VOLUME IV-A

APPENDIX-A

TO

P U B L I C   H E A R I N G S

before

ASSEMBLY AGRICULTURE AND ENVIRONMENT COMMITTEE

on

WATER POLLUTION AND RELATED ISSUES

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Installation of Underground Petroleum Storage Systems

Marketing Department

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1. FOREWORD

The prevention and detection of product leakage from petroleum storage and dispensing systems is important to both industry and the public. In preparing this bulletin, careful consideration was given to:

1. Safety;
2. Protecting the environment;
3. Preventing tank and piping failures;
4. Minimizing maintenance;
5. Protecting product quality; and
6. Minimizing installation costs.

Furthermore, attention was also given to the applicable sections of National Fire Protection Association (NFPA) 30, Flammable and Combustible Liquids Code, NFPA 329, Underground Leakage of Flammable and Combustible Liquids, and Underwriters' Laboratories, Inc. (UL) 58, Specifications for Underground Storage Tanks.

This bulletin, covering the installation of underground gasoline, diesel fuel and waste oil systems, is offered as a guide for use by architects, engineers, marketers, jobbers and contractors. Its primary application is at retail and commercial facilities. It is not intended to cover specialized installations, such as airports, marinas, home-heating oil systems or tanks to be installed inside buildings.

Federal, state and municipal codes or laws may have specific restrictions, which must be taken into account prior to the installation of underground tanks and piping.

The information in this bulletin may be used by anyone desiring to do so, but the American Petroleum Institute shall not be held responsible or liable in any way, either for any loss or damage resulting therefrom, or for the violation of any federal, state or municipal regulations with which it may conflict.

Note: Vapor recovery systems have not been covered in this bulletin. Anyone preparing to make an underground gasoline tank and piping installation in an Environmental Protection Agency Air Quality Control Region should investigate the local requirements and current methods of compliance in that region.

2. INTRODUCTION

Many underground storage tanks and piping systems installed in the United States have operated safely and free of leaks in excess of 30 years. Materials and procedures currently are available to help ensure that today's installations also can be operated without problems for the life of the facility. Success depends on a number of factors, including:

- Sound design of installation;
- Proper selection of materials for the specified location;
- Installation procedures in accordance with good engineering specifications and manufacturers' instructions;
- Capable and adequate supervision and inspection during installation;
- Thorough testing at appropriate stages of progress; and
- Appropriate monitoring and maintenance programs.

Prior to construction of a facility and the installation of underground equipment, a detailed analysis of the selected site is necessary. At a minimum, the analysis should include a determination of soil conditions, water table level and drainage. In addition, a review should be made of the corrosion history of the area. If sufficient data are not available and metal tanks and piping are to be used, a corrosion survey should be performed by a qualified person.

Uncontrolled corrosion can lead to product leakage. Corrosion is the result of a flow of direct electrical current, which removes metal from the surface. It can be caused by the corrosive nature of the soil, stray electrical currents and/or bimetallic cells.

- Corrosive nature of the soil: Several factors account for the corrosive nature of soils. These include low soil resistivity (the ability of the soil to conduct electrical charges), moisture content, acidity, and the presence of sulfides, as well as the differentials which exist within these factors. Probably the most significant of these is low soil resistivity. Other factors being equal, soil resistivity under 3,000 ohm-centimeters may indicate a very corrosive soil; 5,000 ohm-centimeters, a moderately corrosive soil; and over 10,000 ohm-centimeters, a relatively noncorrosive soil. However, a soil having both a high resistivity and a low pH (acidic) could be potentially corrosive.

- Stray electrical currents: Stray electrical currents that come from underground power lines or from improperly constructed electrical systems can be a source of corrosion.

- Bimetallic and galvanic cells: Corrosion cells which derive their driving voltage from the interaction of two different metals are called "bimetallic cells." Such cells are created when two dissimilar metals are connected. Typical examples might be found where a bronze check valve is joined to steel piping, or where galvanized piping is connected to a steel tank. In many cases, the circuit connection may be obscure. For instance, a copper water pipe crossing a service station property does not necessarily have to be in direct contact with a gasoline line for a "cell" to be created. If the electrical service in the station is grounded to the water service, a circuit can exist at the pump island, where both the electrical conduit cable and the gasoline piping reach a common junction point. Corrosion cells can also be created where the same metal is used, for example where there are impurities such as slag inclusions, or where weld metal is used that differs from the parent metal or piping has been scratched or cut.

Two important points should be kept in mind by persons planning on installing new tanks and piping systems, or replacing existing systems that are leaking due to corrosion:

First, unprotected steel tanks should be used only in non-corrosive areas. Otherwise, install either:

- A system constructed of non-corrosive materials such as fiberglass-reinforced plastic (FRP) or its equivalent; or
- A steel system cathodically protected by an impressed current cathodic protection system, sacrificial anodes, or some other type of equivalent protection.

Second, if it is necessary to replace or interior-coat an underground steel tank which developed a corrosion-induced leak, it is recommended that all other steel tanks at the facility—which are of the same age or older—also be treated similarly, even though they may not be leaking at that time. Newer tanks can be anodic to old steel. Therefore, they should be uncovered sufficiently to determine if additional protection or replacement is required.

Other factors to consider when making a choice between the use of metallic or nonmetallic tanks or piping would include initial and operating costs, and the availability of qualified personnel for the installation and maintenance of the selected corrosion control equipment.

If a cathodic protection system is used, an ongoing preventive maintenance program must be in effect. If sacrificial anodes have been installed, their proper operation should be confirmed by a qualified person at least once a year.

If an impressed current cathodic protection system is used, it is necessary to verify—at least once a month—that the rectifier is operating. Such systems are subject to vandalism, and the electrical service may be disconnected by accident or on purpose, making periodic inspections mandatory. While it may be feasible for local personnel to monitor operation, a qualified person should conduct an on-site test and inspection of the facility no less than once a year to measure the structure-to-soil and structure-to-structure potentials, and the rectifier voltage and current output.

The installation of cathodically protected systems usually involves the use of wiring connections between anodes and test stations. The exact location of such wiring and anodes should be carefully identified on a plot plan of the facility, and a copy of this plan should be kept at the site. A notice board should be placed adjacent to the tank location reading:

CAUTION: THIS SITE HAS CATHODICALLY PROTECTED TANKS. BEFORE EXCAVATING, CONTACT:

____

(Insert name and telephone number of company representative.)

3. TANKS

A number of factors must be considered in the (1) selection, (2) location, (3) installation, and (4) testing of tanks.

(1) Selection: Primary considerations in tank selection include the material required for the anticipated service, tank dimensions, and the capacity desired.

(a) As previously noted, the material to be used at a particular site will depend upon the conditions at that location (see "Introduction). Steel fabrication should comply with the latest issue of UL 58, Steel Underground Tanks for Flammable and Combustible Liquids. Both steel and FRP tanks should bear the applicable UL Label.

(b) Selection of tank dimensions is somewhat flexible. This can be of importance where a high water table exists or where rock conditions or suction pumping lift requirements dictate a shallow installation. Tanks of the same nominal capacity can be secured in many areas, with various diameters and lengths.

For example: 6,000 gallon steel tanks are available in the Eastern U.S. in diameter/length combinations of 95"/17'; 84"/21'; and 72"/29'.

The shorter lengths may be required to fit a site with restricted dimensions.

Note: Prior to installation, tanks should be measured to confirm the tank gauging chart(s) that should be supplied by the manufacturer. It is necessary to have this information available for product purchase/sale transactions, as well as for testing and maintenance to determine any leakage that may occur as a result of installation or subsequent damage or corrosion.

(c) Tanks of the most commonly used capacities are available in most areas. FRP tanks are available in any size normally used at service stations. Steel tanks can be secured for underground petroleum service in almost any capacity. The selection of tankage capacities and numbers for a particular site are discussed in detail in API Bulletin No. 1611, Service Station Tankage Guide, 1961.

(2) Location: Whenever possible, tank fill openings should be located so that a minimum amount of maneuvering will be required by the truck or transport making the product delivery. The driveway grade should be such that the tank truck will drain properly.

(a) Tanks should be located so that the parked tank truck will not be on the public right of way, block the driveway to consumer use, obstruct the motorist's view of the service station building, or interfere with the operator's use or visual control of the driveway.

(b) Regulations may permit underground tanks to be located closer than 10' to a building, but care should be taken to avoid possible damaging effects to the foundation of the building where this option is used.

(3) Installation: Tank excavations should be sufficiently large to provide a minimum clearance of 12" (in the case of steel tanks) and 18" (for FRP tanks) in all horizontal directions. The excavation should be deep enough to provide for a backfill below the bottom of the tank of at least 6" for steel tanks and 12" for FRP tanks. The burial depth of the tank is dependent on local regulations, the type of finished surface to be applied, soil conditions, topography, suction pumping lift requirements, and the piping cover needed.

In areas not subject to traffic, the cover depth of underground tanks should be a minimum of 24", or not less than 12" plus a reinforced concrete slab not less than 4" in thickness. Where tanks are subject to or likely to be subject to traffic, cover depths should be a minimum of 36", or not less than 18" of well-tamped material plus at least 6" of reinforced concrete or 8" of asphaltic concrete.

(a) Backfill below, around and above tanks should be clean, noncorrosive porous material, such as clean washed sand or gravel for steel tanks and, for FRP tanks, must be in accordance with manufacturer's specifications.

Backfilling operations are most important to the life of the installation. The owner should continuously supervise these operations to ensure that only specified materials and installation methods are followed by the contractor.

(b) It is recommended that tanks be ballasted with product as soon as possible after backfilling. Water ballast may be used as an alternative, but it is necessary to defer installation of submerged pumping units in the tank until after the water ballast is removed. If ballasting is necessary in order to prevent tank flotation (from a high water table or from rain), the end-use product should be used as a first choice.

(c) With product ballast, attention is required in handling, inventory control, and safeguarding against accidents or thefts. All fill caps and pumps should be locked during unattended periods.

(d) Anchoring should be used to prevent tank flotation from a high water table. When a concrete slab is used for anchoring, tanks should be separated from the slab by no less than 12" of sand. Tanks should not be set directly on the concrete nor placed on hard or sharp material that could cause deformation or damage to either the tanks or tank coatings. Anchor straps should be installed so as not to damage tanks or tank coatings and to ensure that the tank is electrically isolated from the anchor straps. This can be accomplished by placing a section of rubber tire between the tank and anchor strap.

The entire installation should comply with the requirements of NFPA Code 30.

(4) Testing: Requirements for the testing of underground tanks vary with state and local regulations. Tests can be performed (1) at the time of the delivery of the tank to the site; (2) in hole prior to covering; (3) after installation but prior to completing the backfilling; and (4) after the paving and all piping has been installed.

(a) Since damage can occur to tanks at any stage of construction, specific testing requirements would be dictated by the degree of control the owner must exercise. Any damage to the exterior coating should be repaired using material of similar nature.

(b) Testing should comply with NFPA Code 30 requirements.

(c) As a minimum, it is recommended that all tanks be tested with air pressure prior to installation. PRESSURE MUST NOT EXCEED 5 POUNDS PER SQUARE INCH (psi). All fittings, seams and visible dents should be soaped during this period, and inspected for bubbling.

4. PIPING

As is the case with tanks, proper care must be taken in the (1) selection, (2) installation, and (3) testing of piping for underground tankage.

(1) Selection: The location of the piping will determine the type and size that should be used.

(a) Schedule 40 steel pipe, either galvanized or wrapped black iron, or UL approved nonmetallic pipe, is recommended for all underground piping; and Schedule 40 galvanized steel pipe should be used for aboveground vent piping. Piping with a 1½" or 2" diameter is generally used. As a minimum, couplings and fittings should be 150-lb. malleable iron.

(b) Delivery piping from tanks to dispensers should be sized according to the recommendation of the pump manufacturer. In determining size, consideration must be given to the length of runs, flow rates, and number of dispensers to be served.

(c) Siphons may be used to equalize product levels in two or more tanks storing the same product. Material for siphons may be galvanized iron, wrapped black iron or nonmetallic. It is recommended that siphon piping be the same size as the suction and/or delivery lines to the dispensers.

(d) Each tank should be vented through adequately sized piping. This is necessary to prevent the build-up of excessive pressure, or the blow-back of vapor or liquid at the fill opening, while the tank is being filled. The maximum rate of fill can be limited by the diameter of the vent line. Two-inch diameter vents (in lengths up to 150') should be adequate for flow rates incurred using 4" delivery equipment. If nonmetallic pipe is used for underground vent piping, special adapters are required at the point where this pipe connects with the steel swing joint. Such adapters are available from the pipe manufacturer.

(2) Installation: Product lines should be run in a single trench between the tank area and the pump island area. Similarly, vent lines, between the tank area and the building or other structure to which the aboveground vent lines are attached, should be placed in a single trench.

(a) Before any underground lines are laid, the trench or ditch for such piping should receive a minimum 6"-deep bed of well-compacted noncorrosive material, such as clean, washed sand or gravel. All trenches should be wide enough to permit at least 6" of such protection around all underground lines. This applies to both metallic and nonmetallic underground piping. Bedding and the covering backfill should be of the same material. This will be helpful for grading the lines, and in providing corrosion protection for any adapter fittings used with non-metallic piping.

(b) The actual location of pipe runs should be noted on as-built drawings, if there is a change from installation drawings. Photographs of underground piping are desirable as part of the permanent record of piping locations.

(c) Piping should be arranged so that lines do not cross over underground tanks.

(d) Underground product lines should have a uniform slope of not less than 1/8" per foot toward the tank. Product lines should be at least 12" below the finished surface. Underground piping requires careful attention to the tightness of joints and pipe fittings. A pipe dope certified for petroleum service is to be used for galvanized or black iron pipe fittings, while the manufacturer's recommendation will apply for the cement to be used in nonmetallic piping joints.

(e) Possible breakage of underground piping and vent lines, or the loosening of pipe fittings resulting in product leaks, will be minimized through the use of swing joints. These should be installed in lines at points where the piping connects with the underground tanks, and where the piping ends at the pump islands and vent risers. Fiberglass piping, which is inherently flexible, does not require swing joints, if at least 4' of straight run is provided between any directional change exceeding 30 degrees.

Note: When nonmetallic piping (that has been approved for underground use) is selected, it is extremely important that it be installed strictly in accordance with the manufacturer's specifications.

(f) Occasionally, it is necessary or advisable to install more than one storage tank for a given grade of product. Such multiple tanks may be interconnected through a siphon connection. This permits the equalization of the product in the connected tanks. However, a siphon system will give reliable service only if care is taken to see that all joints in the siphon manifold are tight.

(g) Interconnected tanks should be the same diameter and be installed with the bottoms at the same depth. Although it is not recommended, if it is necessary to siphon-connect tanks of different diameters at a new installation, both the tank bottoms and the ends of the suction stub piping should be at the same level. Additionally, care should be taken to see that the vent line leaving the smaller diameter tank rises vertically to a point higher than the top of the larger tank before the horizontal section of the vent piping is installed.

(h) Remote pumps are available with a siphoning attachment, which can be connected to a siphon manifold. This permits one pump to draw the contents from two or more interconnected tanks. The manufacturer's installation instructions should be followed.

(i) Vent piping should be at least 12" below the finished surface beginning from the point where it rises vertically (or 4" in no-load areas), and slope uniformly towards the tank. The slope should be no less than 1/8" per foot, and the piping laid so as to avoid sags or traps in the line in which liquid can collect. Just as with product piping, swing joints should be installed at the tank and vent riser ends of all underground steel vent piping. No swing joints are needed where fiberglass piping is used, provided at least 4' of straight run is used between any changes in direction exceeding 30 degrees.

(j) Vent piping aboveground should be located, or protected and anchored, so as to prevent damage from traffic and other sources of potential damage. Vent outlets should be located so as to prevent flammable vapors from entering building openings or reaching hazardous areas. Vent outlets must discharge upwards, and the discharge point must not be less than 12' above adjacent ground.

(3) Testing: It is essential that, during testing of piping, the piping be disconnected from the tanks, pumps and dispensers. Failure to disconnect the piping from the tanks could result in damage to the tanks and product loss. The piping should then be subjected to an air test of 1 1/2 times the working pressure but not less than 50 psi, and the pressure maintained for a minimum of 60 minutes, with only a minimal change. Leaks may be detected by soaping all joints, while the system is under pressure.

(a) After all piping has been tested and found to be tight, all exposed threads of galvanized pipe should be coated with a coal tar product or tape film. This prevents the formation of an electrolytic cell between the galvanized fitting and the threaded area where the protective galvanized layer has been removed. Electrolytic cells can cause premature pipe failure. Where sacrificial tank anode cathodic protection systems are installed, non-metallic tank bushings should be installed in tank openings at all points of connection of product and vent piping to the tank, and separate protection provided for steel piping. When remote pumps are used, an insulating fitting should be installed in the electrical conduit at the pump.

(b) All piping must be covered with the same material used in the bedding. Depth of such material should not be less than 6".

5. EQUIPMENT

Although this bulletin is primarily a guide to underground tank and piping installations, consideration should be given also to the type of pumping system to be used, and to the tank fittings. The type of system selected (suction pumping, and remote or submerged pumping) has a direct bearing on the kind of tank and piping installed.

• Suction Pumping: This system usually consists of a pump at each dispenser on the pump island, with individual product suction lines running from each pump to the underground storage tank.

(a) When a suction type pumping system is used, the height to which the pumps can lift the product may be a critical factor.

(b) The tank diameter and the length of product piping between the tank and the pump should be kept to a minimum. This is especially important in warmer climates and at higher altitudes.

• Remote or Submerged Pumping: In this system, the pump is located in or above the underground storage tank. This permits the use of a single product line from each product pump to the dispensers on the pump islands. The system permits the use of more dispensers for each product, and a reduction in the quantity of buried piping. An impact valve, level with the top of the island, is to be installed at each dispenser.

(a) Leaks in these lines will result in an outward flow and loss of product, but leaks into the system are minimized.

(b) With submerged pumping systems, the delivery of product is not dependent on the diameter of the tank nor—within limits—on the length of product piping.

• Other Factors: Other factors to be considered in the selection and installation of pumps include the following:

(a) Pump construction, seals and trim should be designed for and be compatible with the liquids to be handled.

(b) Suction stubs in suction-type pumping systems should be the same diameter as the product line they serve. Such stubs and remote pumps should extend to within 3" of the bottom of the tank or as specified by the tank manufacturer.

(c) It is recommended that a double poppet (under the pump or angle check valve at the tank) be installed on each product line, where suction-type pumps are used. If the fitting is to be installed under concrete, an extractor angle valve manhole or concrete breakout can be used.

