CAPSULE®
ENVIRONMENTAL ENGINEERING, INC

August 5, 1998

Mr. Scott Seery, CHMM
Environmental Protection Division, Suite 250
Alameda County Environmental Health Department
1131 Harbor Bay Parkway
Alameda, California 94502

Dear Mr. Seery:

Re: Geophysical Investigation Work Plan

This letter-type work plan is submitted in response to the April 3, 1998 Alameda County letter and as a follow-up to our July 9, 1998 telephone conversation.

Local Physical Conditions

Ingersoll-Rand operates a construction equipment sales and maintenance facility at 1944 Marina Boulevard, San Leandro, Alameda County, California. The eastern shore of San Francisco Bay is approximately 1.25 miles west of the facility. The local topography around the facility is fairly flat. Facility land surface elevations range from 25 to 30 feet above sea level. The shallow subsurface is comprised of sands, silts, and clays of low to moderate permeability. The depth to ground water is 15 to 20 feet. There are no nearby streams.

The facility includes an office, a large building with service bays and storage, and an outside equipment storage yard, used for staging large construction equipment during maintenance and repair.

Recent Site History

Gasoline corrective action began in 1989 with the removal of a leaking underground storage tank. After approximately two years of soil vapor extraction corrective action, an off-site ground water investigation was performed in 1995, and several years of ground water monitoring, a site closure recommendation and low risk determination were submitted to Alameda County in the fall of 1997.

In an April 3, 1998 response, Alameda County issued a letter dated April 3, 1998, requiring the submittal of a work plan to investigate potential sources for the gasoline

1970 Oakcrest Avenue, Suite 215 • St. Paul, MN 55113-2624 • (612) 636-2644 • Fax (612) 636-3106
Toll Free 1 800-328-8246

constituents found in the ground water beneath the northern part of the site. These constituents were identified during the 1995 investigation and observed again during the 1997 investigation along the north fence. A copy of the April 3 letter is enclosed as Appendix A.

Work Plan Objectives

In response to the April 3, 1998 letter and to continue efforts to close the site, Ingersoll-Rand Equipment Sales authorized additional geophysical site investigation and reporting activities. The objectives of the proposed work are:

1. Geophysically survey a portion of the facility to identify potential unknown gasoline sources, including underground petroleum storage tanks, piping, and appurtenances.

2. Evaluate and report on the likelihood of a possible gasoline source beneath the northern part of the site.

3. Comply with that portion of the Alameda County April 3, 1998 letter, calling for a geophysical investigation.

Scope of Work

The following tasks will be accomplished to meet these objectives.

Task 1 Conduct a Geophysical Investigation

A geophysical survey will be performed over a portion of the facility, using appropriate surface geophysical techniques to identify subsurface features that suggest buried petroleum tanks or piping.

Subtronic Corporation, Concord, California has been selected to perform the geophysical investigation. Please see Appendix B for their statement of qualifications. The survey will be performed under the direction of Subtronic's registered geophysicist.

The area to be surveyed is generally shown on Figure 1. The exact boundaries of the survey will depend on site conditions. Much of the survey area is used for construction equipment storage while it is being repaired or serviced. Capsule will work with the facility to clear the survey area of equipment and parts.

Subtronic Corporation will perform the geophysical field work using a cesium vapor magnetometer as the geophysical survey tool. The magnetometer responds well to metal objects, which are generally the subject of the survey, and works well over larger areas.

Upon completion of the field work, Subtronic will prepare a report of their findings.

Task 2 Reporting

Once the Subtronic report is issued, Capsule will evaluate its findings. There are two general geophysical outcomes.

One outcome is that something is found on the property that requires additional investigation or corrective action. Alameda County will be contacted to discuss the findings, status, and possible additional activities.

The second outcome is that nothing is found below the surveyed area. If this is the case, Capsule will prepare a letter-type report. The report will include the Subtronic report and will discuss the site status in light of the geophysical survey findings and other recent data, including ground water monitoring results.

Schedule

The following schedule is proposed to accomplish the work.

Activity	Day
1. Alameda County approval of work plan	1
2. Equipment and materials removed from survey area	2-15
3. Subtronic performs geophysics field work	16-17
4. Subtronic prepares findings report	17-27
5. Capsule prepares submittal to Alameda County	28-38

Ingersoll-Rand and Capsule are prepared to begin work on this project following your review of the work plan. If you have questions or comments, please call me at 800-328-8246.

