibit No. ___ (HVS-2) to my testimony. Those regulations address the process of leak classification.

However, we remain vigilant and work to minimize leaks as part of the operation of our distribution system.

Q. What are the major causes of a leak?

A. Most leaks result from construction contractors, homeowners, or other third-parties accidentally damaging a service or main line while excavating. In the last four months, 52% of leaks in service or main lines owned by PSE have been caused by third-party damage. Although there is a legal requirement to notify PSE before digging more than one foot deep into the ground, that law is often overlooked and, even if damage is caused to a service or main line during excavation (rather than line-breakage), PSE is not necessarily notified. In addition to third-party damage, a smaller percentage of leaks are caused by mechanical or material failure, loose pipe fittings and joints, corrosion, and other unknown causes.

Q. Is there a way to slow the corrosion of metal gas service and main lines?

A. Yes. PSE has placed special coatings on the outside of our buried metal pipes to help prevent corrosion. In addition, PSE and other gas distribution companies use various forms of "cathodic protection" methods to block the electro-chemical reaction between steel pipe and the surrounding soil that causes oxidation (or rusting).

Q. How does cathodic protection minimize corrosion?

A. There are two basic methods of cathodic protection: the "galvanic anode" (or sacrificial anode) system, and the "impressed current" (or rectifier) system. Both

systems cause a direct current of electricity to flow onto the pipe—from either the sacrificial anode or the rectifier.

Q. Do all the gas service and main lines serving PSE customers have cathodic protection?

A. No. Most metal, but not all, PSE gas service and main lines have cathodic protection. The purpose of cathodic protection is to protect steel pipes from corroding. Although PSE has steel pipelines that are protected by some type of cathodic protection, we also have plastic (polyethylene) gas service and main lines that do not require cathodic protection at all. Approximately 97% of PSE pipelines that serve homes and businesses are either plastic or cathodically protected steel. The remaining 3% are bare steel or cast iron, which do not require cathodic protection.

Q. How often does PSE inspect to ensure the integrity and safety of its gas mains and services?

A. In accordance with federal and state law, PSE uses sophisticated electronic equipment to leak survey every neighborhood's gas system—block-by-block, and house-by-house. Areas with cast-iron and bare-steel service and main lines are surveyed, at a minimum, every six months. Areas with high-occupancy structures, business districts, or gas-transmission mains are surveyed annually. Cathodically protected steel and plastic gas service and main lines are surveyed every five years, at a minimum. In addition, the cathodic protection systems themselves are inspected, depending on their type and size. For example, our rectifiers are inspected every two months. Moreover, during the course of daily activities, PSE technicians and other field employees monitor the gas system for anything out of the ordinary, including construction activity in the vicinity of gas service and main lines. Additionally, PSE performs regularly scheduled

atmospheric corrosion monitoring on all above-ground pipeline facilities and inspects critical valves each calendar year.

Q. In your view, is the PSE gas distribution system safe?

A. Yes, we believe that it is a safe system and we have heard that statement publicly confirmed by the WUTC Staff. We also work hard to keep it that way.

IV. THE EVENTS LEADING UP TO THE INCIDENT

Q. Please tell us in what ways the Rectifier was monitored to ensure it was in compliance with federal and state regulations in the year leading up to the September 2 explosion.

A. PSE monitors the Rectifier through an annual cathodic protection survey, bi-monthly readings, exposed pipe condition reports, and other ways, all consistent with applicable regulations.

Q. Please describe what an annual cathodic protection survey is and how PSE performs them.

A. The annual cathodic protection survey collects pipe-to-soil potential measurements at test points identified throughout the system.

Q. What does "potential" mean?

A. When a piece of metal is placed in an electrolyte, such as soil, a voltage will develop across the metal-soil interface because of the electrochemical nature of the corrosion process. This voltage is called "potential." An "electrolyte" is a substance which, when placed in water, will conduct electricity and carry electric current.

Q. Describe the most recent annual cathodic protection survey that occurred

prior to the incident.

A. In the summer and fall of 2003, an annual cathodic protection survey was conducted in the Spiritridge area. Over sixty test points were investigated in the Spiritridge vicinity during the survey. The data indicates that throughout this area of the system, at the time of these tests, the cathodic protection system was operating at a level sufficient to meet the federally mandated criteria for effective cathodic protection in the Spiritridge area.

Q. You mentioned bi-monthly readings as a way of ensuring compliance with federal and state cathodic protection requirements. Please tell us what they are and how they relate to the Rectifier.

A. The Rectifier was monitored on a bi-monthly schedule as is required by 49 C.F.R. § 192.465.2. For this process, we check the DC Voltage and current output of the Rectifier, as well as the tap settings. We document those findings.

Q. Please describe the results from the bi-monthly reading of the Rectifier.

A. The bi-monthly readings from 2003 and leading up to the incident indicates that from February of 2003 through April of 2004 the Rectifier was operating as designed and under normal circuit conditions.

Q. You also mentioned the use of exposed pipe condition reports ("EPCRs") as a means of ensuring compliance with federal and state cathodic protection requirements. Please explain the purpose of EPCRs and how they relate to the Rectifier.