(d) With remote or submerged pumping systems, a leak detection device is required by NFPA Code 30.

(e) Pumping systems should be equipped with clearly identified and easily accessible electrical switches or circuit breakers. These should be located away from dispensers and pumps, and permit the shutting off of all dispensing devices, in the event of an emergency.

(f) Dispensers should be of an approved type, which meets requirements of UL 87, and bear the UL Label.

• Tank Fittings: Tanks should be constructed to recognized standards of design (such as UL 58/1971, Standards for Steel Underground Tanks for Flammable and Combustible Liquids), and equipped with the desired number and size of tank openings. Tank manufacturer's specifications and drawings must be checked to determine what types (steel or FRP), sizes and capacities are available, and whether they conform to recommended standards.

(a) Tank openings of 4" diameter are recommended, and most steel tanks will meet that specification. Fill pipes, fill caps, and fill tubes normally are also 4" in diameter. Submersible pumps, designed with the capacity to meet normal service station layout and operation requirements, are built to fit 4" tank openings. If greater capacity is needed, larger pumps and tank openings may be required.

(b) Double-tapped bushings are used to reduce the size of the tank opening, so that appropriate fittings can be attached, and connecting pipes inside and outside of the tank installed.

(c) At the time of installation, temporary plugs in unused openings should be removed and replaced with malleable iron plugs that are wrenched tight.

(d) Nonmetallic tanks are fitted with threaded openings to receive the same double-tapped bushings or plugs referred to above, or shown in the installation diagrams which follow.

(e) Fill pipes may be located at any opening in the tank.

(f) Tight fill connections are recommended. A fill tube should be inserted at the fill opening, and should extend to within 6" of the tank bottom. The use of tight fill connections and fill tubes will increase the rate of product flow during filling, and decrease turbulence and product vapor loss.

(g) A liquid-tight fill cap, equipped with a lock, should be installed. This may be used in conjunction with a manhole ring and cover (see Figure 2). The fill assembly or manhole ring should be marked with product identification and tank size. This can be done either by using a color code, or by having the product name stamped or applied to the fixed portion of the fill assembly, or both.

(h) A float activated vent valve should be installed in the tank to help prevent overfilling.

(i) Vent caps should be installed, where required by local ordinances or special conditions, so as to not restrict the discharge of vapors from the outlet.

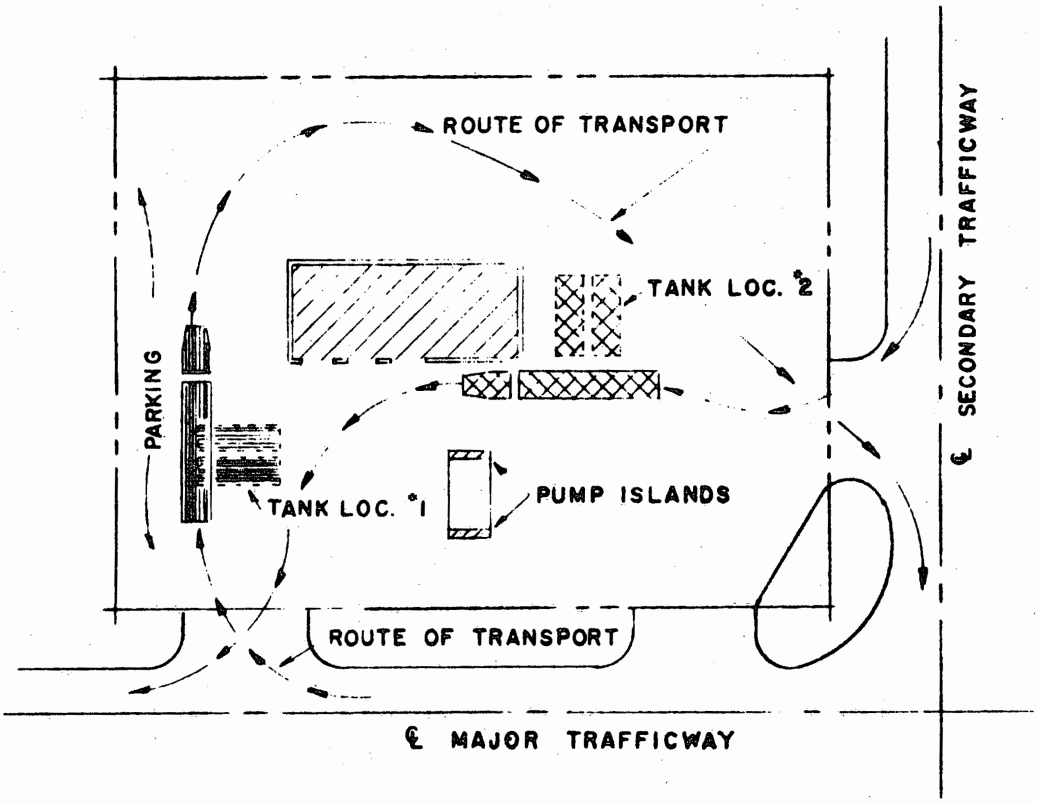
6. PREVENTION AND DETECTION OF LEAKAGE

The prevention of product leaks and overfills from storage and dispensing systems is necessary to provide a safe environment for the community, employees, customers and neighbors; and to minimize air and water pollution. Prevention of leaks should be given high priority. This can best be accomplished by properly installing and maintaining a tight storage and dispensing system, specifically designed and protected for its particular environment.

Should a leak develop, it must be detected promptly. This can be done through the daily preparation and reconciliation of inventory control records, and recognition of the symptoms of leaks. For inventory control procedures, the reader is directed to API Bulletin No. 1621, Recommended Practice for Bulk Liquid Stock Control at Retail Outlets.

FIGURE 1

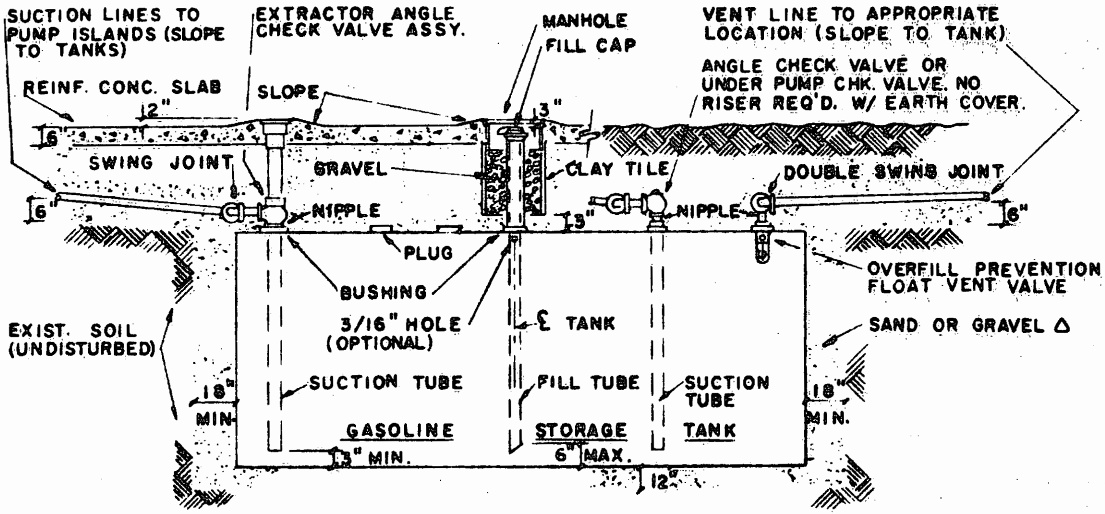
TYPICAL PLOT PLAN SHOWING POSSIBLE TANK LOCATIONS



1. ROUTE OF TRANSPORT REQUIRES MIN. 50' TURNING RADIUS.
2. NO "BACKING" REQUIRED FOR TRANSPORT.
3. PRODUCT LINES ARE A PRACTICAL LENGTH, FOR EITHER SUCTION OR REMOTE PUMPING.
4. RECOMMEND PAVING OVER TANKS AT EITHER LOCATION.

FIGURE 2

TANK PIPING DETAILS - SUCTION SYSTEM



PIPING DETAILS FOR TANKS — UNDER CONCRETE

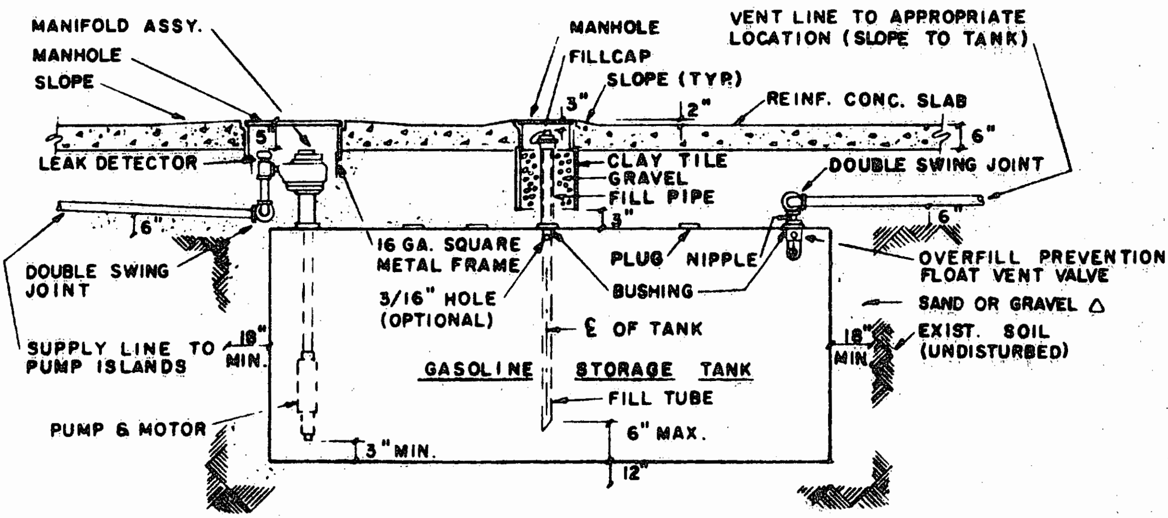
NO SCALE

△ PEA GRAVEL FOR NON-METALLIC TANKS (OR MFR. APPROVED ALTERNATE)

NOTE: ELIMINATE CONC. SLAB IN NON-TRAFFIC AREAS & CONSTRUCT CONC. PADS (ONLY) AROUND MANHOLES. THE EXTR. ANGLE CHECK RISER IS NOT REQ'D. W/ EARTH COVER.

FIGURE 3

TANK PIPING DETAILS - SUBMERGED SYSTEM



PIPING DETAILS FOR TANKS — UNDER CONCRETE

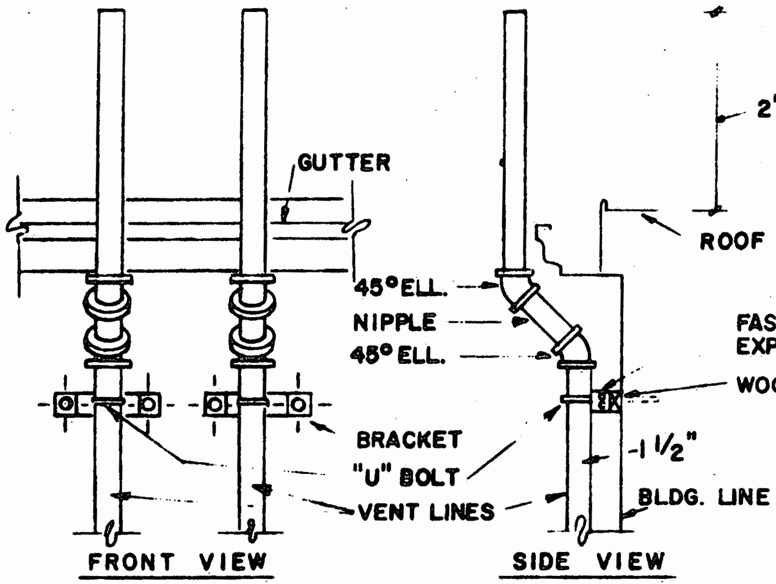
NO SCALE

△ PEA GRAVEL FOR NON-METALLIC TANKS (OR MFR. APPROVED ALTERNATE)

NOTE: ELIMINATE CONC. SLAB IN NON-TRAFFIC AREAS & CONSTRUCT CONC. PADS (ONLY) AROUND M.H.'S.

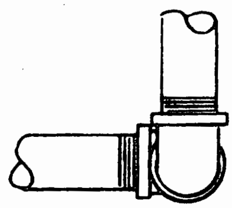
FIGURE 4

MISCELLANEOUS DETAILS



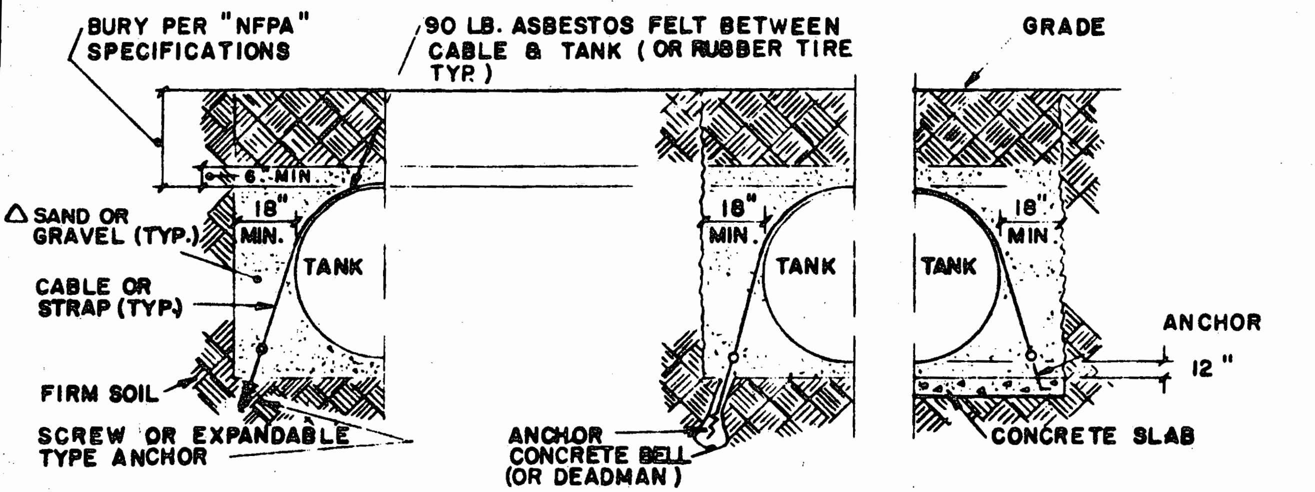
VENT DETAILS

NO SCALE



TYPICAL SWING JOINT

(ISLAND & VENT TERMINAL)
NO SCALE



NOTE: SEE MANUFACTURERS RECOMMENDATIONS FOR ANCHOR AND INSTALLATION INSTRUCTIONS.

TANK INSTALLATION

(WHERE SUB-SURFACE WATER CONDITIONS EXIST.)

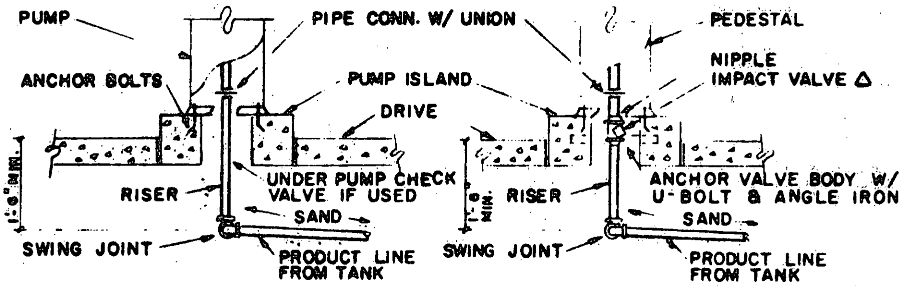
NO SCALE

△ PEA GRAVEL FOR NON-METALLIC TANKS (OR MFR. APPROVED ALTERNATE)

FIGURE 5

PUMP ISLAND PIPING - SUCTION & SUBMERGED

△ IMPACT VALVE MUST BE INSTALLED SO THE SHEAR SECTION IS LEVEL WITH TOP OF PEDESTAL ISLAND. THIS IS IMPORTANT FOR PROPER FUNCTIONING OF VALVE.