Sincerely,

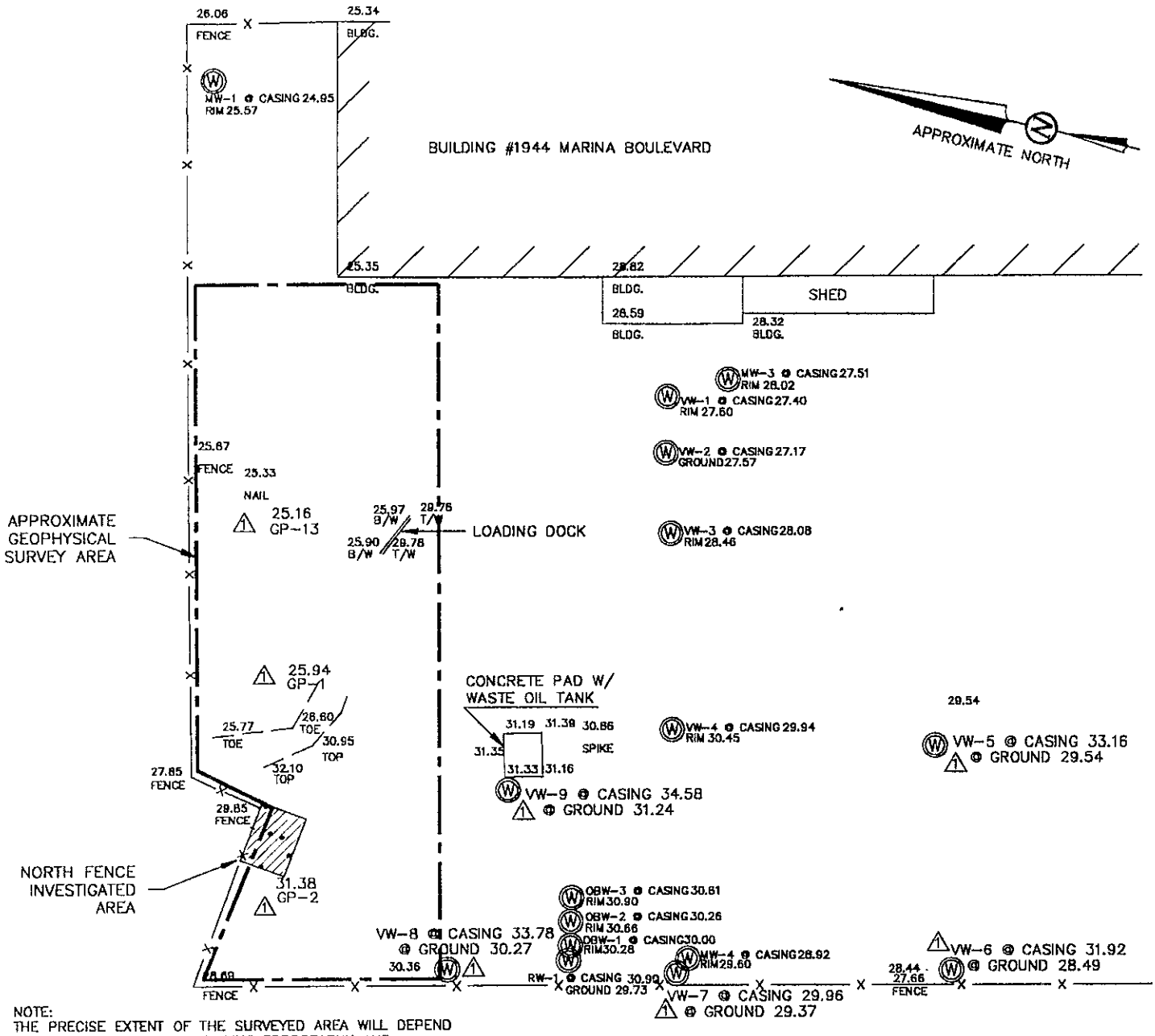
CAPSULE ENVIRONMENTAL ENGINEERING, INC.