A. An EPCR is a report PSE or its contractors must prepare under 49 C.F.R. § 192.459 to document the condition of buried pipe wherever it is exposed. The exposed portion of the pipe must be examined for evidence of external corrosion and coating condition. EPCR's can also include information related to the

effectiveness of the cathodic protection system through recording pipe-to-soil potentials at the excavation locations.

Q. Please describe the EPCRs that were done in the Spiritridge area in the months prior to the incident.

A. In the months prior to the incident, five EPCR's were completed in the Spiritridge area.

Q. What were the results of the five EPCR's?

A. Two of these reports triggered an investigation because of low reads. Ultimately, PSE discovered that both a cracked insulator (discovered and then corrected on September 21, 2004) and a ground wire from an adjoining cell tower touching a PSE main (discovered and then corrected on October 18, 2004) were the cause of the bad reads. However, the process of finding and rectifying these two problems required extensive disbonding and analysis over a period of time. The other potentials collected on the EPCR reports indicated that the cathodic protection system was functioning properly and providing sufficient cathodic protection to polarize the associated pipelines to potentials in meeting the accepted criteria for adequate protection.

Q. What did the investigation and EPCR's find for July and August 2004?

A. Throughout July and much of August 2004, the on-going investigation and additional EPCR's indicated pipe-to-soil potentials in the protective range (more negative than -850mV). But, on August 30, 2004, an EPCR in the Spiritridge area showed pipe-to-soil potentials of 0 mV. Pipe-to-soil potentials of this magnitude on coated steel buried piping are indicative of either stray current interference (that is, current flow from a foreign source that is collecting on and discharging from the structure being measured) or an indication of an impressed

current source (rectifier) operating with the output polarity reversed. Initially, PSE thought that this read was the result of issues that were already under investigation as discussed in the previous question of this testimony. Additional testing conducted on September 1, 2004 at an excavation in the southern part of the Spiritridge area also indicated pipe-to-soil potentials of 0 mV. Importantly, however, PSE was responding to the issues and proceeding with its investigation to discover the source of these unusual reads.

Q. What did the technician do after discovering the low readings?

A. The 0 mV readings were reported as "low readings" to the cathodic protection technician, who had discovered the shorted flange in June of 2004. These two reads were then incorporated into the broader investigation already underway.

V. THE EVENTS OF SEPTEMBER 2, 2004

Q. Are you aware of the September 2, 2004, explosion that occurred at the home of Mrs. Frances Schmitz, 16645 SE 26th Place, Bellevue?

A. Yes.

Q. Please describe PSE's activities the morning of September 2, 2004.

A. On the morning of September 2, PSE personnel were responding to a reported odor of gas in the Spiritridge subdivision of Bellevue. PSE received the odor call at 8:29 a.m., dispatched our first responder at 8:37 am, and he arrived at the site at 9:00 a.m. While meeting with the concerned neighbors and investigating the source of the odor, the explosion and fire at 16445 S.E. 26th Place occurred.

Q. Has PSE determined what caused the explosion?

A. Yes. The explosion occurred because gas from a leak on the Schmitz residence service line migrated into the residence and was ignited. As experts for both

WUTC Staff and for PSE have testified, the leak on the service line occurred as a result of severe external corrosion that began prior to the application of cathodic protection to the Spiritridge neighborhood. The gas was able to migrate into the Schmitz residence because of several unique factors that were specific to that home, as explained later in my testimony and also in more detail by Kevin Garrity and James Hogan.

Q. Please describe the gas service line servicing the house at 16645 SE 26th Place, Bellevue, Washington.

A. The house at 16645 SE 26th Place in Bellevue, Washington received gas by a nominal ¾-inch wrapped steel gas service line that was installed in January 1963. The original service installation records indicate that the service extended sixty feet from a 2-inch intermediate pressure wrapped steel gas main located along S.E. 26th Place. Installation of the service was completed on January 10, 1963, and the application for gas service was completed January 14, 1963.

Q. Was the house at 16645 S.E. 26th Place, Bellevue, Washington, served by a cathodic protection system at the time of the incident?

A. Yes. However, cathodic protection systems were first required in 1971, eight years after the service line was installed. As was allowed, PSE undertook a multi-step process over several years to implement cathodic protection systems throughout its entire service area in the Puget Sound region.

Q. Please describe the cathodic protection system that serviced the house.

A. Cathodic protection was applied to the gas mains in the area that serviced the house during the early 1980's. The coated and wrapped steel service line was installed with no dielectric union at the tie-in to the main. The service line, therefore, was cathodically protected via the cathodic protection sources

protecting the main. The predominant cathodic protection current source serving the house is the Rectifier, located at S.E. 43rd Street and 164th Place S.E. The Rectifier is situated approximately 3,240 feet from the explosion site. This Rectifier and ground bed were installed in March 1982. In addition, there is evidence that galvanic cathodic protection existed in the area with the placement of sacrificial anodes along the main lines.