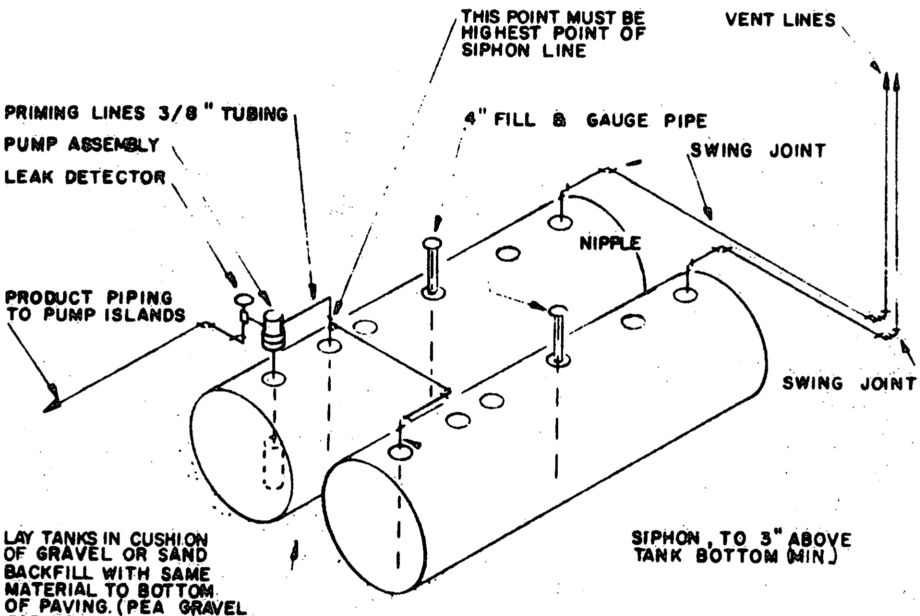


SUCTION PUMP PIPING DETAILS
NO SCALE

SUBMERGED PUMP PIPING DETAILS
NO SCALE

FIGURE 6

TYPICAL REMOTE PUMPING SIPHON SYSTEM

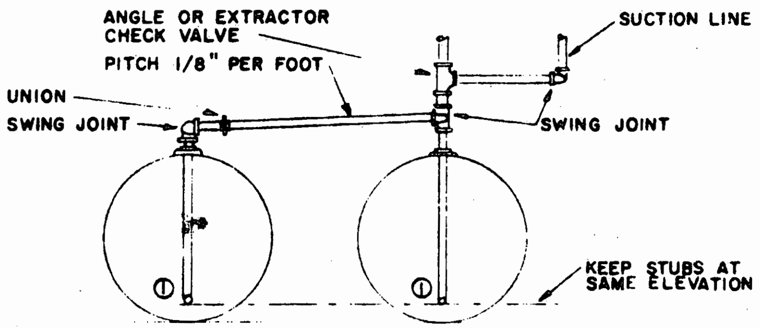


NOTES

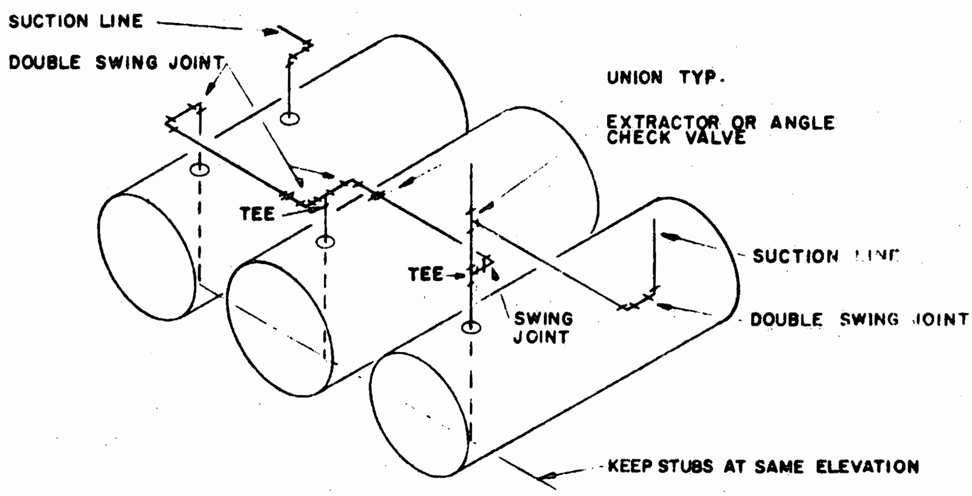
1. TANK BOTTOMS TO BE AT SAME ELEVATION.
2. SWING JOINTS TO BE INSTALLED WITH APPROXIMATELY 45° BEND WITHOUT TWISTING.
3. BOTTOM OF SIPHON STUBS TO BE AT SAME ELEVATION.

FIGURE 7

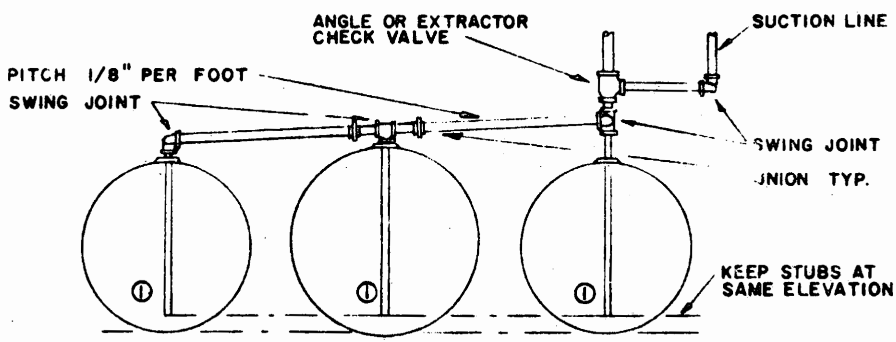
TYPICAL SUCTION PUMP SIPHON SYSTEM



2 - TANKS TO 1 - OR MORE PUMPS



ISOMETRIC OF 3 - TANKS TO 1 - OR MORE PUMPS



3 - TANKS TO 1 - OR MORE PUMPS

① WHEN EXISTING U.G. TANKS, THE BOTTOMS OF WHICH ARE NOT ON THE SAME LEVEL, ARE TO BE TWINNED, BOTTOMS OF SUCTION STUBS MUST BE ON THE SAME LEVEL.

1400—11/79—2M

The Hinchman Company

Suggested Ways to Meet Corrosion Protection Codes for Underground Tanks and Piping

Prepared by

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Corrosion Engineers
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Detroit, Michigan 48226

Our Job Number: 1079-4542

April 8, 1981

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President

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The Hinchman Company

SUGGESTED WAYS TO MEET CORROSION PROTECTION CODES

FOR

UNDERGROUND TANKS AND PIPING

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1. INTRODUCTION

The purpose of this article is to tell you what the codes say about corrosion control - what the requirements are that must be followed when designing and installing tanks and piping for flammable liquids. Note that the codes cover both tanks and piping.

This article will help:

a. Code officials who must enforce corrosion protection codes.

b. Code officials who are considering writing corrosion protection codes.

c. Engineers who are designing new facilities.

d. Owners who must install and maintain underground flammable liquid tanks and piping.

Corrosion has been identified as a major cause of underground tank and pipe leaks.[1] Figure 1 shows typical corrosion patterns found on tanks and piping. It is these corrosion problems that the codes are designed to prevent.

The corrosion control portions of NFPA 30-1981 (the National Fire Protection Association Flammable and Combustible Liquids Code) and the Uniform Fire Code-1979, two major codes widely used today, are discussed in detail in this article. Several other codes are covered also.

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The intent of the fire codes, of course, is safety. Coincidentally, there is concern over environmental pollution from leakage of tank or pipe contents. These factors will make adherence to the various codes more and more important as time goes on.

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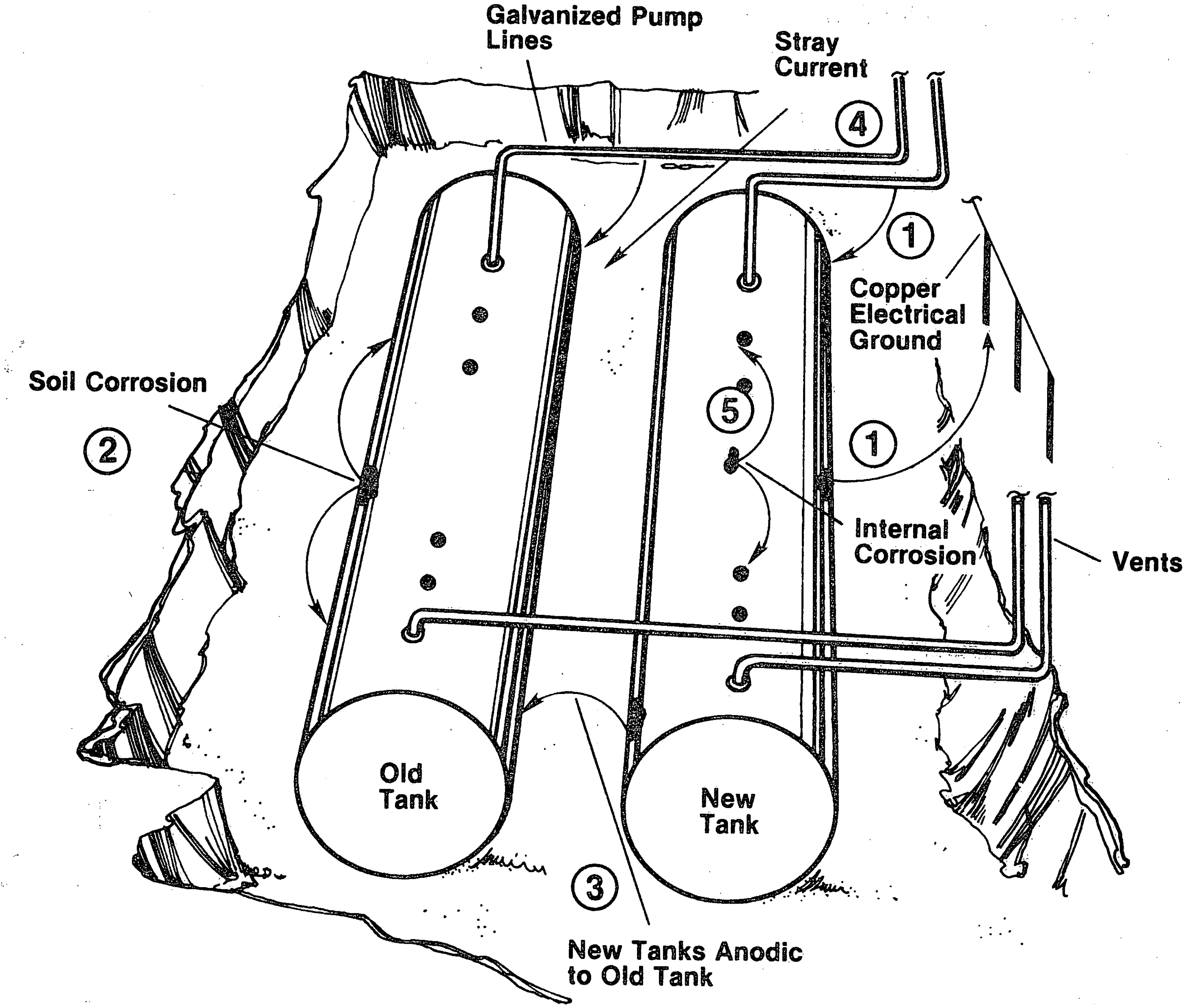

Figure 1: Corrosion Patterns – Buried Tanks And Piping

Various corrosion reactions affect buried tanks and piping. Among these are:

1. dissimilar metals
2. soils
3. surface conditions
4. stray current
5. internal corrosion from atmospheric contaminants, water in tank, dipstick impact

Accelerated corrosion occurs at breaks in coatings.

2. SPECIFIC CODES AND RELATED DOCUMENTS

2.1 NFPA - 30 (1981)[2]

Section 2 - 3.3 of this code has been revised to read:

"Unless tests show that soil resistivity is 10,000 ohms-cm or more, and there are no other corrosive conditions, tanks and their piping shall be protected by either:

(a) A properly installed and maintained cathodic protection system with or without coatings, or

(b) Corrosion resistant materials of construction such as special alloys, fiber glass reinforced plastic or fiber glass reinforced plastic coatings, or equivalent approved systems. Selection of the type of protection to be employed shall be based on the corrosion history of the area and the judgement of a qualified engineer.

See API Publication Number 1615 'Installation Underground Petroleum Storage Systems' for further information."

There are two important aspects of this code that deserve special attention. First, note that it applies to both tanks and piping. The safety and integrity of a storage installation can be compromised just as swiftly by a leak in a pipe as in a tank.

The second aspect represents a change from earlier codes. Earlier requirements called for the use of one or more of the following:

(1) Protective coatings or Wrappings;
(2) Cathodic protection; or
(3) Corrosion Resistant Materials of Construction

The option of using (1) without (2) has now been eliminated. Cathodic protection is the required corrosion prevention method for steel tanks; it may be used with or without coating. The important matter is that one may not use coated tanks without cathodic protection in areas where corrosion protection is required. This is as it should be. No tank or pipe coating

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is perfect, even if it is carefully spark tested and patched before backfilling. Flaws (holidays) develop eventually and accelerated corrosion occurs at these breaks in the coating. Consequently, tanks or pipes that are coated, but do not have cathodic protection frequently fail faster than bare structures. Cathodic protection prevents corrosion at coating holidays; thus coating and cathodic protection are combined to form a corrosion control system.

NFPA - 30, in prohibiting coating alone as a form of corrosion control is in step with other regulations. The U.S. Department of Transportation, for example, in its safety regulations for natural gas piping requires cathodic protection for coated pipe.

2.2 Uniform Fire Code (1979)[3]

Section 79.213 covers corrosion protection. This section, and the pertinent part of Appendix B read:

"Prior to the issuance of a permit to install any underground tank, the issuing authority shall be provided with the results of a soil resistivity test conducted by a qualified engineer, if such information is not already a matter of record. If the test shows a soil resistivity of 10,000 ohm-centimeters or less, corrosion protection shall be provided for the tank and its piping. See Appendix B for details on methods of protection.

EXCEPTION: Tanks made of corrosion-resistive materials."

"APPENDIX B

1. METHOD OF PROTECTION

(a) In order to assure long-term protection of underground tanks and pipe, all such installation shall be protected against corrosion by one of the following:

(i) Use of protective coatings or wrappings and cathodic protection, or

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(ii) Corrosion-resistant materials of construction.

(b) Installation and maintenance procedures for corrosion-protection equipment and/or tanks and pipe shall be in accordance with qualified protection engineering design and manufacturer's specifications.

(c) Corrosion protection may be omitted if soil-resistivity tests from the proposed location have been performed by a qualified engineer and the resistivity has been found to be greater than 10,000 ohm-centimeters. Written proof shall be furnished to the local authority prior to final approval."

Note the similarity between the Uniform Fire Code and NFPA - 30. This similarity is indicative of the course that codes and industries are following today.

2.3 Other Codes

Other fire codes that find use in various parts of the country are:

a. Southern Building Code Congress International, Inc. (SBCC) Standard Fire Prevention Code

b. Building Officials Code Administrators (BOCA) Basic Fire Prevention Code.

Both of these codes reference NFPA - 30.

Various environmental codes contain similar corrosion protection requirements. This is to prevent groundwater contamination from leaking tanks and piping.

2.4 Other Documents

2.4.1 API (American Petroleum Institute) Publication 1615 (November 1979) [4]

This publication offers excellent guidance for corrosion control of underground tanks and piping. It is referenced by NFPA - 30 as a source of information.

Section 2 discusses the fundamentals of corrosion control

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and also points out the importance of a preliminary site survey. In addition, this section emphasizes the importance of cathodic protection maintenance. Owners should pay particular attention to the need for maintenance, for without proper attention, cathodic protection may well not do the job for which it was designed.

API Publication 1615 covers both tanks and piping in separate sections. Section 3, on tanks, contains two items of note. First, it points out that the installation should comply with NFPA - 30, which contains, of course, the corrosion control requirements. Second, it mentions the importance of good backfill. One should not infer from this, however, that backfill alone will provide corrosion protection. Clean, high resistivity backfill (such as sand, eg) enhances corrosion control, but it will not prevent corrosion of steel tanks. This is one of the reasons that NFPA - 30 requires cathodic protection on steel tanks in corrosive environments.

Section 4, on piping, states that if the piping is dielectrically insulated from the tanks, the piping will require separate cathodic protection. Some tanks, protected by magnesium anodes may have insulating bushings where the piping is attached. If steel piping is used, separate cathodic protection must be designed for the piping.

2.4.2 API Recommended Practice for the Prevention and Detection of Leaks from Underground Tanks and Piping [5]

This document represents a good guide for those considering or who are in the process of writing codes. Sections 4 and 5 discuss corrosion control of tanks and piping. Here again, note the emphasis on both tanks and piping; from a corrosion control standpoint, one is just as important as the other.

This recommended practice also references NFPA - 30. Section 4 - 6 states "The entire installation shall comply with the requirements of NFPA - 30..."

We have stressed the importance of maintenance of cathodic protection. This is addressed in this document as well as in API 1615 and NFPA - 30. Code officials, inspectors and owners need to be aware of the importance of maintenance. Corrosion control systems may indeed fail if not properly maintained. We will discuss maintenance further in Item 4c below.

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3. GENERAL CODE REQUIREMENTS

Both NFPA - 30 and the Uniform Fire Code require a site survey to be made before installing tanks and/or piping. This survey should cover both soil, stray current and other corrosive conditions. It is important that all sources of corrosion be considered. The soil resistivity may be above 10,000 ohm-cm, but if the soil is contaminated with cinders or acids, for example, it may be highly corrosive. Likewise, a site that is affected by stray current, from for example, welding shops, rail transit lines or nearby cathodic protection, may be highly corrosive even though the soil is rather mild.

Because of the complexity of deciding the degree of corrosivity a site displays, the site survey must be done by a qualified corrosion engineer. Both NFPA - 30 and the Uniform Fire Code state that the survey shall be done by a "qualified engineer". To be so qualified, the engineer making the survey should be accredited by the National Association of Corrosion Engineers as a Corrosion Specialist, qualified in underground corrosion.

Both NFPA - 30 and the Uniform Fire Code define corrosive soil as that having a resistivity of 10,000 ohm-centimeters or less. While this may imply that soils of higher resistivity are non-corrosive, one must recognize that many corrosion failures occur in soils of resistivity above 10,000 ohm-centimeters. This is particularly true on a site where soil is heterogenous or where bi-metallic couples are involved - interconnection between steel tanks and a copper grounding system, for example.

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Although the Uniform Fire Code is silent on other corrosive conditions, NFPA - 30 requires protection if <u>any</u> corrosive conditions are found. In so doing, NFPA - 30 recognizes that soil resistivity is not the sole criterion on which to base the need for corrosion control.

The 10,000 ohm-centimeter break point is an old one that originated in the pipeline industry. Back in the early 1950's this was used as a guideline by which to judge if corrosion control was required. The pipeline industry recognized that corrosion indeed occurred in higher resistivity soils. The rate of corrosion in these soils was slow enough, however, that it was less expensive to repair leaks than it was to provide corrosion protection.

Today's economics and safety standards dictate that one should not budget for leaks, but should provide corrosion protection for buried tanks and piping containing flammable liquids.

One must also recognize the difference between a pipeline and a tank failure. A leak in a pipeline can usually be repaired by excavating and patching the pipe. A leak in a tank may mean tank replacement, making a leaking tank usually a much more expensive proposition that a leaking pipeline. Added to this is the danger of leaking gasoline infiltrating a sewer or contaminating ground water.

Where steel tanks are used on a site that falls into the category where the code does not require corrosion protection, it would be best to use bare tanks if no corrosion control is planned. As mentioned earlier, holidays will sooner or later

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develop in tank coating and accelerated corrosion will occur at these coating flaws..

It becomes, therefore, quite apparent that the decision as to the corrosivity of the site depends on considerably more than just a simple soil test. This is why the codes insist that the survey be done by a qualified engineer.

The codes also specify that non-metallic tanks and piping may be used. These are considered corrosion resistant and will satisfy requirements for a corrosive site. If non-metallic tanks and piping are used, there is no need for a preliminary site corrosion survey.

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4. METHODS OF PROTECTION

4.1 Steel Tanks

4.1.1 Coating

The coating must have high dielectric insulating properties, low water adsorption rates and be relatively resistant to construction damage. It must also be resistant to the product being stored in the tank. Hot applied bituminous products, often reinforced with a felt or fiberglass wrapper or coal tar epoxy are commonly used tank coatings. Refer to NACE Standard - RP-01-69[6] for the characteristics of acceptable coatings.