John J. McDermott
Hydrogeologist

JJM: dmh
Enclosures

cc: Bob Heindl/Ingersoll-Rand Equipment Sales, Bethlehem, PA
Tim Tinsley/Ingersoll-Rand Equipment Sales, San Leandro, CA
Kevin Graves/ Regional Water Quality Control Board, Oakland, CA
Michael Bakaldin/San Leandro Fire Department, San Leandro, CA

FIGURE 1



NOTE:
THE PRECISE EXTENT OF THE SURVEYED AREA WILL DEPEND ON FIELD CONDITIONS, INCLUDING TOPOGRAPHY AND INACCESSIBILITY DUE TO LARGE EQUIPMENT STORAGE.

LEGEND	
T.C.	TOP OF CURB
	BUILDING LINE
T/W	TOP OF WALL
B/W	BASE OF WALL
-x-	FENCE LINE
W	WELL
E.P.	EDGE OF PAVEMENT
TOP	TOP OF BANK
TOE	TOE OF SLOPE

GP 1995 GEOPROBE LOCATION

GRAPHIC SCALE

25 0 25 50

(IN FEET)
1 INCH = 50 FEET

WELL LOCATION SURVEY

INGERSOLL-RAND EQUIPMENT CORPORATION
LOCATED AT 1944 MARINA BOULEVARD
CITY OF SAN LEANDRO, COUNTY OF ALAMEDA, CALIFORNIA
JUNE 1994
⚠ SURVEYED JULY 7, 1995

MORAN ENGINEERING
CIVIL ENGINEERS \ LAND SURVEYORS
1930 SHATTUCK AVENUE
BERKELEY, CALIFORNIA
94704
(510) 527-7744

F.B. #598 \MARINA.DWG JOB #94-3513

BASIS OF ELEVATIONS. CITY OF SAN LEANDRO BENCHMARK, CINCH NAIL ON TOP OF CURB AT STORM WATER INLET SOUTHEAST CORNER OF THE INTERSECTION OF MARINA BOULEVARD AND MERCED STREET, ELEVATION = 22.96'.

ALL CASING ELEVATIONS WERE TAKEN AT THE SOUTHWEST EDGE OF PVC PIPING.

ALL RIM ELEVATIONS WERE TAKEN AT THE SOUTHWEST EDGE OF STEEL RIM UNLESS OTHERWISE NOTED.

CAPSULE
ENVIRONMENTAL ENGINEERING, INC.
1970 OAKCREST AVE., SUITE 215
ST. PAUL, MINNESOTA 55113
(612) 636-2644

TITLE: AREA TO BE SURVEYED
GEOPHYSICAL WORKPLAN
INGERSOLL-RAND EQUIPMENT SALES
SAN LEANDRO, CALIFORNIA

DRAWN BY:	CHECKED BY:	DATE:	PROJECT NO.:	DRAWING NO.:	FIGURE:
TCD	JJM	8/4/98	001-327	C00689	1

APPENDIX A

ALAMEDA COUNTY
HEALTH CARE SERVICES
AGENCY
DAVID J. KEARS, Agency Director

April 3, 1998

ENVIRONMENTAL HEALTH SERVICES
ENVIRONMENTAL PROTECTION (LOP)
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577
(510) 567-6700
FAX (510) 337-9335

Mr. Robert Heindl
Ingersoll-Rand Equipment Sales
1495 Valley Center Parkway
Bethlehem, PA 18017

RE: Ingersoll-Rand Equipment Sales, 1944 Marina Boulevard, San Leandro, CA

Dear Mr. Heindl:

I have been in frequent contact over the last several weeks with Mr. John McDermitt, Capsule Environmental Engineering, Inc. (Capsule), regarding issues surrounding your bid for final closure of the environmental case at the subject Ingersoll-Rand (I-R) site. As you are likely aware, there remains a nagging issue associated with this site, one which has effectively stalled further consideration of your case closure request for the time being.

The referenced issue is the high-concentration hydrocarbon plume, discovered in ground water during a 1995 Geoprobe study, and its source. This plume was discovered west and northwest of the I-R building during the 1995 study. The presence of this plume was subsequently confirmed in mid 1997 during an intrusive investigation of a former petroleum storage area located along the "north" fence line.

Mr. McDermitt and I have been working to find a plausible explanation for the occurrence of this plume. We have attempted to discover direct evidence for other off-site fuel releases, from underground storage tanks (UST) or other sources, which may explain the appearance of this plume. In pursuit of this, I have reviewed records archived at the San Leandro Fire Department (the local UST and hazardous materials permitting agency) looking for potential sources at neighboring properties upgradient of the I-R site. So far, no other "smoking guns" have been discovered, other than the known UST release at the subject I-R site.