Q. Please describe the area served by the Rectifier.

A. The Rectifier was designed to provide cathodic protection to an area near Lake Sammamish in Bellevue, Washington, containing approximately 2,600 homes served with natural gas by PSE, including the Spiritridge neighborhood where the explosion occurred.

VI. THE CROSS-WIRED RECTIFIER

Q. Was the Rectifier functioning properly at the time of the explosion?

A. No.

Q. Why not?

A. The lead wires of the rectifier were cross-wired.

Q. When did PSE discover this?

A. The morning of September 3, 2004. PSE alerted the WUTC staff in the afternoon of September 3.

Q. When did PSE correct the cross-wired Rectifier?

A. The morning of September 3, 2004, as soon as it was found.

Q. Is the sole fact that the Rectifier was cross-wired or that the level of cathodic

protection was below -.85 volts a violation of the Code of Federal Regulations ("CFR") or WAC?

A. No. Although James Hogan and Dennis Burke will discuss the details in their testimony, my understanding is that PSE had 90 days to fix the Rectifier and restore the requisite level of cathodic protection from the date of discovery. PSE fixed the cross-wired Rectifier on the same day it was discovered. So, even if one assumes that the WUTC Staff is correct that PSE could theoretically have discovered the cross-wired Rectifier within 64 days after certain cathodic protection readings were taken, PSE would still fall within the 90-day repair period. Moreover, because PSE was complying with applicable federal and state regulations, PSE was operating a safe gas distribution system.

Q. Did the cross-wired Rectifier cause the explosion?

A. All the evidence indicates that the Rectifier did not cause the explosion. The WUTC Staff's Answer to PSE Data Request No. 1, Exhibit No. __ (HVS-3), confirms that the gas "leak most likely occurred prior to the mis-wiring of the rectifier." In the WUTC Staff's Answer to PSE Data Request No. 6, Exhibit No. __ (HVS-4), they admit that "there is no ability to measure the impact of the cross-wiring on the Schmitz house service line." Furthermore, their own expert, Dr. Bell, states at page 64 of his prefiled testimony that "it is highly unlikely that the rectifier reversal was a major or primary contributor to the leak." His position is consistent with that of PSE's expert, Kevin Garrity of CC Technologies Services, Inc.

VII. THE UNUSUAL CIRCUMSTANCES OF THE SCHMITZ HOME

Q. Had any leaks caused by corrosion been detected in the Spiritridge

neighborhood prior to the incident?

A. Three corrosion leaks had been detected in the area of the Spiritridge system in the 10 years preceding the explosion. No significant corrosion or corrosion protection related conditions have ever been noted in the area.

Q. Had any leaks been previously reported or detected around Mrs. Schmitz's home?

A. No.

Q. Are you aware of anything about Mrs. Schmitz's residence that could have made it unusual as compared to other homes in the Spiritridge neighborhood or within PSE's gas distribution system?

A. Yes. On September 2, after the explosion occurred and the investigation was under way, the PSE, WUTC Staff, and Bellevue Fire Department investigation team discovered evidence that the ground directly above the gas service line had been used as a small drainage area for a sink located in the lower level of the home. A normal plumbing system drains into a sewer system and has a "P-Trap" that prevents gas from back flowing from a sewer system into a home. This sink, however, had a pipe that had been diverted through the foundation wall so that any materials or substances poured down the drain would flow out of the residence and into the soil directly above the gas service line. Although the particular scientific effects of this unique drainage system will be discussed in greater detail in the testimony of James Hogan, my understanding is that the presence of that pipe in the foundation contributed to the incident because the gas leaking from the service line could easily enter the house through that drain. We are not aware of any other similar drainage designs in PSE's service area.

Q. Now that PSE has completed several months of leak surveys and other

inspections and monitoring, have you seen anything in the results that would suggest that PSE has a systemic corrosion problem that requires heightened scrutiny?

A. No. When we considered all of the results and analysis of experts—within PSE and independent of PSE—we concluded that our system is safe and is well-maintained.

VIII. THE EXTRAORDINARY LEAK SURVEYS IN SPIRITRIDGE

Q. When did PSE last conduct a leak survey in the Spiritridge area?

A. The last scheduled leak survey was in 2002. Immediately following the September 2, 2004, house explosion, however, PSE performed a house-by-house survey of the approximately 2,600 gas customers in the affected neighborhood. A second such survey was done in late September 2004 and has been completed each subsequent month for this neighborhood, in accordance with the order by the Commission's Emergency Order.

Q. Do you think continuing leak surveys beyond what is required by federal and state regulations is necessary for the Spiritridge neighborhood?

A. No.

Q. Do you believe annual leak surveys are necessary for neighborhoods with pipe of similar type and vintage as that which existed in the Spiritridge neighborhood?

A. No. The applicable regulations call for leak surveys in neighborhoods with cathodically protected wrapped-steel and plastic pipe every five years. There is no evidence to suggest that annual leak surveys should be required. In fact, since

PSE recently replaced the steel mains and gas service lines with plastic in the Spiritridge neighborhood, there is no evidence that PSE's system is anything other than safe and well-maintained.

Q. Does this conclude your testimony?

A. Yes, it does.