Before backfilling, a coated tank should be tested with a holiday detector (spark tester) and any holidays patched. Backfilling must be done carefully so as to avoid damage to the coating. API Publication 1615 recommends well tamped, clean washed, sand or gravel. It is important to minimize coating damage so that the effectiveness of the cathodic protection will not be impaired.

We have already discussed the need for cathodic protection on coated tanks and piping. Coating enhances cathodic protection since it makes it possible to protect structures with less current than would be required if the structures were bare. This reduces the overall cost of corrosion control and reduces the possiblility of stray current effects on other structures.

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4.1.2 Cathodic Protection

Both galvanic and impressed current cathodic protection are used for buried tanks and piping. Each type is described below. Cathodic protection should be designed and tested by a NACE Accredited Corrosion Specialist qualified in underground corrosion.

4.1.2.1 Galvanic Cathodic Protection

Magnesium anodes are the most common form of galvanic protection, although zinc may be used in low resistivity soil (generally below 1000 ohm-cm). To reduce protective current requirement, it is desirable from both an economic and engineering standpoint that the tanks be coated. Similarly, dielectric insulation, eg. nylon bushings, helps to reduce current requirements and hence the number of anodes required. Galvanic anodes may be used to protect uninsulated tanks, however, if the protective system is properly designed. Where dielectric insulation is used, it must not be "shorted" (bypassed) lest tank protection be lost.

Galvanic anodes have less chance of interference effects on foreign structures than impressed current systems do. This can be a distinct advantage in congested areas.

Usually, the anodes are distributed around the tanks as shown in Figure 2. Where there is paving over the tanks, one should provide test access holes through the paving; this permits the corrosion engineer to contact the soil with a reference electrode to test the effectiveness of the cathodic

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protection. Tank-to-soil potentials taken over concrete (or worse yet -- blacktop) can be quite erroneous.

It is also essential that test wires be brought up from the tank. If anodes are attached to the tank and the tank is insulated from its piping, it may be difficult or impossible to contact the tank. Electrical contact with the tank is necessary to test the effectiveness of the cathodic protection. It is good practice to bring the anode wire up into the test station and attach it to a wire running back to the tank. This way, anode output can be tested.

4.1.2.2 Impressed Current Cathodic Protection

Impressed current systems also are used to protect tanks. Because of the large amount of current available, impressed current can be used to protect bare tanks. This, of course, results in higher power costs and greater possibility of interference effects on foreign structures. Where possible, (eg, new construction), coated tanks should be used to reduce current requirements. Dielectric insulation may be used. Where tanks are under paving, test access holes are desirable for making potential measurements.

Impressed current systems, of course, require constant power supply to the rectifier. Interruption of the power source will interrupt the cathodic protection, exposing the tanks to corrosion. This is a point that owners need to understand.

Figure 3 shows a typical installation using impressed

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current. The distributed anode array is necessary to minimize shielding due to tank configuration. This distributed arrangement also helps minimize effects on foreign structures. Since impressed current systems always have the potential to create interference, local utilities should be contacted and tests run whenever such systems are installed. The cognizant corrosion coordinating committee should be notified of all impressed current installations.

4.1.2.3 Cathodic Protection Maintenance

Maintenance of cathodic protection is essential if the system is to function properly and provide long term protection. Current may fail because of anode deterioration, broken lead wires, rectifier malfunction or interruption of power. Changes in underground structure configuration or coating deterioration will change protective current requirements, necessitating changes in the cathodic protection.

Impressed current rectifiers should be checked monthly and adjusted as needed. Owners need to understand the importance of cathodic protection and the effect that its failure can have on their business. At least once a year, potential measurements should be taken to check the adequacy of protection and determine if any rectifier adjustments are needed.

Galvanic anode systems need to be checked also. Although there are no electrical components to maintain, measurements of structure-to-soil potential and anode outputs should be made at least annually.

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There are no maintenance-free systems. Without maintenance, one cannot determine whether or not the protection is effective. If the tanks are "buried and forgotten", cathodic protection may fail someday and no one will realize it until a leak or catastrophic failure occurs. Eventually, anodes will have to be replaced; but only through periodic maintenance can one determine when this must be done.

It may be difficult or impossible to test the effectiveness of galvanic anode cathodic protection if there are no test wires connected to the tank and/or pipe. Code compliance requires that provisions for testing (and proper maintenance) be installed.

API Publication 1615 addresses maintenance of cathodic protection and gives good advice. Maintenance is required by NFPA - 30 and by the Uniform Fire Code.

4.1.3 Dielectric Insulation

Dielectric insulation is an important part of corrosion control. Insulated bushings and unions are placed at tank/pipe connections and at places where the piping is attached to dispensing pumps, buildings and the like. Insulators confine the cathodic protection current to the structure being protected. Too often protection is designed for a piping network and no insulators are included. While such a situation can be protected with a properly designed system, the protection may not be effective if insulators are omitted. Dielectric insulation is especially important when magnesium

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anode cathodic protection is used.

4.2 Corrosion Resistant Materials of Construction

4.2.1 General

NFPA - 30 considers the following to be corrosion resistant materials:

(a) Special Alloys
(b) Fiberglass Reinforced Plastic
(c) Fiberglass Reinforced Plastic Coatings
(d) Other Equivalent Approved Systems

4.2.2 Special Alloys

Special alloys find uses usually when exotic fluids are to be contained and the alloys are needed for internal protection. It is seldom possible to justify the cost of, for example, stainless steel just for external corrosion resistance.

4.2.3 Fiberglass Reinforced Plastic

These tanks are not subject to corrosion since they are non-metallic. Fiberglass tanks are designed for the storage of petroleum products and gasohol and are strong enough to withstand most soil or other loading stresses. Careful placement is important, however, since fiberglass tanks can be damaged due to improper backfilling or installation.

4.2.4 Fiberglass Reinforced Plastic Coatings

This type of corrosion resistance refers to a thick (about 1/8-inch) fiberglass coating on a steel tank. The corrosion resistance of this system depends upon the interity of the coating. We have mentioned that coatings alone do not represent complete corrosion resistance because coatings are just not perfect. The fiberglass coating is, however, thicker than bituminous or epoxy coatings used in conjunction with cathodic protection and less susceptible to damage.

Great care must be exercised when using these tanks to insure that the coating is not damaged. The coating should be carefully spark tested and even the tiniest holiday carefully patched. Lowering in and backfilling must be done with great care to insure no damage to the coating.

Although the codes do not require it, it is good practice to insulate metallic piping from these tanks. This is particularly true if copper pipe is to be used. A tiny flaw in the coating could lead to a failure if the tank is interconnected through the piping to more noble metals.

4.2.5 Other Equivalent Approved Systems

This is a broad category that requires careful evaluation by the code official. Any such system should be reviewed and approved by a NACE Corrosion Specialist qualified in underground corrosion.

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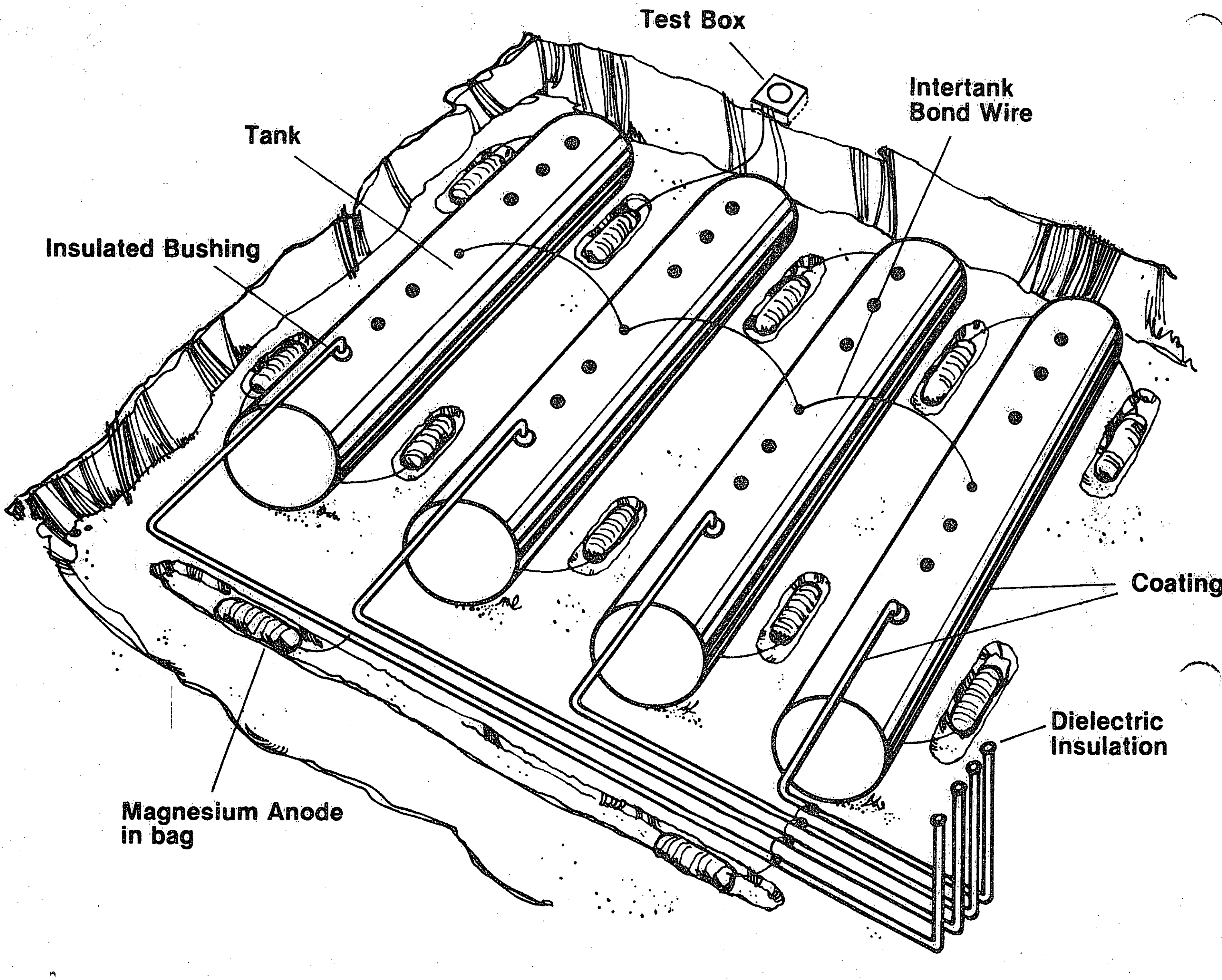

Figure 2: Magnesium Anode Cathodic Protection – Typical Configuration

Dielectric insulation is usually required; when insulation is placed at the pipe to tank connection, separate protection is required for the piping.

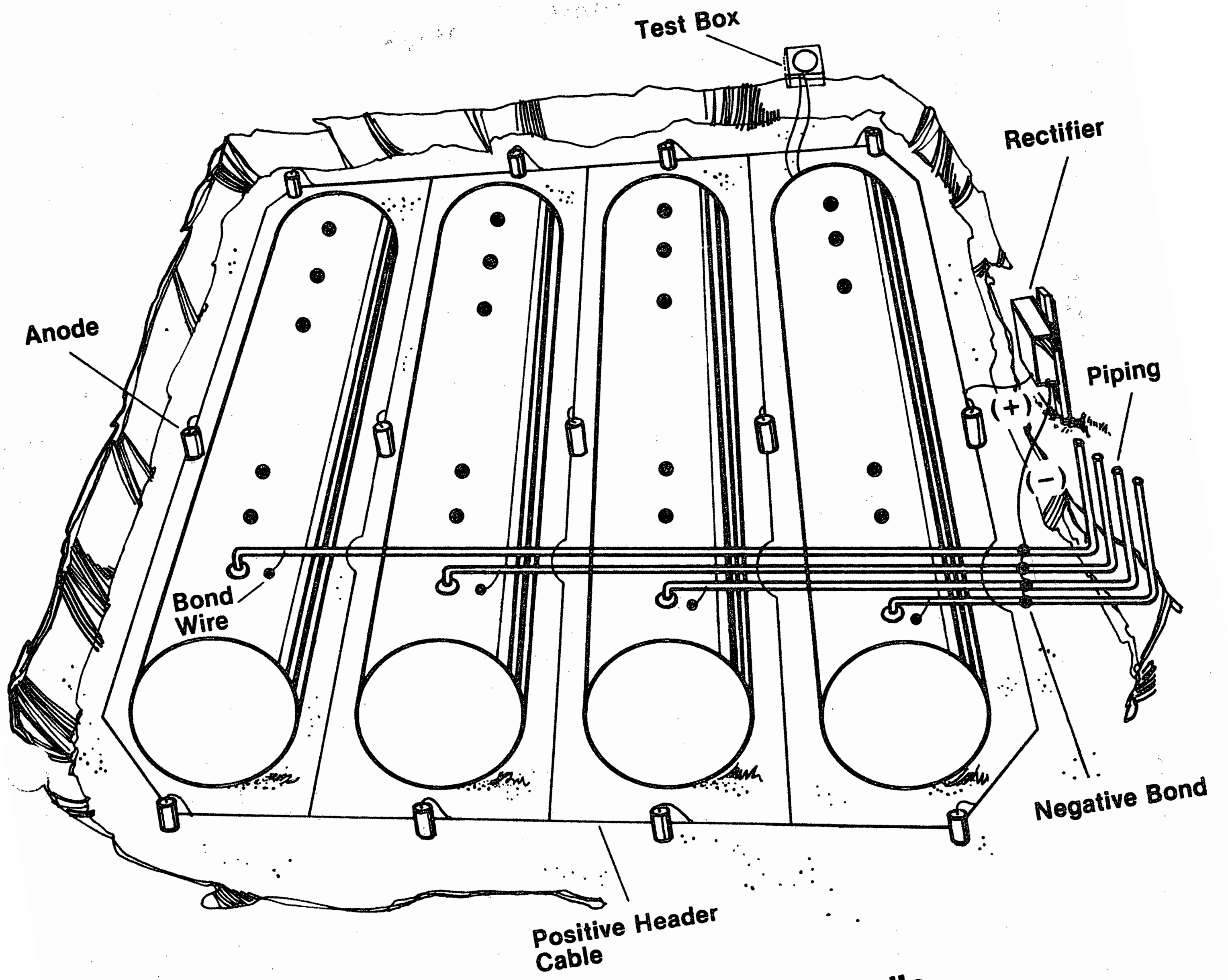

Figure 3: Impressed Current Cathodic Protection – Typical Configuration

Impressed current systems may also protect other equipment. Because of possible interference, installations should be reported to corrosion committees; tests should be made.

5. PIPING

5.1 General

We have mentioned before that corrosion control is required by code for the piping as well as the tanks. Section 4 of the API Publication 1615 is devoted to the protection of piping. It points out that if the piping is insulated from the tanks, separate cathodic protection is required for the piping.

5.2 Metallic Pipe

Where steel pipe is used, it must be treated in the same manner as steel tanks. It must be provided with cathodic protection and, preferably, coating. Remember the importance of separate cathodic protection for steel pipe that is insulated from the tanks.

Cathodically protected pipe must be electrically continuous. This may mean installing bond wires across flexible or other mechanical pipe joints. Screw coupled pipe should not be relied upon to provide electrical continuity.

Galvanized pipe may be used, and galvanizing is a form of cathodic protection. Galvanized pipe, should, however, be insulated from tanks and from dispensing pumps or other structures. This will prevent interconnection between the galvanized (zinc coated) steel and more noble metals. Galvanized pipe, by itself, is often corrosion resistant. When coupled to more noble metals such as copper or cast iron, however, it may corrode rapidly.

Copper pipe is generally quite corrosion resistant. The

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corrosion engineer who makes the initial survey should be consulted if copper pipe is contemplated. Copper is attacked in some soils and it will cause accelerated corrosion if interconnected to ferrous metal.

5.3 Non-Metallic Pipe

U.L. listed fiberglass reinforced plastic pipe meets the code requirements of a corrosion resistant material. The comments discussed in Item 4.2.3 (Fiberglass Tanks) above apply to fiberglass pipe. Fiberglass pipe may be a logical and economical choice, particularly when corrosion resistant tanks are used.

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6. INTERNAL CORROSION

Although not presently covered by codes, internal corrosion may be of concern. The API leak survey of January, 1981, revealed that about nine percent of the steel tank corrosion leaks reported were caused by internal corrosion. It is important to realize that protection of the tank exterior won't help the inside. Separate measures are necessary to prevent internal corrosion.

Internal linings of epoxy or fiberglass are often used to combat internal corrosion. Some experimental work has been done with cathodic protection using zinc ribbons in the bottom of the tank; there is, however, some concern over potential product contamination.

Dip sticks should have soft tips. This will prevent development of a hot spot from impact on the tank bottom. Some manufacturers provide a striker plate under the fill pipe. This keeps the dip stick from striking the tank bottom.

REFERENCES

1. American Petroleum Institute Tank and Piping Leak Survey, January, 1981.

2. Flammable and Combustible Liquids Code, 1981
National Fire Protection Association
Boston, Massachusetts, Pamphlet 30

3. Uniform Fire Code, Article 79, 1979
International Conference of Building Officials and Western Fire Chiefs Association, Whittier, California

4. Installation of Underground Petroleum Storage Systems
API Publication 1615, November, 1979
American Petroleum Institute, Washington, DC

5. API Recommended Practice for the Prevention and Detection of Leaks From Underground Tanks and Piping, November, 1979
American Petroleum Institute, Washington, DC

6. Recommended Practice, Control of External Corrosion on Underground or Submerged Metallic Piping Systems.
National Association of Corrosion Engineer, Houston, Texas
Standard RP-01-69.

Prepared for

Owens-Corning Fiberglas Corporation
Fiberglas Tower
Toledo, Ohio 43659

Our Job Number: 1079-4542

April 8, 1981

National Fire Protection Association

Flammable and Combustible Liquids Code NFPA 30 1981

2-3.3 Corrosion Protection.

Unless tests show that soil resistivity is 10,000 ohm-centimeters or more, and there are no other corrosive conditions, tanks and their piping shall be protected by either:

(a) a properly installed and maintained cathodic protection system with or without coatings, or

(b) corrosion resistant materials of construction such as special alloys, fiber glass reinforced plastic, or fiber glass reinforced plastic coatings, or equivalent approved system. Selection of the type of protection to be employed shall be based upon the corrosion history of the area and the judgment of a qualified engineer.

(See API Publication 1615-1979, "Installation of Underground Petroleum Storage Systems", for further information.*)

*Available from American Petroleum Institute, 2101 L St., N.W., Washington, DC 20037.