I also met earlier this week with Messrs. Stephen Hill and Chuck Hedley of the San Francisco Regional Water Quality Control Board (RWQCB) to discuss your case and solicit ideas from the RWQCB's perspective regarding solutions to this issue. The consensus of the meeting was this:

1) further data are needed to evaluate the nature of the plume, and

2) a search for additional on-site sources must be conducted

To facilitate this work, access to the adjoining railroad easement, as well as to the Mark Container (1951 Williams) and Case Manufacturing (1919 Williams) sites, is to be sought. Additional plume definition in these areas is to be completed. In addition, a search for other on-site sources is to be performed. The initial stage of this task may best be completed using geophysical techniques (e.g., ground-penetrating radar, magnetometer, etc.) to look for underground anomalies which may suggest the presence of a long-abandoned UST or product conveyance piping. Intrusive work may likely follow depending on what is discovered during the geophysical survey.

Mr. McDermitt and I have already discussed these issues. I also informed him that this office and the RWQCB will intervene should attempts to receive permission for access to the noted adjoining sites be denied or otherwise problematic.

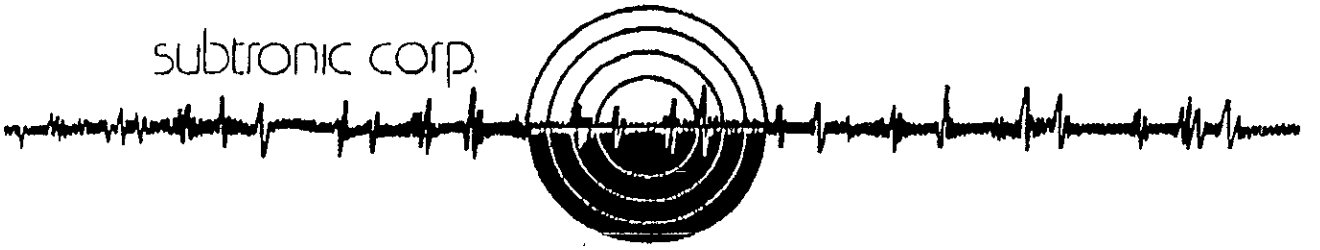
Please have your consultant submit a brief work plan depicting plans for completion of the cited work. I may be reached at (510) 567-6783 should you have any questions or if I can be of any assistance.

Sincerely,

Scott O. Seery, CHMM
Hazardous Materials Specialist

cc: Mee Ling Tung, Director
Dick Pantages, Chief, Environmental Protection
Mike Bakaldin, San Leandro Hazardous Materials Program
Chuck Hedley, RWQCB
John McDermitt, Capsule Env. Engineering, Inc.
1970 Oakcrest Ave., Ste. 215

APPENDIX B



Subtronic Corporation, 2099 C Arnold Industrial Way
Telephone: (510) 686-3747 Fax: (510) 686-5281

To: **John McDermott**
Company: **Capsule Environmental Engineering**
Fax No: **(612) 636-3106**

Total pages: 13 Friday, July 10, 1998

Message:

John:

Following is our brochure. I think you will find anything you want to know about the magnetometer on page 3. We use a Cesium Vapor Magnetometer.

Statement of qualifications would be on page 12. Pierre Armand is a Registered Geophysicist License # GP 1021.

If this still isn't enough, let me know!! (I hope it's overkill!!)

Yours sincerely,
Subtronic Corporation

Cheri Aubert
Office Administrator

Subtronic Corporation

Subtronic Corporation maintains its position at the forefront of international subsurface surveying, both technologically and professionally, and has done so since 1974. Since its inception, Subtronic's full range of underground utility survey and geophysical services has saved lives and millions of dollars for public and private sector clients throughout the world

Subtronic continues to build a strong reputation for providing quality, turn-key surveying solutions for our clients. Our clients include engineers, architects and consultants contracted to large construction and civil engineering projects, public utilities, governmental agencies and yes, even Mr. Jones who lives just up the street from you. We believe that one of the keys to Subtronic's continued success and growth is our ability to provide professionals such as yourself with the information you need in order to expedite the safe completion of your project.