Also Note:

The BOCA **Basic Fire Prevention Code—1982**

And

The SBCCI **Standard Fire Prevention Code—1982**

have referenced NFPA 30—1981 or adopted wording similar to it.

1982
Uniform Fire Code

Article 79
Flammable and Combustible Liquids
Section 79.603
Corrosion Protection

Corrosion Protection

Sec. 79.603. All underground tanks and piping shall be protected from corrosive conditions by any of the following methods:

(a) Through the use of an engineered, properly installed and maintained cathodic protection system.

(b) Approved corrosion-resistant materials of construction such as special alloys, nonmetallics, reinforced plastic coatings, composites or equivalent systems.

If conditions, based on adequate proof, actually warrant the deletion of the corrosion protection requirements, the chief may waive the corrosion protection requirements.

As Approved By The Western Fire Chiefs Association
Uniform Fire Code Committee August 4, 1981
For Publication in the 1982 Edition of
The Uniform Fire Code.

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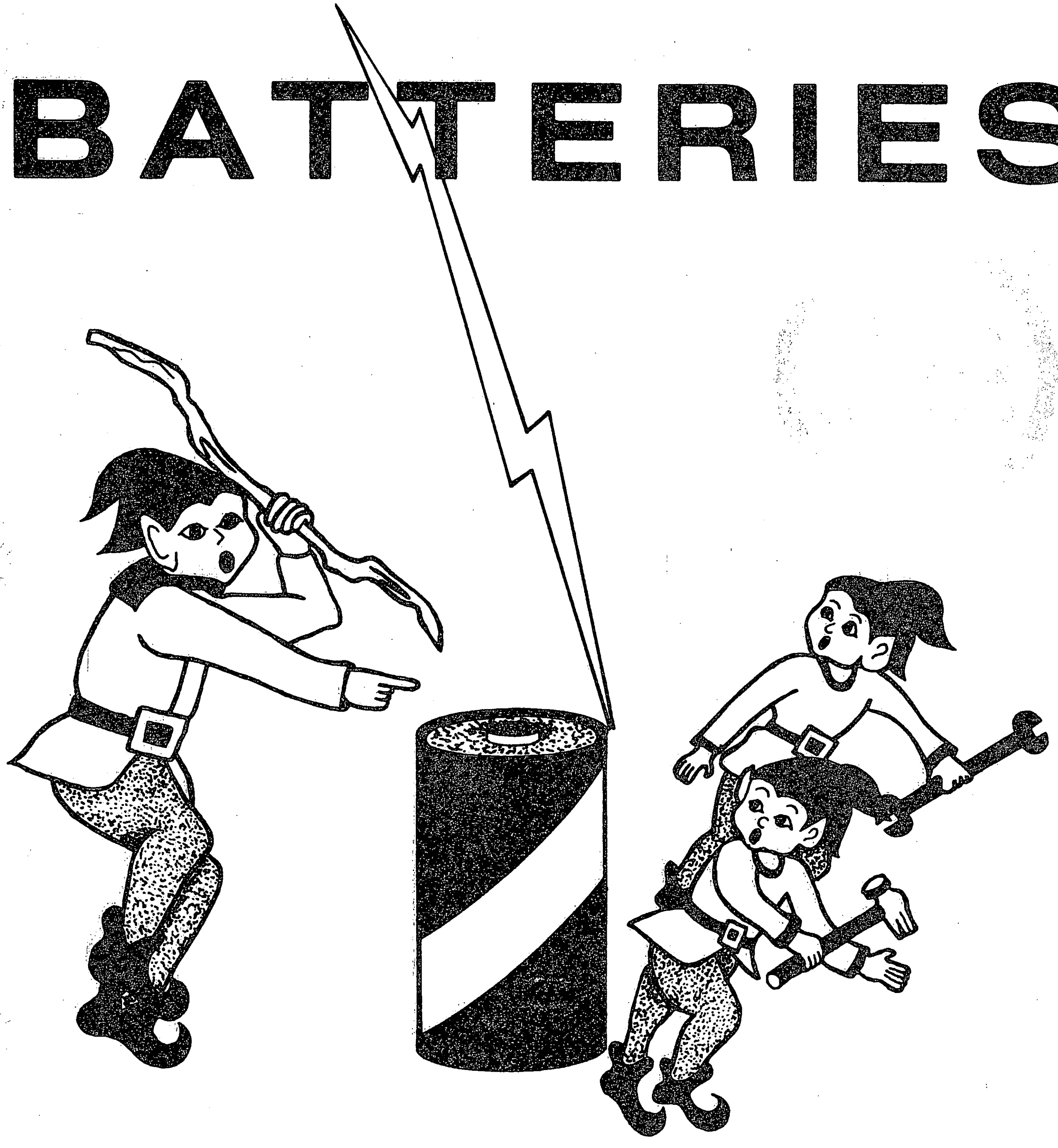
DON'T MAKE BATTERIES



BY CHARLES A. FREY
HIGHLAND TANK & MFG. CO.
MANHEIM, PA

Any attempt to design protection for underground tanks requires a familiarity with the forces that cause corrosion. I will attempt in untechnical language to acquaint you with these forces.

It is a law of physics that if two dissimilar metals are in an electrolyte and are electrically connected together—current will pass from one to the other through the electrolyte. An electrolyte is a non-metallic conductor of electricity in which current is carried by the movement of ions.

Example—a dry cell battery consists of a zinc can (figure 1) filled with an electrolyte—with a carbon rod in the center, insulated from the zinc. If we run a wire from the tip of the carbon to the zinc can, current will flow through the wire—light a bulb, run a radio or calculator etc. Electricity must go in a circuit (circle) so we know it is flowing through the electrolyte. It flows from the zinc to the carbon and as it flows from the zinc, the zinc corrodes. When the corrosion builds up to the point where it insulates the zinc from the electrolyte, the battery no longer makes current. If you could take the dry cell apart, clean the corrosion off the zinc and put it back together it would keep working until the zinc was completely decomposed (corroded). Now you know why a used dry cell will leak electrolyte and ruin your flashlight. This type of reaction is called galvanic corrosion. This is a form of electrolysis but electrolysis can also be caused by an external source of current which causes the passage of current from a metal into an electrolyte and the same corrosion effect.

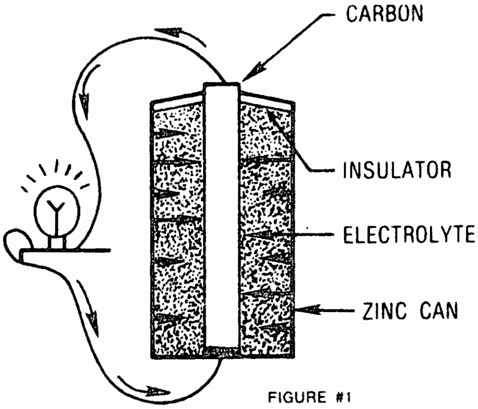


FIGURE #1

Notice the litter box (figure 2). Various types of metal can be attached to the alligator clips and current will flow from one to the other (as shown by the meter). The important part of this phenomenon however, is as shown (figure 3 next column) that current flows from the clean steel to the rusty steel. This means that clean steel and corroded steel can act as two different metals.

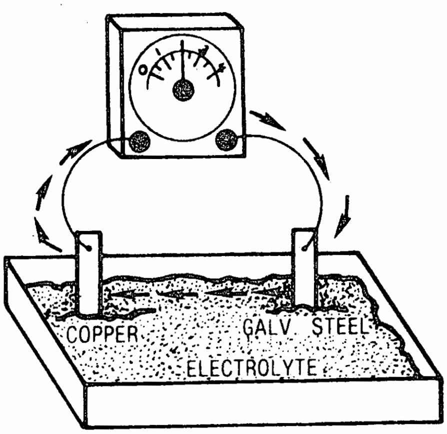


FIGURE #2

How does this affect my underground tanks? Well, tanks are metal and the earth is usually an electrolyte, more or less, depending on the composition of the soil and its density and its moisture content. The more resistant it is to the passage of current the less corrosion you will encounter. (This resistance is measured in ohms per cubic centimeter—the higher this figure the better your protection.)

When you put a tank in the ground it can react with various parts of itself or other metallic objects with which it is electrically connected. Often this reaction occurs between the new tank and other older tanks which have been in the ground (figure 4) and therefore somewhat corroded when a new tank is added. They are electrically connected through the piping to the dispensers and current will flow from the new tank to the others through the backfill and this will accelerate the corrosion on the new tank and actually slows the deterioration of the older tanks.

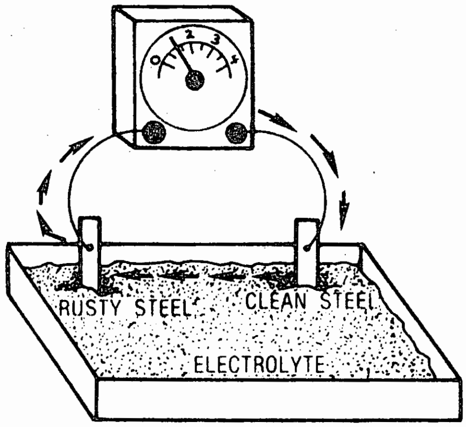


FIGURE #3

How do you prevent this? From what we said above we can conclude that if we are sure the tanks are not electrically connected, the reaction between tanks cannot occur. Also, if we make sure our backfill is not a good electrolyte or if the tank is protected by a coating or a wrapping with a high dielectric constant the reaction cannot occur or—we can build a battery that will work in our favor instead of against us (figure 5). The usual method for the latter is to use a sacrificial anode made of a metal (usually magnesium or zinc) that you know will have a higher potential to the electrolyte than your steel tank. In this system you sacrifice the magnesium or zinc in order to protect your tank. This anode has a limited life since it corrodes in use but its life is determined by how much it needs to protect. If it must protect the whole tank its life will be short but if it need protect only small defects in a good coating on the tank its life can be extended by many times.

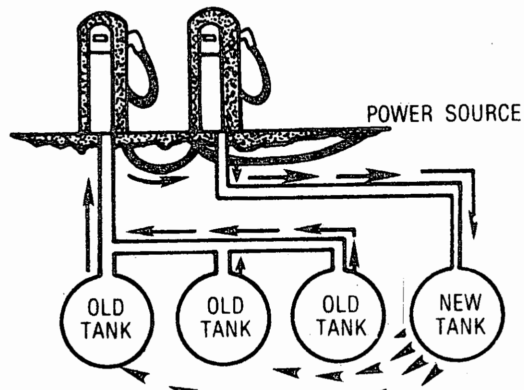


FIGURE #4

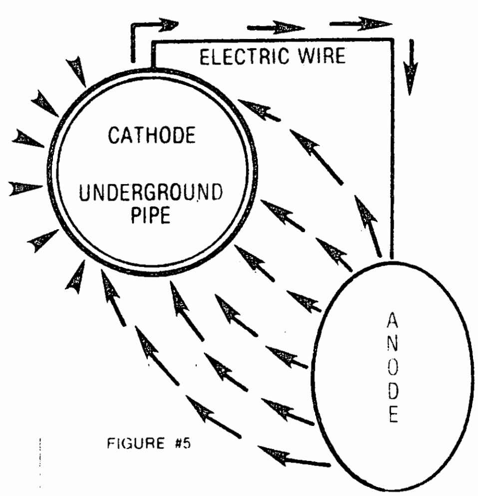


FIGURE #5

We have illustrated that corroded steel can be a different metal than new steel. Steel affected by aerobic bacteria (needs oxygen to live) and found near soil surface can be different from that affected by anaerobic bacteria (lives where oxygen is not available) found deeper in the soil. Unfortunately that latter affects the steel at the bottom of the tank causing it to have a higher potential to the electrolyte, the backfill in this case, than the aerobic bacteria and the corrosion occurs at the bottom. Similarly if the tank sits on a concrete pad the concrete can cause the steel next to it (the bottom of the tank again) to have a higher potential to the backfill than the rest of the tank and current flows causing corrosion at the concrete pad. Organic matter such as scrap wood, paper, and other forms of trash are often pushed into the hole when backfilling, this can cause electrolysis because of the effect these substances have on base steel. If the tank is protected from electrolysis it is also protected from bacterial and other types of corrosion.

Another cause of electrolysis comes from stray currents which travel through the ground and use your tank piping as a conductor. These currents can be caused by electric railways and street cars which use D.C. current and by induced current used by pipeline companies to protect defects in the protection on their pipes. This induced current is fed to the ground through a carbon electrode and will find its way to any defect in the pipeline's protective covering. If it finds your piping and tank a good pathway on its travels, where it leaves your tank it can eat your steel (figure 6). Di-electric fittings on your tank insure that your tank is not likely to be used as a pathway by this induced current.

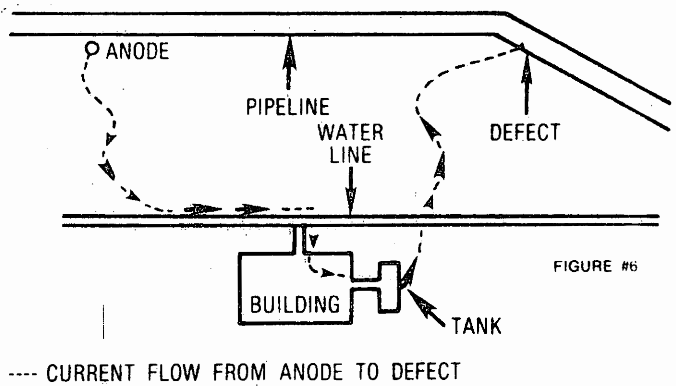


FIGURE #6

Keep in mind that for any of these things to occur your tank must be exposed to backfill which is an electrolyte. If a good electrolyte, that's bad—if a poor electrolyte, that's good. Also remember that these currents are very small (low voltage and amperages usually) but they go on year round, 24 hours a day, 7 days a week and may take one year or fifty years to cause a failure. Like the dry cell that no longer makes electricity due to its corrosion, corrosion on your tank can actually become its protection and this is what we mean by a stabilized situation.

Starting from the easiest and cheapest to the more sophisticated methods, these are steps to protect your tank and your valuable product and protect our environment.

GOOD 1. Use an homogeneous backfill.

(a) If you are not going to bring in new backfill, do not mix top soil with underburden; use only the latter near tank.

(b) Be sure no extraneous debris is pushed into excavation.

(c) Use clean river sand, gravel, or crushed limestone under, beside and above tank.

BETTER 2. Isolate the tank from the backfill.

(a) Cover the tank with a wrapper having a high di-electric constant such as a Polytube Enclosure as supplied by Highland Tank & Mfg. Co.

(b) Cover the tank with a durable coating having a high di-electric constant. (If a sand blast is not required by the manufacturer of the coating, I wouldn't trust it.) But remember, if there is one defect in an otherwise good coating, stray current corrosion will concentrate at the defect if added protection as shown below is not also furnished. It would be better to use a very poor coating like black asphaltum so corrosion would not be concentrated at an accidental holiday in the coating.

BEST 3. Isolate the tank from the backfill and use back-up protection.

(a) Specify a good epoxy coating over a commercial sand blast with sacrificial anodes to protect any possible holidays that may occur due to handling in delivery and installation and use di-electric bushings at all connections to ward off stray currents and to be sure that your anodes are only protecting your tank. (They will protect anything connected to your tank electrically such as the city water mains, gas mains, light poles, lift bases, etc. and will be prematurely used up thereby.)

This last method is the ultimate in underground tank protection and is embodied in the STI-P3 tank as furnished by licensees of the Steel Tank Institute with a 20 year limited warranty. This is the only such warranty in the industry. The cost is modest, the system is pre-engineered and idiot resistant, (if not idiot proof), and gives you the strength of steel and long term protection against corrosion. As of this date there have been no failures reported in an STI-P3 tank.

To sum up—some do's and don'ts:

A. Don't allow debris in backfill.
B. Don't allow tank to set directly on concrete pad.
C. Do specify a striker plate under your fill opening so a dip stick will not be constantly causing an area of clean steel where it hits bottom.
D. Don't reuse a tank that has been in the ground without taking especially great care in the new installation. (A scratch or bump exposing clean steel in an otherwise stabilized used tank will concentrate electrolysis at the clean steel because it will have a higher potential to the backfill than the rest of the tank.)
E. Do take extra precaution when putting a new tank in an installation where older tanks now exist.
F. Do take extra precaution if the tank is to be installed near electric railways, subways, mine cars, or pipelines.

Steel tanks, if installed with care, are stronger by far, less vulnerable to mechanical damage and cheaper to install than any of the newer substitutes. They are the only tanks that can be had with a written long-term warranty.

GLOSSARY OF TERMS:

Electrolyte—non-metallic conductor of electricity in which current is carried by movement of ions.

Electrolysis—producing chemical change by passage of an electric current through an electrolyte.

Galvanic Corrosion—a type of corrosion caused by a pair of dissimilar metals capable of acting together as an electric source when brought in contact with an electrolyte.

Polytube Enclosure—an 8 to 10 mil polyethylene bag which is installed on the tank and tied at the end.

Striker Plate—a 12″ x 12″ steel plate welded at bottom interior of tank under the fill opening so the dip stick is not always making a clean spot to enhance corrosion at that spot.

Holiday—a defect in the coating.

Di-electric Constant—a measure of non-conductivity.

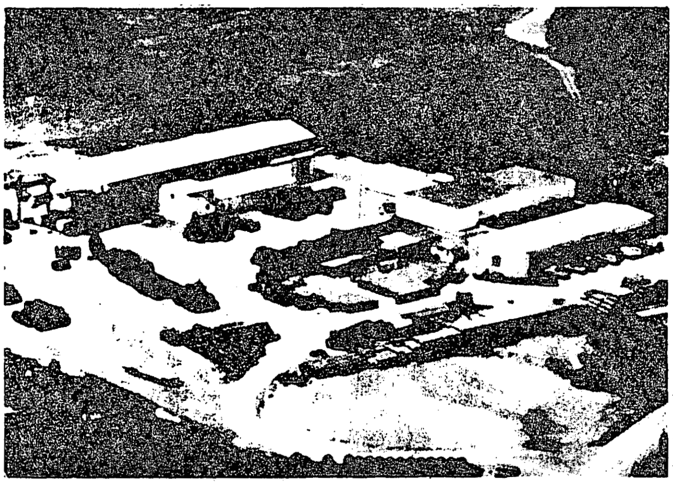
MORE ABOUT CHUCK FREY AND HIGHLAND TANK

After serving with the United States Navy, Chuck Frey returned to college and received a bachelor's degree in industrial management from Duquesne University. He came to the Highland Tank, Stoystown Plant in 1956 where he spent some time setting up production standards before opening the Manheim Plant in 1961.

At Manheim Chuck felt the need for a more technical approach to sales to help Highland's customers. He made an intense study of environmental damage due to tank leakage. He was soon considered an authority on preventing tank corrosion, having published several articles in trade magazines, including Fuel Oil News. He has also given many seminars to groups who are interested in what causes corrosion and how to prevent it.

This brochure is an attempt to put some of this information in a form meaningful to people without technical backgrounds as well as to professional engineers and physicists.

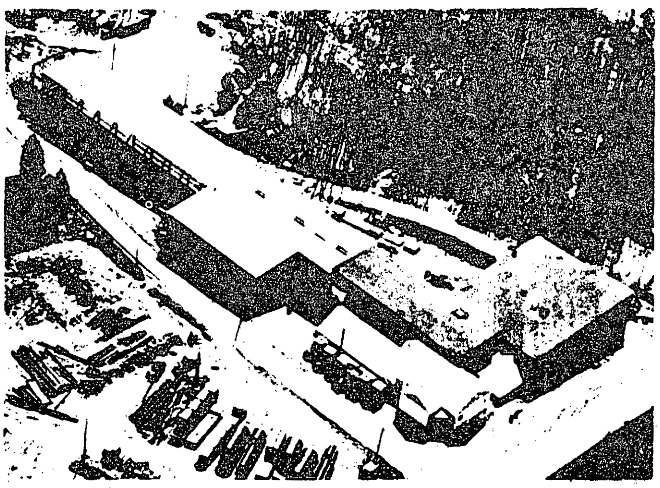
Manheim, PA



RD #4 MANHEIM, PA 17545 PH 717-665-6877

Highland Tank and Manufacturing Company was incorporated under the laws of Pennsylvania in 1946, with its first plant in the Laurel Highland community of Stoystown, Somerset County. Although the original product line contained diverse items the company soon developed a reputation for producing quality fuel storage tanks at reasonable prices. In 1961 a second plant was opened in Manheim giving Highland Tank a unique competitive position to service a large geographic area efficiently.

Stoystown, PA



RD #3 STOYSTOWN, PA 15563 PH 814-893-5701

At these plants, aboveground and underground storage tanks, both standard dimensioned and custom built, are manufactured. Both plants are licensed by the Steel Tank Institute to manufacture the Sti-P_3 tank, the only storage tank with a limited 20 year warranty against corrosion.

Today Highland's plant facilities encompass an area of over 50,000 square feet. A fleet of modern trucks deliver thousands of quality steel tanks each year to ten states. We invite your inquiries by mail or phone to learn more about the Highland Tank story.

3-79 T.P. INC.

API Industry Recommended Practice for the

Prevention and Detection of Leaks

from Underground Tanks and Piping

SEP 8 1980

Scope

The intent of this practice is to prescribe the requirements for the detection and prevention of leaks of flammable or combustible liquids from underground tank and piping systems.

1 General Provisions

1-1 This practice applies to all flammable and combustible liquids underground storage facilities except fuel oil tanks and containers connected with burning equipment and storage and dispensing systems with capacities under 2,000 gallons which are located on farms and isolated construction projects.

1-2 In particular installations the provision of this practice may be altered at the discretion of the authority having jurisdiction after consideration of the special features such as topographical conditions, barricades, walls, and proximity to buildings and adjoining property.

2 Definitions

2-1 AUTHORITY HAVING JURISDICTION shall mean the organization, office or individual responsible for "approving" equipment, an installation or a procedure.

2-2 COMBUSTIBLE LIQUID shall mean a liquid having a flash point at or above 100°F (37.8°C).

2-3 FLAMMABLE LIQUID shall mean a liquid having a flash point below 100°F (37.8°C) and having a vapor pressure not exceeding 40 pounds per square inch (absolute) at 100°F (37.8°C) and shall be known as a Class I liquid.

2-4 LISTED shall mean equipment or materials included in a list published by a nationally recognized testing laboratory, inspection agency, or other organization concerned with product evaluation that maintains periodic inspection of production of listed equipment or materials, and whose listing states either that the equipment or material meets nationally recognized standards or has been tested and found suitable for use in a specified manner.

2-5 OPERATOR shall mean the lessee or person(s) in control of and having responsibility for the daily operation of the facility for the storage and dispensing of flammable and combustible liquids.

2-6 OWNER shall mean the person(s) who owns, as real property, the tank storage system used for the storage and dispensing of flammable and combustible liquids.

2-7 PRODUCT LINE LEAK DETECTOR shall mean a device used to detect product or pressure losses in a pressurized product line of a remote pumping system.

2-8 REMOTE PUMPING SYSTEM shall mean a pressurized product line system in which flammable or combustible liquids are supplied to a point(s) away from the tank(s) by means of a pumping unit(s) in or on the storage tank(s).

2-9 SUCTION PRODUCT SYSTEM shall mean a non-pressurized product line system in which flammable or combustible liquids are removed from the storage tank(s) by means of a pumping unit(s) located at a point(s) away from the storage tank(s).

2-10 PRODUCT HANDLING SYSTEM shall mean a system composed of storage tank(s), product line(s), vent line(s), tank fill line(s), pump(s), dispenser(s), and other associated appurtenances, for the storage and dispensing of flammable or combustible liquids.

3 Inventory Control

3-1 Accurate daily inventory records shall be maintained and reconciled on all flammable and combustible liquid storage tanks for indication of possible leakage from tanks or piping. The records shall be made available for inspection by the enforcing authority, and shall include, as a minimum, records showing by product, daily reconciliation between sales, use, receipts, and inventory on hand. If there is more than one system consisting of a tank(s) serving pump(s) or dispenser(s) for any product, the reconciliation shall be maintained separately for each tank system.

3-2 Daily inventory shall be maintained for each tank system at each location by the operator. The inventory records shall be kept for a minimum of the past twelve (12) months at the premises.

3-3 Inventory shall be based on the actual daily measurement and recording of tank product and water levels and the daily recording of actual sales, use, and receipts. Daily measurements shall be made by gauge, gauge stick, or by readout from an automated gauging system. The inventory records shall include a daily computation of gain or loss. The mere recording of pump meter readings and product delivery receipts shall not constitute adequate inventory records.

3-4 The operator of the location shall be responsible to notify the owner or person(s) in control of the facility to take action to correct any abnormal loss or gain not explainable by spillage, temperature variations or other causes.

3-5 As a minimum the following steps shall be taken in an expeditious manner when daily inventory records indicate an abnormal loss:

3-5.1 The inventory records shall be checked for error.

3-5.2 If no error is apparent, an independent calculation of apparent loss shall be made by a qualified person starting from a point in time where the records indicate a no loss condition.

3-5.3 If step 3-5.2 confirms an apparent loss, the readily accessible physical facilities on the premises shall be carefully inspected for evidence of leakage.

3-5.4 If step 3-5.3 does not disclose a leak, the dispensers used with the particular product involved with the apparent loss shall be checked for calibration.

3-5.5 If steps 3-5.1 through 3-5.4 do not explain the apparent loss, the situation shall be reported promptly to the authority having jurisdiction.

3-5.6 If step 3-5.4 does not explain the loss, and if the piping system can be tested without the need for excavation, the piping system between the storage tank and dispenser(s) shall be tested in accordance with 7-1. If it is necessary to excavate to perform a piping test, such a test shall be conducted after a storage tank test has been performed in accordance with 3-5.7.

3-5.7 If step 3-5.6 does not disclose a leak, the storage tank(s) shall be tested for tightness.

3-5.8 If steps 3-5.1 through 3-5.7 do not confirm the apparent loss, the daily inventory shall be continued with a daily independent verification by a qualified person. Additional surveillance of the facility should be engaged to insure against unauthorized removal of product.

3-5.9 If any of the above tests or investigations indicate the source of the loss, the owner shall take immediate action to correct the system failure.

3-6 Daily inventories need not be maintained on those days that an installation is not in operation, but not to exceed fifteen (15) days.

4 Tank Selection and Installation

4-1 Tanks shall be designed and built in accordance with recognized good engineering standards for the material of construction being used.

4-2 The areas that have been determined noncorrosive by a soil test performed by a qualified person, any tank meeting the requirements of 4-1 may be used. In corrosive areas or at sites where corrosion tests have not been conducted, tanks shall be constructed of noncorrosive materials such as fiberglass reinforced plastic (FRP) or its equivalent; or a steel system cathodically protected by an impressed current cathodic protection, sacrificial anodes, or some other type of equivalent protection. If a cathodic protection system is used it shall be maintained in accordance with 7-7.

4-3 Steel underground tanks shall be set on firm foundations and surrounded with at least 12 inches of noncorrosive inert material such as clean sand or gravel well-tamped in place. The tank shall be placed in the hole with care, since dropping or rolling the tank into the hole can break a weld, puncture or damage the tank, or scrape off the protective coating of coated tanks.

4-4 Steel underground tanks shall be covered with a minimum of 2 feet of earth, or shall be covered with not less than 1 foot of earth, on top of which shall be placed a slab of reinforced concrete not less than 4 inches thick. When they are, or are likely to be, subjected to traffic, they shall be protected against damage from vehicles passing over them by at least three feet of earth cover, or 18 inches of well-tamped earth plus 6 inches of reinforced concrete or 8 inches of asphaltic concrete. When asphaltic or reinforced concrete paving is used as part of the protection, it shall extend at least 1 foot horizontally beyond the outline of the tank in all directions.

4-5 Nonmetallic underground tanks shall be installed in accordance with the manufacturer's instructions. The minimum depth of cover shall be as specified in 4-4 for steel tanks.

4-6 The entire installation shall comply with the requirements of NFPA 30, Flammable and Combustible Liquids Code.

4-7 If it is necessary to replace or interior-coat an underground steel tank which developed a corrosion induced leak, all other steel tanks at the facility which are the same age or older whether or not they are leaking shall be interior-coated or replaced with tanks that meet the requirements of 4-2.

5 Piping

5-1 In the areas that have been determined noncorrosive by a soil test performed by a qualified person, schedule 40 steel pipe, either galvanized or wrapped black iron, or approved nonmetallic pipe, may be used for all underground piping. In corrosive areas or at sites where corrosion tests have not been conducted, piping shall be constructed of noncorrosive materials such as fiberglass reinforced plastic (FRP) or its equivalent, or a steel system cathodically protected by impressed current cathodic protection, sacrificial anodes, or some other type of equivalent protection. If a cathodic protection system is used, it shall be maintained in accordance with 7-7.

5-2 Product lines shall be installed in a single trench between the tank area and the pump island. Similarly, underground vent lines shall be installed in a single trench.

5-3 Before underground piping is installed, the trench shall receive a minimum 6"-deep bed of well compacted noncorrosive material such as clean, washed sand or gravel. All trenches shall be wide enough to permit at least 6" of noncorrosive backfill material around all lines.

5-4 After all piping has been tested to the requirements of 7-1, all exposed threads of metallic pipe shall be coated with a coal tar product or tape film.

6 <u>Pumping Systems</u>

6-1 Remote pumping systems shall be designed or equipped so that no part of the system will be subjected to pressures above its allowable working pressure.

6-2 All new remote pumping systems shall be equipped with a product line leak detector. It is recommended that existing remote pumping systems also be equipped with product line leak detectors. Leak detectors shall be tested in accordance with 7-8.

6-3 A listed rigidly anchored emergency shutoff valve, incorporating a fusible link or other thermally actuated device, designed to close automatically in event of severe impact or fire exposure shall be properly installed in the supply line at the base of each individual island-type dispenser. The automatic closing feature of this valve shall be checked at the time of initial installation and at least once a year thereafter by manually tripping the hold-open linkage.

6-4 The operator shall immediately advise the owner should a leak detector signal a suspected product loss or a suction product system indicate a potential symptom of a leak (i.e., meter display jumping or skipping, liquid not being pumped when pump is on, initial pump overspeed followed by slow pumping, erratic liquid flow indicating air and liquid mixture, continued loss of prime in the pumping unit, etc.)

6-5 The owner shall take immediate action to verify the operation of the pumping system when advised of a suspected leak by the operator. Should a loss be determined, the owner shall take immediate corrective action. The affected pumping system shall be taken out of service until the necessary corrective action has been taken.

7 <u>Testing</u>

7-1 All piping before being covered, enclosed or placed in use shall be hydrostatically tested to 150 percent of the maximum anticipated pressure of the system, or pneumatically tested to 100 percent of the maximum anticipated pressure of the system, but not less than 50 pounds per square inch gage at the highest point of the system. If a pneumatic test is performed, all joints and connections shall be sprayed with a soap solution and the test shall be maintained for a sufficient time to complete visual inspection of all joints and connections, but for at least 10 minutes.

7-2 New underground tanks shall be tested for tightness hydrostatically or with air pressure at not less than 3 pounds per square inch and not more than 5 pounds per square inch after installation but before being covered or placed in use.

7-3 The authority having jurisdiction may require the operator of an underground tank storage system to test the system for tightness, at the operator's expense, when accurate daily inventory records have not been

7-4 The authority having jurisdiction may require the owner of an underground tank storage system to test the system for tightness at the owner's expense when inventory records reveal an unexplained loss as specified in 3-4; or flammable or combustible liquids or their vapors have been detected in neighboring structures, sewers, wells, or another on or off property location.

7-5 Product tanks shall not be pressure tested with air except as in 7-2.

7-6 Piping tests as required in 7-3 and 7-4 shall be by air pressure as specified in 7-1 or by a pipeline test with liquid as specified in NFPA 329, "Underground Leakage of Flammable and Combustible Liquids."

7-7 If a cathodic protection system is installed, an ongoing preventive maintenance program shall be used. If sacrificial anodes have been installed, their proper operation shall be confirmed by a qualified person at least once a year. If an impressed current cathodic protection system is installed, at least once a month the operator shall verify that it is operating and at least once a year a qualified person shall conduct an on-site test and inspection to measure the structure-to-soil and structure-to-structure potentials, and the rectifier voltage and current output.

7-8 Product line leak detectors shall be tested for proper operation prior to use of the remote pumping system after initial installation and shall be retested on an annual basis.

May 6, 1980

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PEI
PETROLEUM EQUIPMENT INSTITUTE

The Commonwealth of Massachusetts

Secretary of State

Regulation Filing and Publication

1. REGULATION CHAPTER NUMBER AND HEADING: AMENDMENTS TO 527 CMR 5.00 – CONSTRUCTION AND MAINTENANCE OF BUILDINGS OR OTHER STRUCTURES USED AS GARAGES, SERVICE STATIONS AND THE RELATED STORAGE, KEEPING AND USE OF GASOLINE OR OTHER MOTOR F

2. NAME OF AGENCY: BOARD OF FIRE PREVENTION REGULATIONS

3. READABLE LANGUAGE SUMMARY: State the general purposes and requirements of this regulation as well as the persons, organizations and businesses affected.

These amendments, in conjunction with those to 527 CMR 9.00 also being filed this date, require and explain in detail procedures for the prevention and detection of leakage of flammable and combustible liquids stored in underground tanks. They expand on the previous Section 5.05 (3) and mainly affect the petroleum industry and service stations in particular.

A TRUE COPY ATTEST
Michael Joseph Connolly
MICHAEL JOSEPH CONNOLLY
SECRETARY OF STATE
DATE 11/28/80 CLERK J. M.

4. AGENCY CONTACT FOR ADDITIONAL INFORMATION: Mrs. Mary F. ~~Watkins~~ Administrative Secretary to the Boards
Department of Public Safety Board Office
Address: McCormack Bldg., One Ashburton Place, Boston, MA 02108 Telephone 727-6255

5. STATUTORY AUTHORITY: M.G.L.A. - C. 22, S. 14; C. 148, Ss. 9 & 10

The Regulations Division will complete the following 6 and 7:

6. PUBLICATION: Massachusetts Register Number 238 Date 12/4/80

   Code of Massachusetts Regulation Volume 15 Page 53

7. EFFECTIVE DATE: 12/4/80

527 CMR 5.00: CONSTRUCTION AND MAINTENANCE OF BUILDERS OR OTHER STRUCTURES USED AS GARAGES, SERVICE STATIONS AND THE RELATED STORAGE, KEEPING AND USE OF GASOLINE OR OTHER MOTOR FUEL - AMENDMENTS

5.05: General Provisions

Delete (3) and substitute the following:

(3) All underground storage facilities except fuel oil tanks and containers connected with burning equipment shall be installed and monitored for the prevention and detection of leakage of flammable and combustible liquids in accordance with the following provisions:

(a) Accurate daily inventory records by means of dip sticking shall be maintained and reconciled on all flammable or combustible liquid underground storage tanks for indication of possible leakage from said tanks or piping. The records shall be kept on the premises available for inspection by any member of the Department of Public Safety, head of the fire department or his designee, and shall include, as a minimum, records showing type of product, daily reconciliation between sales, use, receipts and inventory on hand. If there is more than one system consisting of a tank(s), serving pump(s) or dispenser(s) for any product, the reconciliation shall be maintained separately for each tank system.

(b) Daily inventory shall be maintained for each tank system at each location by the operator. The inventory records shall be kept for a minimum of the past twelve (12) months at the premises. The operator shall mean the lessee or person(s) in control of and having responsibility for the daily operation of the facility for the storage and dispensing of flammable and conbustible liquids.

(c) Inventory shall be based on the actual daily measurement and recording of tank product and water levels and the daily recording of actual sales, use,and receipts. Daily measurements will be acceptable either by gauge, gauge stick, or by readout from an automated gauging system. The inventory records shall include a daily computation of gain or loss. The mere recording of pump meter readings and product delivery receipts shall not constitute adequate inventory records.

(d) The operator of the location shall be responsible to notify the head of the fire department of situation, and to notify the owner or person(s) in control of the facility to take action to correct any abnormal loss or gain not explainable by spillage, temperature variations or other causes. The owner shall mean the person(s) who owns, as real property, the tank storage system used for the storage and dispensing of flammable and combustible liquids.

(e) As a minimum the following steps shall be taken in an expeditious manner when daily inventory records indicate an abnormal loss:

1. The inventory records shall be checked for error.
2. If no error is apparent, an independent calculation of apparent loss shall be made by a qualified person starting from a point in time where the records indicate a no loss condition.