The following pages give a brief insight into some of the basic survey methods and unique skills Subtronic has developed over the years to better serve you. If you have further questions regarding a specific project, or would like to discuss any of the methods explained in the following pages, please give us a call.

Index

Electromagnetic Utility Location

Electromagnetic methods are the most frequently employed techniques to detect underground utilities made of or containing conductive materials e.g. steel, copper. Examples of these utilities include water, natural gas, fuel lines, electricity and telephone. In order to detect these utilities using electromagnetic survey techniques, a radio frequency is induced onto the utility. This signal is carried by the conductor along its length and is detected above ground with a radio frequency antenna. Often, buried electrical and telephone utilities radiate their own electromagnetic field and can be readily detected using the radio frequency (RF) receiver without inducing a current. By detecting the maximum signal strength at several locations, the surface trace of an underground utility can be determined.

Non-metallic pipes do not accept, produce or transmit an electromagnetic frequency. If such a utility is found, i.e., a clay sanitary sewer, a transmitter is introduced into the pipe and traced. This method can also provide depth readings to some degree of accuracy.

No single utility location instrument can detect all types of buried utilities. It is therefore imperative to utilize a variety of instruments which are uniquely suited to a few tasks. Subtronic uses several different utility locating instruments to determine the surface trace of utilities from a small, single line telephone cable to large diameter storm drains. Subtronic also employs advanced geophysical technology to assist in utility location where field conditions warrant the use.

Locating buried utilities is an art as well as a science. Experience, tenacity, and equipment are the most important factors for successful utility location. Subtronic has 23 years of experience gained at thousands of sites. Examples include service stations, manufacturing facilities, military installations, industrial parks and public roadways.

Using these methods, Subtronic successfully undertakes surveys on a daily basis.

Geophysical Surveys

Ground Penetrating Radar

Ground Penetrating Radar (GPR) obtains a subsurface "picture" by inducing a pulse of electromagnetic energy at very high frequencies into the ground. A portion of the induced pulse is reflected upward to the antenna from a reflection boundary. The reflection boundary is the interface between materials, each having a measurable contrast in electrical properties. The graphic results are viewed on a video monitor and/or printed out. These graphic data, or GPR "records," are interpreted in the field.

Different frequency antennas are available dependent on the application. In general, the higher the frequency the shallower the depth of penetration and the greater the resolution. A 900MHz (megahertz) antenna is well-suited to determining the location of steel reinforcing bars in concrete whereas a 100 MHz antenna is more appropriate for geologic application, such as determining stratigraphy.

GPR can provide high quality data of near-surface conditions, however it has some limitations. GPR is most effective in areas with resistive near-surface soil types such as gravel and sands. Clayey, silty, moist or conductive soils often severely limit the depth of penetration Cultural features also limit the suitability of GPR to site assessments. Areas covered with steel, reinforced concrete, foundry slag, or metal debris tend to

Typical uses for GPR are confirming magnetometer anomalies, locating underground storage tanks, locating underground utilities, locating buried foundations and locating burial grounds at archeological sites.

Magnetometer

The magnetometer normally is used to locate anomalies generated by buried ferromagnetic objects and to investigate geologic features containing magnetic rocks. Those anomalies not related to visible surface features typically represent buried ferromagnetic objects.

Magnetic data is collected on evenly spaced points (a grid) throughout the area of interest. A contour map is generated in the field to determine the location of anomalous areas. Interpretation of the magnitude, shape, and orientation of each anomaly may

suggest the type of object buried. This information allows a follow-up investigation by ground penetrating radar or electromagnetic instruments to more precisely locate the buried object.

An important limitation to magnetometry is interference caused by large magnetic field gradients such as those from steel-reinforced concrete buildings or a chain linked fence. Since these are common in the urban environment, it is vital that the geophysicist has an abundance of experience; gained only by conducting many investigations under a variety of site conditions.

Magnetometer surveys are commonly used to identify buried 55 gallon drums, Underground Storage Tanks (UST's), abandoned oil wells and steel debris. Other geologic applications for magnetometry are locating igneous dikes and the location of archeological sites.

Conductivity

Conductivity surveys (EM or electromagnetic methods) identify lateral and vertical changes in the earth's subsurface conductivity. EM methods utilize an alternating magnetic field, generated by a coil at the ground surface, which penetrates the ground. A second coil, also at the surface, measures the earth's response. The response is proportional to the electrical resistance of the terrain's conductivity. Anomalies detected by EM surveys are often the result of buried metallic debris, buried building foundations or septic tanks. Geological applications for conductivity surveys are locating buried stream channels (higher conductivity) or mapping stratigraphy.

The instrument most often used for conductivity surveys is the EM-31. This instrument enables quick data collection which is easily downloaded to a laptop computer. The EM-31 may detect metal objects up to 18 feet deep below the instrument height. The EM-34 has similar applications as the EM-31. However, it is used to record conductivity anomalies from farther below the surface. The EM-34 is well suited for defining depths and the lateral extent of landfills.

Resistivity

Resistivity surveys measure the resistivity of rocks using electrodes placed in the ground. Electrical resistivity methods require a direct coupling to the earth. Two sets of electrodes are inserted into the earth and a current is applied to one set and the potential difference is measured at a second set. While the resistance to the flow of electrical current between the electrodes is dependent on variations of the soil's chemical composition and distribution, it is most sensitive to changes in the quantity and quality of groundwater.

Two resistivity techniques are commonly applied; vertical sounding and horizontal profiling. Vertical sounding is used to determine changes in electrical characteristics of subsurface materials with depth. Horizontal profiling identifies lateral changes in the electrical properties of the underlying strata.

Resistivity surveys provide good vertical resolution and thus, have a proven track record in groundwater applications. Resistivity surveys are well suited for monitoring the progression of contaminants in the groundwater, and are often used in assessing the properties of aquifers such as porosity, salinity and depth to the water table. These surveys also are used to map clay layers, delineate stream channels and define fracture zones.

Seismic Refraction

Refraction seismology is a geophysical method which consists of using sound waves which travel through the ground. These waves refract along geologic stratigraphic boundaries and are detected by geophones spaced at regular intervals along the ground surface. The equipment used includes a seismograph (which records and processes data), geophones (which measure ground acceleration) and an energy source (such as a plate and hammer or explosives). The data provides a cross-sectional display of soil and rock velocities which are interpreted.

The primary application of seismic refraction is defining the depth to the soil/bedrock interface and in observing faults.

Underground Storage Tank Location and/or Delineation

Subtronic is able to survey property for lost or abandoned underground storage tanks (UST's) or their "graves" (excavation where UST's were formerly located). Prior to any geophysical surveys, the site is visually inspected for evidence of appurtenant piping, i.e., vent lines, product lines or fill ports. A survey with utility locating equipment may be conducted. If a fill port is present, the tank may be physically probed to determine its dimensions. If no fill port is visible, then a grid of evenly-spaced points is established over the area of investigation. Data is collected with a magnetometer and/or a soil conductivity measuring instrument. The data is processed on a laptop computer in the field, to enable same day results. The surface location of the anomalies are then spray painted (or otherwise marked) on the ground surface. Anomalies may be further characterized with ground penetrating radar (GPR) or utility locating equipment.

Leak Detection

Acoustic Leak Noise Locating

Pipes that carry product under pressure, be it water, gasoline or a gas product, will make a noise when they leak from a broken or faulty pipe. This noise can be used in a number of ways to help pinpoint leaks in pipelines.

There are a number of ways of using the produced sound for acoustic leak location.:-

Ground microphones are highly sensitive microphones connected to a portable amplifier. The sound produced from the leak is amplified, filtered and monitored by headphones worn by the surveyor as well as by a visual reading taken off the amplification unit.

This unit contains a number of special filters to help remove background noise. Typical background noise would include cars traveling past or machinery working close by. With up to nine filter combinations, it is possible to decrease outside noise so the surveyor can concentrate on the leak with minimal interference.

In certain circumstances, surface conditions and the depth of the pipeline in question make it impossible to locate leaks from the surface using the methods described above. In these circumstances, Subtronic utilizes an advanced technology known as Leak Noise Correlation.

Leak Noise Correlation

Leak Noise Correlation uses the principle that although leaks may not be visually detected from the surface, the sound of the leak will travel along the pipe. Two sensors are placed on the pipe, normally at fittings such as valves or hydrants, one either side of the leak. These sensors pick up all signals at frequencies between 250 Hz and 5 kHz; understanding that sound produced from a leak usually falls within this band width. The Leak Noise Correlator receives these sounds, and measures the difference in time between the component of the signal representing the leak at one sensor and its arrival at the other sensor. Leaks produce a sound that usually remains constant in relation to its position on the pipe. Therefore, the signal received through radio link at

the Leak Noise Correlator is computed and displayed in a graphic format, showing a "peak" or "spike" at the point of the leak.