5.05: continued

3. If step 2 confirms no apparent loss, the readily accessible physical facilities on the premises shall be carefully inspected for evidence of leakage.
4. If step 3 does not disclose a leak, the dispensers used with the particular product involved with the apparent loss shall be checked for calibration.
5. If steps 1 through 4 do not explain the apparent loss, the situation shall be reported promptly to the authority having jurisdiction.
6. If step 4 does not explain the loss, and if the piping system can be tested without the need for excavation, the piping system between the storage tank and dispenser(s) shall be tested in accordance with CMR 9.06(20)(a). If it is necessary to excavate to perform a piping test, such a test shall be conducted after a storage tank test has been performed in accordance with step 7.
7. If step 6 does not disclose a leak, the storage tank(s) shall be tested for tightness by an approved test.
8. If steps 1 through 7 do not confirm the apparent loss, the daily inventory shall be continued with a daily independent verification by a qualified person. Additional surveillance of the facility should be engaged to insure against unauthorized removal of product.
9. If any of the above tests or investigations indicate the source of the loss, the owner shall take immediate action to correct the system failure.

(f) Daily inventories need not be maintained on those days that an installation is not in operation, but not to exceed fifteen (15) days.
(g) The owner and operator will conduct an inventory verification program on a scheduled basis, at least once every two (2) years. A copy of the record of this verification program shall be kept on the premises available for inspection by any member of the Department of Public Safety, or head of the fire department or his designee.

THOMAS C. ANDREWS
DIRECTOR

STATE OF MARYLAND
DEPARTMENT OF NATURAL RESOURCES
WATER RESOURCES ADMINISTRATION
TAWES STATE OFFICE BUILDING
ANNAPOLIS, MARYLAND 21401

August 15, 1981

CERTIFIED MAIL

RE: Daily Inventory of Underground Storage Tanks

Gentlemen:

The Honorable Robert F. Sweeney, Chief Judge, District Court of Maryland, has recently adopted a revised fine schedule to be utilized by all Maryland law enforcement officers authorized to issued citations for violations of the Natural Resources Laws.

The purpose of this notice is to advise you that the revised fine schedule creates a provision for the issuance of a $100.00 citation for violation of COMAR 08.05.04.07 (J). Section J (2) of this regulation requires that liquid levels of underground storage tanks be measured by the service station operator each day of operation, that these levels be compared with pump meter readings and receipt of product, and that a written daily record of this inventory be maintained. As there are several other provision contained in Section J of the regulation which apply to service stations, a copy of that entire section is enclosed for your information.

Operation in accordance with the requirements set forth in the regulation, which was promulgated on April 12, 1978, will insure that you are maintaining your facility in a manner which should minimize undetected loss of product and associated profits and also reduce the risk of pollution of either underground or surface waters of the State.

If you have any questions concerning this matter please contact this office (301) 269-3551.

Sincerely yours,

J. L. Hearn, Program Director
Resources Protection Program

JLH:rlf

encl: COMAR 08.05.04.07

Thomas C. Andr
Director

STATE OF MARYLAND
DEPARTMENT OF NATURAL RESOURCES
WATER RESOURCES ADMINISTRATION
TAWES STATE OFFICE BUILDING
ANNAPOLIS, MARYLAND 21401

REGULATION 08.05.04.07

PREVENTION OF OIL POLLUTION CONCERNING GARAGES, SERVICE STATIONS,

MARINAS AND SIMILAR OIL HANDLING FACILITIES

Service stations, garages, marinas and similar facilities are not required to obtain a permit but shall meet the requirements of Section J.

J. Garages, Service Stations, Marinas, and Similar Oil Handling Facilities.

(1) Storage tanks, venting, piping, and metering devices installed after the effective date of this regulation shall be in accordance with the recommended standards of the National Fire Protection Association and the American Petroleum Institute.

(2) Inventory Control of Underground Storage Tanks. Liquid levels of underground storage tanks shall be measured by the operator each day of operation and compared with pump meter reading and receipt of product. These records shall be kept in a log book and be available for reasonable inspection by the Administration. Loss of product above normal evaporation loss shall be reported immediately to the Administration. Records shall be retained for a minimum of 1 year. This period may be extended upon request of the Administration.

(3) The oil distribution company shall be responsible for monitoring inventory control of the storage tanks when the facility operates under the meter marketing plan.

(4) When unusual variation occurs, a verification of the operator's inventory records shall be accomplished, and, if a loss of product is indicated, a test for tightness on the underground tank shall be performed to the standards set forth in the National Fire Protection Association Standard No. 329-1972, Chapter IV, Page 30, "Final Test."

(5) Requirement For Oil Separating Facilities. All sewers and drains serving these facilities, and receiving oil-bearing wastes or wastewaters from operations at these facilities, shall be provided with adequate and properly maintained oil separating systems.

(6) Separate Drainage System Required. Drains receiving oil waste from operations at these facilities shall be entirely separate from any other drain pipe of the plumbing system.

(7) Facilities which generate waste oil shall provide storage that will prevent pollution of Waters of the State.

(8) Ultimate Disposal of Waste Oil. The ultimate disposal of waste oil shall be undertaken in a manner that will avoid water pollution, such as salvaging or sale to a salvage company, or use as fuel, or other methods approved by the Administration.

(9) Marina fuel delivery nozzles shall be equipped with a self-closing valve that will shut off the flow of fuel when the operator's hand is removed from the nozzle.

(10) Each line conveying oil to a wharf, pier, or dock shall be provided with a readily accessible block valve located on shore near the approach to the wharf, pier, or dock, and outside any diked area. Valves shall be grouped at one location.

(11) New marina installations and repairs of existing piping systems will assure flexibility by appropriate layout of arrangement of piping supports so that motion of wharfs, piers, and dock structure resulting from wave action, currents, tides, ice, or the mooring of vessels will not subject the pipe to strain beyond the elastic limit.

(12) New marina installations and repairs of old piping systems shall be protected from external corrosion by techniques such as coating, wrapping, or cathodic protection to retard corrosive action.

Report any spill or discharge of oil immediately to the Water Resources Administration

(301) 2693551	(301) 269-3181
(Office Hours)	(Other Hours)

NASSAU COUNTY FIRE PREVENTION ORDINANCE

ARTICLE III

FLAMMABLE AND COMBUSTIBLE LIQUIDS

ORDINANCE NO. 51-81

ORDINANCE NO. 51-81

AMENDING ORDINANCE NUMBER 60, 1950, AS AMENDED ENTITLED "AN ORDINANCE FOR THE PREVENTION OF FIRES BY ESTABLISHING UNIFORM REGULATIONS FOR THE CONTROL OF FIRE HAZARDS AND FOR THE ENFORCEMENT OF SUCH REGULATIONS IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE NASSAU COUNTY FIRE COMMISSION."

(Passed by Board of Supervisors on February 23, 1981. Became an ordinance on February 23, 1981 with the approval of the County Executive)

BE IT ORDAINED by the Board of Supervisors of the County of Nassau, as follows:

Section 1. Article III of Ordinance No. 60, 1950 as amended is further amended to read as follows:

ARTICLE III

Flammable and Combustible Liquids

Section 3.0 GENERAL PROVISIONS

(a) Adoption of Generally Accepted Standards. Unless more restrictive provisions are specifically provided for in any other Local Law or Ordinance within the County of Nassau, the Standard for Foam Extinguishing Systems, Standard NFPA No. 11-1978; the Standard for Flammable and Combustible Liquids, Standard NFPA No. 30-1977; and the Standard for the Installation of Oil Burning Equipment, Standard NFPA No. 31-1978, shall be applicable throughout the County of Nassau. These Standards are hereby incorporated and shall be deemed to be a part of this Ordinance. Copies of said Standards are on file with the Clerk of the Board of Supervisors of the County of Nassau.

(b) Compliance with Standards Except as Otherwise Prescribed. Compliance with applicable provisions of Standard NFPA No. 11-1978, Standard NFPA No. 30-1977, and Standard NFPA No. 31-1978, except as otherwise prescribed in this Ordinance, shall constitute compliance with this Article.

(c) Scope. The scope and application of the Article applies to flammable and combustible liquids with a flash point below 200° F.

(d) Classifications. For purposes of this Article, flammable and combustible liquids shall be classified as follows:

(i) Flammable liquids shall mean any liquid having a flash point below 140° F., and having a vapor pressure not exceeding forty (40) pounds per square inch (absolute) at 100° F.

Flammable liquids are classified as follows:

Class I liquids shall include those having flash points below 100° F., and may be subdivided as follows:

Subclass IA shall include those having flash points below 73° F., and having a boiling point below 100° F.

Subclass IB shall include those having flash points below 73° F., and having a boiling point at or above 100° F.

Subclass IC shall include those having flash point at or above 73° F., and below 100° F.

Class II liquids shall include those having flash points at or above 100° F., and below 140° F.

(ii) Combustible liquids shall mean any liquid having a flash point at or above 140° F. (60° C.), and shall be known as Class III liquids and are further classified as follows:

Subclass IIIA shall include those having flash points at or above 140° F. (60° C.), and below 200° F. (93.4° C.).

Subclass IIIB shall include those having flash points at or above 200° F. (93.4° C.).

This Article does not cover Subclass IIIB combustible liquids. Where the term combustible liquids or Class III liquids is used in this Article, it shall mean only Subclass IIIA liquids.

(e) Definitions. Definitions listed in Standard NFPA No. 11-1978, Standard NFPA No. 30-1977, and Standard NFPA No. 31-1978 shall be applicable to this Article.

(f) Prohibitions.

(i) Crude Oil. The storage or processing of crude petroleum is hereby permitted upon compliance with regulations of the Fire Marshal when such storage and processing is deemed to be in the public interest.

(ii) Untested Appliances. The sale or use of any appliance using flammable or combustible liquids for heating or lighting, unless such appliance has been tested by a nationally recognized testing laboratory, and certified that it has been properly safeguarded against fire hazard, is hereby prohibited.

The Underwriters' Laboratories, Inc. shall be deemed such a laboratory.

(iii) Smoking. Smoking wherever flammable liquids are stored, handled, or dispensed, is hereby prohibited. "No Smoking" signs, in letters of at least two inches in height, shall be posted on such premises.

(iv) Sources of Ignition. Sources of ignition, which include, but are not limited to open flames, fire-producing devices, hot surfaces, frictional heat, radiant heat, static electricity, electrical and mechanical sparks, chemical reactions evolving heat, and materials or substances subject to spontaneous ignition, shall be prohibited where flammable liquids are stored, handled, or dispensed.

(v) Maintenance and Repair.

(a) When necessary to do maintenance work in a flammable or combustible liquid storage or handling area, the work shall not commence until authorized by the Fire Marshal.

(b) Hot work, such as welding or cutting operations, the use of spark producing power tools, and chipping operations shall be permitted only after operating procedures have satisfied the safety requirements of the Fire Marshal. Prior to any hot work being performed, the Fire Marshal is to be notified.

(g) Deviations. Deviations from the applicable provisions of Standards NFPA No. 11-1978, NFPA No. 30-1977, and NFPA No. 31-1978 or of the provisions of this Ordinance as otherwise prescribed, when it shall have been conclusively proven to the Fire Marshal that such deviations meet the performance requirements of this Ordinance shall constitute compliance with this Ordinance.

(h) Discharge of Flammable or Combustible Liquids Prohibited. It shall be unlawful to discharge flammable or combustible liquids upon any roadway, on the surface or into the subsurface land, aquifer, or waterway anywhere in the County of Nassau by whatever method such discharge may occur. Any discharge of ten (10) gallons or less shall be reported to the Fire Marshal within twenty-four (24) hours. Any discharge in excess of ten (10) gallons shall be reported to the Fire Marshal immediately.

Section 3.1 FUEL OIL

(a) Fuel Oil Storage Tanks and Containers Connected Exclusively to Oil Burning Equipment. Such Fuel Oil storage tanks and containers shall conform with Standard NFPA No. 31-1978 and shall not otherwise be subject to the provisions of this ordinance.

(b) Installation of Oil Burning Equipment. Installation of oil burning equipment and all connections thereto shall conform with Standard NFPA No. 31-1978.

Section 3.2 BULK STORAGE - SPECIAL PROVISIONS

Bulk Storage Plans are those terminals where flammable or combustible liquids are received by tank vessel, pipe lines, tank car, or tank vehicle, and are stored or blended in bulk for the purpose of distributing such liquids by tank vessel, pipe line, tank car, tank vehicle or container.

For the purpose of this Article, bulk storage plants, because of conditions associated with their physical locations, shall be known as either Marine or Inland Terminals.

Marine Terminals shall be considered flammable or combustible liquid storage installations located adjacent to, or bordering on, navigable waters surrounding or within the County of Nassau.

Inland Terminals shall be considered all other flammable or combustible liquid storage installations which are not located adjacent to, or bordering on, navigable waters surrounding or within the County of Nassau.

(a) Filing of Plans. No new bulk storage plant shall be constructed, nor shall any replacements, additions, alterations, or major repairs be made to existing bulk storage plans unless plans have been filed with the Fire Marshal showing compliance with requirements of this Ordinance. Work shall not commence until such plans are approved by the Fire Marshal. Plans shall include a statement from a licensed professional engineer or registered architect, certifying that the proposed construction will conform to the regulations of the building department of the municipality wherein the plant is to be located.

(b) Certification. Upon completion of work for which plans have been approved by the Fire Marshal, pursuant to Section 3.2(a) of this Ordinance, a certificate issued by a licensed professional engineer or registered architect shall be filed with the Fire Marshal, stating that the completed work conforms with the plans approved by the Fire Marshal for such project.

Section 3.3 DIKE ENCLOSURES

(a) Requirement. Dike enclosures shall be required for all new and existing aboveground, outside storage tanks unless otherwise determined by the Fire Marshal.

(b) Individual Dikes. Individual dike enclosures shall be required for each new tank having a storage capacity of five hundred thousand (500,000) gallons or more. Tanks arranged in groups, having a total storage capacity not in excess of five hundred thousand (500,000) gallons may be enclosed by a single dike.

(c) Construction. New dikes shall be constructed of steel, reinforced concrete or masonry. All dikes shall be designed to be liquid tight, to withstand a full hydraulic head, and wind pressures. When protection of adjoining property or waterways is by means of impounding by diking around the tanks, such system shall comply with the following:

(i) A slope of not less than 1 percent away from the tank shall be provided for at least 50 feet or to the dike base, whichever is less.

(ii) The volumetric capacity of the diked area shall not be less than the greatest amount of liquid that can be released from the largest tank within the diked area, assuming a full tank. To allow for volume occupied by tanks, the capacity of the diked areas enclosing more than one tank shall be calculated after deducting the volume of the tanks, other than the largest tank, below the height of the dike.

(iii) To permit access, if property limitations permit, the outside base of the dike at ground level shall be no closer than 10 feet to any property line that is or can be built upon.

(iv) Except as provided in (v) below, the walls of the diked area shall be restricted to an average interior height of 6 feet above interior grade.

(v) Dikes may be higher than an average of 6 feet above interior grade where provisions are made for normal access and necessary emergency access to tanks, valves and other equipment, and safe egress from the diked enclosure.

A. Where the average height of the dike containing flammable or combustible liquids is over 12 feet high measured from interior grade, or where the distance between any tank and the top inside edge of the dike wall is less than the height of the dike wall, provisions shall be made for normal operation of valves and for access to tank roof(s) without entering below the top of the dike. These provisions may be met through the use of remote operated valves, elevated walkways or similar arrangements.

B. Piping passing through dike walls shall be designed to prevent excessive stresses as a result of settlement or fire exposure.

C. The minimum distance between tanks and toe of the interior dike walls shall be 5 feet. The distance between the tank(s) may be less than 5 feet if property and distance restrictions make maintaining that distance impractical.

(vi) Each diked area containing two or more tanks shall be subdivided preferably by drainage channels or at least by intermediate curbs in order to prevent spills from endangering adjacent tanks within the diked area as follows:

A. When storing normally stable liquids in vertical cone roof tanks constructed with weak roof-to-shell seam or approved floating roof tanks or when storing crude petroleum in producing areas in any type of tank, one subdivision for each tank in excess of 10,000 bbls. and one subdivision for each group of tanks (no tank exceeding 10,000 bbls. capacity) having an aggregate capacity not exceeding 15,000 bbls.

B. When storing normally stable liquids in tanks not covered in subsection A., one subdivision for each tank in excess of 100,000 gallons (2,500 bbls.) and one subdivision for each group of tanks (no tank exceeding 100,000 gallons capacity) having an aggregate capacity not exceeding 150,000 gallons (3,570 bbls.).

C. When storing unstable liquids in any type of tank, one subdivision for each tank except that tanks installed in accordance with the drainage requirements of the Standard for Water Spray Fixed Systems for Fire Protection, NFPA 15-1979, shall require no additional subdivision.

D. Whenever two or more tanks storing Class I liquids, any one of which is over 150 feet in diameter, are located in a common diked area, intermediate dikes shall be provided between adjacent tanks to hold at least 10 percent of the capacity of the tank so enclosed, not including the volume displaced by the tank.

E. The drainage channels or intermediate curbs shall be located between tanks so as to take full advantage of the available space with due regard for the individual tank capacities. Intermediate curbs, where used, shall be not less than 18 inches in height.

(vii) Where provision is made for draining water from diked areas, such drains shall be controlled in a manner so as to prevent flammable or combustible liquids from entering natural water courses, public sewers, or public drains, if their presence would constitute a hazard. Control of drainage shall be accessible under fire conditions from outside the dike.

(d) Earthen Dikes. All earthen dikes now in use shall be permitted to continue in use and shall be deemed to satisfy the requirements of this Ordinance, providing however, that such dikes shall be maintained in a manner so as to effectively contain any spillage of the liquid contained in the tank which the said dike shall surround and, further provided, that such dikes shall meet all other applicable requirements of this Ordinance. If in the opinion of the Fire Marshal the dike would fail to effectively contain any spillage of the liquid contained in such tank, then in that event, such dike shall be replaced by a new dike to be constructed in accordance with the provisions of Section 3.3(c) of this Ordinance.

(e) Access to Dikes. All dikes in excess of four (4) feet in height shall be provided with adequate flights of stairs of non-combustible material and shall be mounted on each side of the dike, opposite each other. Other means of access to, or egress from the area between the tank and dikes may be accepted by the Fire Marshal provided that accessibility is equal to or greater than that provided by stairs hereinabove provided for. The number of such flights of stairs is to be determined by the Fire Marshal taking into consideration the height and diameter of the dike.

(f) Surface Treatment - Diked Area. The area within a dike enclosure shall be covered or treated with a substance or material to render such surface resistant to liquid spills.

(g) Fire Protection. Dikes in excess of eight (8) feet in height shall be equipped with a built-in fixed foam extinguishing system installed in accordance with Standard NFPA No. 11-1978. Such dikes shall have fixed foam nozzles located in the dike wall, which shall be connected to the required foam extinguishing system.