This method of leak location has been used in situations from private residences to finding leaks in subsurface petrochemical pipelines. Due to the non-destructive nature of this principle, it has saved our public and corporate clients millions of dollars in lost product, excavation costs and down times.

Natural Gas Leak Detection

Subtronic utilizes the latest flame ionization detectors for natural gas leak surveys. A small self-contained flame is present in the ionization detector. As methane is pumped from the surrounding atmosphere, the electrical property of the flame changes. It is this change, measured by the sophisticated electronics in the machine, that enables Subtronic to provide clients with highly accurate results, in the most time efficient manner.

Tracer Gas Leak Location

As environmental and economical concerns grow, and potable water becomes more scarce, concern is increasing over the integrity of subsurface, product carrying utilities. Both public and private corporations are increasingly vigilant about the loss of their resources due to pipe leakage.

Acoustic leak location uses the noise made by the product escaping from the pipe to pinpoint the leak. However, the characteristics of plastic, transite and fiberglass pipes make them good absorbers of sound; as opposed to steel and cast iron which are good carriers of sound. This makes leak noise location extremely difficult in more modern materials. When leaks are suspected in such pipes, Subtronic has adopted the use of gas injection and tracing for leak locating.

The area of leakage is first isolated by pressure testing. The surveyor will then inject an inert gas into the pipe, which is approximately 5 times denser than air. This avoids "travel" along trench lines and other subsurface features, plus fast migration to the surface and escape into the atmosphere. The latter feature provides more accurate results in inclement weather. Helium may be used in certain circumstances, although there are classic problems encountered utilizing a gas less dense than air.

Depending upon geographic conditions and soil density, the tracing of the gas is usually delayed by at least two hours in order to allow a concentrated "ball" of gas to accumulate around the leak.

Tracing is undertaken by a sensitive gas location device, calibrated specifically for use with an inert gas. This device can detect the gas at one part per billion. Small holes are drilled in the survey area's surface to allow samples of the gas to be collected in sequence along the pipeline. Results are verified by drilling perpendicular to the line to collect further samples.

Subtonic has overcome problems associated with leaks in non-metallic pipes, and experienced accurate, high quality results in difficult situations by using this method of leak locating.

CCTV Surveys

Closed Circuit Television

Subtronic's investment in high quality, high resolution Video inspection equipment completes the scope of services offered by Subtronic. Our equipment has proven to provide above average picture quality in hostile conditions.

Although our equipment was initially designed for use in sewers and drain pipes, we find that we are able to perform video inspections in a variety of situations where the human presence would raise safety problems, including the visual survey of vertical gas chambers, drill borings and hazardous waste sites.

Using a variety of propulsion methods, from pushing the camera on skids in small diameter pipes, to electrically driven, tractor propulsion for pipes from 4 to 48 inches, we are equipped to provide video solutions for the majority of situations.

Pipe Cleaning

For dirty or blocked pipes, Subtronic has an industrial hydroflusher. This enables our survey team to clean pipes and drains prior to surveying, allowing the client the best possible view of the pipe interior.

Together, the cleaning and the video service provides our clients with a complete service for video inspection of sewers and pipes. If you would like to receive a sample video of a selection of our surveys, please contact the Marketing Department at Subtronic Corporation.

Survey Presentation

Subtronic strives to produce survey results to each of our clients' unique specifications.

Ground Markings

Subtronic has adopted the American Public Works Association standard color scheme for the ground marking of subsurface utilities. These utilities are usually marked using environmentally friendly spray chalk. Spray chalk is not deigned to be a permanent marker and will naturally erode when exposed to the elements. More permanent markers are available for marking grass and loose surfaces.

APWA Standard Colors are: Red (Electric), Yellow (Gas, Oil and Steam), Orange (Communications, Cable TV), Blue (Water), Green (Sewer), Magenta (Temporary Survey Markings), White (Proposed Excavation Area).

Site Sketches

Clients who require a more permanent record of a survey, but do not require engineering quality drawings, are supplied with simple sketched diagrams of our survey. Utilities are referenced to fixed points such as buildings or street furniture. This method of presentation provides the client with a quick, permanent and economical hard copy of the survey results.

Scale Drawings

Subtronic has in-house, experienced draft persons, who have the ability to produce high quality, scale drawings to relevant engineering standards.

Computer Drawings

Subtronic is happy to produce in-house, digital survey presentations for those clients who request this method. Ground marks are collected by our surveyors using a total station or GPS (Geophysic Positioning Systems). Coordinates are then transferred to computer for digital presentation using AutoCad Release 13. Surveys can be presented as additions to clients' already digitized drawings, or can be provided as a separate "layer" for additions later. A wide variety of formats, including AutoCad are available.

Key Personnel

Ian D. Ballantyne, MASCE, MICE, MIHE, C., Eng.
Owner and President
Ian is an accomplished engineer with over 35 years experience on projects worldwide. He is a member of the American Society of Civil Engineers, a Chartered Engineer in Europe, a member of the Underground Utility Co-Ordination Committee of the APWA and the North Bay Chapter's chairperson responsible for student internships and scholarships. From 1980 through 1986, Ian Ballantyne was an annual speaker at the American Public Works Association Annual Symposium.

Subtronic was started by Ian as a subsurface surveying company in the United Kingdom in 1974. The company expanded its services to include product sales and development. New markets were investigated, and he opened satellite offices in Saudi Arabia, Scotland, Cyprus and California.

In 1988, he saw the need for comprehensive sewer and drainage software by which an owner of any pipeline can store all relevant system information. The information would then be available for inventory, design and maintenance purposes. He approached a high-tech firm in Sunnyvale, who produced the software as a joint venture. It is now the foremost data collection based used throughout Europe.

Ian Ballantyne established Subtronic, a professional, utility survey company in California in 1984. Subtronic Corporation maintains its headquarters in Concord.

Jon C. Taylor
Vice President-Operations
18 years with Subtronic Corporation
Jon has been at the forefront of subsurface surveying since 1978. As the Vice President of Operations, Jon is responsible for the smooth running of field operations. He often serves as a consultant to our clients, especially on difficult and unique projects. Other responsibilities include quality control and the training of new surveyors. He has a reputation for being one of the top utility surveyors in North America.

Jon has worked extensively in Europe and the Middle East in all aspects of underground utility location, total station mapping, CCTV surveys and cleaning operations. He is instrumental in Subtronic's move to capture a large portion of California's high tech, utility location projects utilizing GPR and cesium magnetometer technology. His work at Subtronic is a major reason for the positive reputation we have with our valued and diverse clientele.

Key Personnel

Pierre Armand
Geophysicist, Project Manager and Utility Surveyor
Subtronic Corporation is pleased to have obtained the services of Pierre Armand recently. Pierre comes to us with a wide variety of location experience and knowledge. His six years in the field bring a wealth of knowledge in the areas of CCTV, utility, magnetometer, GPR, resistivity and refraction surveys. He is an expert in pipeline assessment and evaluation work. Pierre is involved in the successful execution of Subtronic contracts and geophysical investigations. Pierre has a Masters Degree in Geophysics.

Nejat Yolasan
Senior Utility Surveyor
3 years with Subtronic Corporation
Nejat, as a Senior Utility Surveyor, has more than three solid year's experience in all aspects of utility location. He is a skillful, quality conscious locator with additional field experience in geophysical surveys, gas and water leaks. Nejat has a four year college degree in Geology.

Frank Wills
CCTV/Cleaning Department Head
1 year with Subtronic Corporation
Frank Wills brings a wide variety of industry experience to his position as department head. As primary CCTV operator, Frank is knowledgeable about all our cleaning and CCTV equipment, and their capabilities. He has designed a number of accessories to enhance the performance of our equipment. He has solid experience in pipeline assessment and evaluation work. He strives for perfection in the end project, and has that rare combination of high intelligence and good common sense. Frank is working on his AA Degree in Environmental Health Services/Hazardous Materials Department with an emphasis on clean water issues.

Subtronic Corporation is an equal opportunities employer, committed to affirmative action, the training and the development of its employees. All field technicians are Cal Osha and HAZWOPER trained as part of our ongoing training and safety programs. Subtronic also maintains Workers Compensation Insurance and provides medical insurance for all its employees.