(h) Maintenance. Dike enclosures shall be kept free of combustible materials, barrels, drums, or any other encumbrances.

Section 3.4 FIRE PROTECTION

(a) Emergency and Extinguishing Equipment. Wherever flammable or combustible liquids are stored, handled, or dispensed, a sufficient number of approved fire extinguishers, fire extinguishing systems, devices or materials, shall be provided, as determined by the Fire Marshal. Emergency equipment deemed necessary by the Fire Marshal for restraining the possible spread of fire, or containment of a spill, shall also be provided.

(b) Foam Extinguishing Systems and Foam Supplies.

(i) Fixed Fire Extinguishing Systems. All bulk storage plants storing flammable liquids in aboveground, vertical tanks, other than floating roof tanks, shall be equipped with a fixed foam extinguishing system, which shall comply with the applicable provisions of Standard NFPA No. 11-1978.

(ii) Reserve Supply for Fixed Foam Systems. All bulk storage plants equipped with a fixed foam system shall have a readily available reserve supply of foam-producing materials equivalent to the amount initially required to meet design requirements, in order to put the system back into service after operation. This supply shall be in drums or cans located on the premises.

(iii) Foam Requirements for Other Bulk Storage Plants. All other bulk storage plants shall keep on the premises a quantity of foam-producing materials for fire department use, as required by the Fire Marshal, taking into consideration classification of liquid stored, quantity of liquid stored, size of tanks, area contained within dikes, and nature of the operation.

(iv) The loading rack automatic extinguishing system shall be flow tested annually, as per the requirements of the Fire Marshal. A copy of the test(s) result(s) shall be submitted to the Fire Marshal's Office.

(v) The foam extinguishing system shall be flow tested every two (2) years. A copy of the test(s) result(s) shall be submitted to the Fire Marshal's Office.

(c) Absorbents - Dispersants.

(i) All bulk storage terminals shall have a supply of approved absorbent and/or dispersant material sufficient to comply with requirements of the Fire Marshal.

(ii) All marine bulk storage terminals shall provide absorbent and/or dispersant materials in such quantity so as to comply with requirements of the Fire Marshal.

(iii) Dispersant and absorbent materials shall be stored in a readily accessible location.

(iv) Dispersant and absorbent material that has been used shall be replaced as soon as possible.

(d) Spill Containment Protection.

(i) All marine terminals shall be provided with a floating boom of sufficient length to contain the largest boat, barge, or vessel discharging flammable or combustible liquids at such terminal, and the necessary means available for the immediate deployment thereof.

(ii) The boom shall be designed to extend above and below the surface of the water when placed in position for use. When more than one section of boom is required, it shall be capable of being connected to other sections to provide a positive seal for its full height and depth.

(iii) The boom, when not in use, shall be located in close proximity to the marine loading dock and readily accessible.

(iv) Prior to discharge of any flammable or combustible liquid from any boat, barge or vessel, the required booms shall be positioned to contain such boat, barge or vessel, and shall remain in this position until discharging operations have been completed, and all transfer lines disconnected. Any spillage of flammable or combustible liquid contained within the area encompassed by the boom shall be removed prior to the movement of the boat, barge or vessel. Exceptions to the positioning of the boom may be made by the Fire Marshal whenever certain conditions would render it impractical or ineffective. There shall be no booming required from December 15 to March 15.

(v) Whenever flammable or combustible liquids seep, leak or spill into adjacent or surrounding waters from a marine terminal, the required boom shall immediately be placed in such waters to contain the flammable or combustible liquids, and such liquids shall be removed as soon as possible.

(e) Surveillance

(i) Bulk storage plants where flammable or combustible liquids are received by tank vessel, rail tank car, and/or pipe line, shall comply with the following:

A. Shall maintain a "Watchman's Clock System," which shall be used for the purpose of recording the movements of a watchman, and shall consist of equipment for checking the regularity and continuity of the watchman's patrol of his route.

B. Surveillance service shall be performed between the hours of 5 P.M. and 8 A.M. daily, and for twenty-four (24) hours on Saturdays, Sundays, and Holidays when the plant is closed. For the purpose of this Ordinance, a plant shall be deemed to be closed when there is no person or persons on the premises of the plant who is able to visually observe the functions and condition of the plant and equipment at least once every hour. The schedule and assignment of personnel shall be posted in the main office on the premises.

C. The number and location of key stations on each patrol route shall be designed so that the entire plant will have been visibly observed by the watchman at least once each hour.

D. Telephone or radio communications shall be available and accessible to the watchman at key stations, or along patrol routes, for the purpose of reporting emergencies.

E. Chart and/or tape records of the watchman shall be kept on file for a period of at least three (3) months, and shall be available to the Fire Marshal for examination.

F. Where more than one person, firm, or corporation has storage facilities at a bulk storage terminal, a single watchman's clock system shall be acceptable, provided it is operated pursuant to requirements of this Section.

(ii) Bulk storage where flammable or combustible liquids are received by tank vehicle.

A. When closed for more than one (1) hour, these plants shall be secured in accordance with operating procedures submitted by each facility, and approved by the Fire Marshal.

(f) Emergency Organization.

(i) A sufficient number of plant personnel, as determined by the Fire Marshal, shall be trained by a member of the Fire Marshal's staff or an officer of the local fire department in the operation of all fixed and portable fire extinguishing equipment located on the premises. The superintendent, or other person in charge of the plant, shall be responsible for the daily assignment of trained personnel, and shall provide replacements when necessary. Personnel shall also be trained in the operation of valves and equipment to shut down flow of flammable or combustible liquids in the event of an emergency.

(ii) The superintendent, or other person in charge of bulk storage plant, shall file with the Fire Marshal and the local fire department, the names, addresses, and home telephone numbers of not less than three (3) persons, in order of preference, who may be called in case of emergency. The persons designated shall be thoroughly trained and be familiar with the layout of the plant, including the location and operation of shutoff valves, switches, pumps, fire extinguishing equipment and supplies. The list of persons designated shall be kept current.

Section 3.5 STORAGE TANKS

The design and construction of tanks shall conform to generally accepted standards, as listed in Standard NFPA No. 30-1977.

(a) Tank Test. Storage tanks, including valves and piping connected thereto shall be tested prior to use, and thereafter, pursuant to requirements of Section 3.9(d) and (g) of this Ordinance. Tanks, valves, or piping that appear defective or show evidence of leaking, shall be repaired and tested prior to subsequent use.

(b) Capacity. The maximum capacity of any tank used for the storage of Class I liquids shall not exceed one million (1,000,000) gallons, nor more than three million (3,000,000) gallons for storage of Class II or Class III liquids.

(c) Transfer Lines. Tanks at bulk plants shall have transfer capabilities so that the contents of such tanks can be transferred in the event of fire or emergency.

(d) Aboveground Tanks.

(i) Distinctive Markings. The technical name of the liquid contained therein shall be conspicuously lettered on the exterior surface of the tank. Such lettering shall be of sufficient size to be discernible from grade level. The date of construction of the tank and the date of the most recent internal inspection shall be stenciled on or near the manhole cover in the tank wall.

(ii) Tanks Temporarily Out of Service. Fill pipe, gauge opening, and pump suction shall be capped tightly and secured against tampering. Pressure-relief vent must operate normally, and the fire extinguishing system shall remain functional. Tanks temporarily out of service for a continuous period of ninety (90) days or more shall be considered abandoned for the purposes of the requirements of the following paragraph.

(iii) Tanks Abandoned in Place. Tanks that are no longer used for the storage of flammable or combustible liquids, or are temporarily out of service for a continuous period of ninety (90) days or more, must have all liquids removed. The tanks shall be purged, cleaned, and serviced. Fill pipe, gauge opening, and pump suction shall be capped tightly and secured against tampering. Pressure-relief vent must operate normally, and the fire extinguishing system shall remain functional.

(iv) Tank Removal. Prior to dismantling and/or removal of any tank, all flammable or combustible liquids must be completely removed from the tank and connecting lines, and such tank and lines shall be purged and made vapor free.

(e) Underground Tanks.

(i) Rendering tanks "Temporarily Out of Service," Abandoning, or Removing Underground Tanks.

A. Temporarily Out of Service. Tanks should be rendered "temporarily out of service," only when it is planned that they will be returned to active service within a reasonable period of time. The maximum time limit that a tank can remain out of service is one (1) year. When tanks are placed in a "temporarily out of service" condition, the following must be complied with:

1. All flammable or combustible liquids shall be removed from the tank and all connecting lines.

2. Cap the fill line, gauge opening, and pump section; secure against tampering.

3. Leave the vent line open.

4. Tank is to be filled with water.

B. Abandoning Underground Tanks in Place.

1. Remove all flammable or combustible liquid from the tank and from all connecting lines. No cutting torch or other flame or spark producing equipment shall be used until the tank has been completely purged or otherwise rendered safe.

2. Disconnect the suction, inlet, gauge and vent lines.

3. Fill the tank completely with an inert solid material. Cap remaining underground piping.

4. Written notarized notification of abandonment must be submitted to the Fire Marshal, on forms supplied by the Fire Marshal, detailing the tank size, location, date of abandonment, and the method used for placing the abandoned tank in a safe condition.

C. Removal of Underground Tanks.

1. Remove all flammable or combustible liquids from tank and from connecting lines.

2. Disconnect the suction, inlet, gauge, and vent lines; remove sections of connecting lines which are not to be used further and cap or plug inlets, outlets, and leaks if any. After removal, the tank may be gas freed on the premises if it can be done safely at that location or may be transported to an area not accessible to the public and the gas freeing completed at that location.

3. Written notification of removal must be submitted to the Fire Marshal detailing the tank size, location, and the date of removal.

4. Tanks storing flammable or combustible liquids that are subject to corrosion which have been removed from the ground, may not be re-used and installed at another location, in the County of Nassau.

(ii) Leak Detection. Whenever any new tank or replacement tank is installed, each installed tank shall have its own observation wells of not less than four (4) inches in diameter at locations to be determined by the Nassau County Fire Marshal.

Observation wells with well screens not less than ten (10) feet long shall be installed to locate the mid-point of the screen at ground water and shall be located to permit observation of the condition of ground water at the boundary lines of the underground tank field area and/or at such other locations as may be designated by the Nassau County Fire Marshal.

In areas where the depth from grade to ground water, exceeds thirty-five (35) feet, a suitable leak detection system, approved by the Fire Marshal may be installed in lieu of monitoring wells.

In the event of evidence of a leak in the vicinity of a tank(s) storing flammable or combustible liquids, the tank(s) owner shall install observation wells as described previously in this section for the purpose of conducting sampling by the Fire Marshal or his designated representative. Where evidence is found of flammable or combustible liquids leaking into the ground, immediate efforts shall be started by the tank owner to recover and remove said product.

(iii) All new or replacement underground storage tanks shall be constructed of noncorrosive material. All new or replacement piping shall be constructed of noncorrosive material or be suitably protected against corrosion. New or replacement tanks which are not constructed of noncorrosive material shall be coated with a permanently bonded, noncorrosive material.

(iv) Existing tanks in excess of one thousand (1,000) gallons capacity which do not meet the requirements of Section (e) (iii) shall be replaced in accordance with the following schedule:

Tanks in service longer than twenty (20) years shall be replaced within four (4) years of the date of adoption of this Ordinance.

Tanks in service from five (5) years to twenty (20) years shall be replaced within nine (9) years of date of adoption of this Ordinance.

Tanks in service less than five (5) years shall be replaced within fourteen (14) years of the date of adoption of this Ordinance.

The Fire Marshal shall have the authority to modify the replacement schedule of existing non-conforming tanks if information denotes combinations of conditions conducive to corrosion of non-conforming installations.

(f) No new tank, or replacement tank installation, storing flammable/combustible liquids shall be installed until plans are submitted and approved by the Fire Marshal. The plans shall show the following:

(i) the size, location, and topographical contour of the property and exact street address;

(ii) the location of leak detection pipes;

(iii) the location, type, size, and capacity of existing tanks and the material stored therein;

(iv) the location, type, size, and capacity of all proposed tanks and the material proposed to be stored therein;

(v) the location, material, and size of all existing or proposed dikes, when required;

(vi) the location, size, and use of all existing buildings on property involved;

(vii) the location, size, and use of proposed buildings;

(viii) the location of existing or proposed loading racks; and/or dispensing islands;

(ix) the description and location of fire extinguishers and/or fire extinguishing system to be installed;

(x) depth from grade to ground water.

(g) Physical Protection. All new or replacement tanks shall be equipped with a fixed plate, or other suitable device to prevent physical damage to the tank bottom which may be caused by the use of the tank gauging stick.

An Underwriters Laboratories or Factory Mutual approved measuring device, used in lieu of a tank gauging stick, may be allowed if the requirements of the Fire Marshal are met.

Section 3.6 DISPENSING UNITS

(a) Loading Racks at Bulk Storage Plants.

(i) Loading racks shall be surrounded by reinforced concrete curbing or suitable concrete-filled stanchions to prevent vehicles from damaging any part of the loading mechanism, or any platform, support, or piping used in conjunction therewith.

(ii) Provisions shall be made to prevent flammable or combustible liquids that may be spilled at loading or unloading points from entering public sewers and drainage systems, or natural waterways. Connection to such sewers, drains, or waterways, by which flammable or combustible liquids might enter, shall be provided with separator boxes or other approved means whereby such entry is precluded.

(iii) Loading Procedure.

A. The motors of vehicles to be loaded must be shut off, and all vehicle lights turned off when vehicle is in position at the fill stand for loading.

B. Bond connection shall be made fast to the vehicle or tank before dome covers are raised, and shall remain in place until filling is completed and all dome covers have been closed and secured.

C. Compartments, lines, manifold, meters, and pump must be empty, or must contain the same product to be loaded.

D. Tank discharge valves must be properly closed.

E. Valves used for the final control for filling tank vehicles shall be of the self-closing type and manually held open except where automatic means are provided for shutting off the flow when the vehicle is full or after filling of a preset amount.

F. Only one compartment per vehicle shall be filled at a time.

G. The dome cover on each compartment must be closed and secured immediately as each compartment is filled.

(iv) Dispensing nozzles shall be of a self-closing type, listed by a nationally recognized laboratory.

(v) Loading Racks.

A. The loading rack area shall be protected by an automatic fixed extinguishing system. Such system shall also be capable of being operated manually from the loading rack area and at a location sufficiently remote from the loading rack so as not to be endangered by a fire at the loading rack.

1. Depending upon the fire extinguishing medium used compliance with the Standard for Foam Extinguishing System, Standard NFPA No. 11-1978, or the Standard for the Installation of Sprinkler Systems, Standard NFPA No. 13-1978, or the Standard for Water Spray Fixed Systems for Fire Protection, Standard NFPA No. 15-1979, or the Standard for the Installation of Foam, Water Sprinkler Systems and Foam Water Spray Systems, Standard NFPA No. 16-1974, or the Standard for Dry Chemical Extinguishing Systems, Standard NFPA No. 17-1975, shall constitute compliance with paragraph A of subdivision (v) of Section 3.6 of this Article. These Standards are hereby incorporated and shall be deemed to be a part of this Ordinance. Copies of said Standards are on file with the Clerk of the Board of Supervisors of the County of Nassau.

B. An automatic fixed fire extinguishing system shall not be required at an existing bulk storage facility which meets all of the following criteria:

1. The facility shall store and dispense only liquids having a flash point above 100° F., as determined in accordance with the standard method of test for flash point, known as the Tag Closed Cup Test.

2. The facility shall contain a truck loading rack of not more than two positions or there shall be loading positions for not more than two tank vehicles or tank trailers to fill simultaneously.

3. No liquid shall be dispensed into a tank vehicle or container which shall contain a flammable liquid having a flash point of less than 100° F. or the fumes or residue of such a flammable liquid.

C. Any major alteration, replacement or addition to an existing loading rack at a bulk storage facility, which does not require a fixed fire extinguishing system, shall be treated as a new installation and shall meet, all the requirements of Paragraph A of subdivision (v) of Section 3.6 of this Article.

D. At bulk storage plants, an automatically operated remote control valve shall be installed in each supply line to the loading rack. Such valves shall be installed and the controls shall be protected and located remote from the loading rack. All such valves shall close automatically upon operation of the automatic fixed extinguishing system located at the loading rack.

E. Pumps used for dispensing Class I flammable liquids shall not be installed on, at, under or adjacent to loading racks. Such pumps shall be located remote from loading racks, accessible for repair and maintenance and protected against mechanical injury. Metering devices from such pumps will be permitted on the loading rack.

F. Exposed system piping shall be protected from mechanical injury.

(vi) Portable fire extinguishing equipment shall be provided.

(vii) A fire alarm box or other communicating devices shall be located on the premises in close proximity to the loading rack for the purpose of reporting a fire or emergency in this vicinity.

(b) Indoor gasoline dispensing may be permitted when in compliance with the following:

(i) Gasoline dispensing areas shall be separated from motor vehicle repair areas, boiler room, and mechanical equipment rooms by fire-resistive construction.

(ii) The gasoline dispensing unit shall be mounted on a concrete island to protect such unit and its piping from physical damage. Further protection shall be afforded if the unit is located where it could be subject to damage from a vehicle ascending or descending a ramp or slope.

(iii) The area in which the gasoline dispensing unit is located shall have a mechanical ventilation system capable of providing not less than two (2) cubic feet per minute per square foot of floor area.

(iv) An approved emergency switch, clearly marked and readily accessible, shall be provided to cut off the power to the gasoline dispensing unit in the event of an emergency.

(v) An oil separator shall be provided for the purpose of preventing flammable liquids from flowing into the main drainage system, and shall be attached to the house drain.

(vi) Gasoline dispensing units are prohibited below grade level.

(vii) Self-service gasoline dispensing operations are prohibited.

(c) Automatic Dispensing Units. The installation and use of coin-operated gasoline dispensing devices are prohibited.

(d) Self-Service Gasoline Dispensing.

(i) Gasoline, self-service dispensing units shall only be permitted at outdoor, above-grade locations.

(ii) A trained attendant shall be on duty at the control panel whenever the station is open for business, and shall observe, supervise, and control dispensing operations.

(iii) Smoking shall be prohibited in the dispensing area signs reading "No Smoking -- Stop Your Motor" shall be conspicuously posted at the dispensing island, in clear view of the motorist.

(iv) Dispensing operations shall not be permitted until the engine of the vehicle being serviced is shut off.

(v) Only portable containers listed by a nationally recognized testing laboratory shall be filled by gasoline dispensing units.

(vi) Emergency power control switches shall be clearly identified, and shall be capable of disconnecting power to all dispensing units. They shall be located at least twenty (20) feet from the nearest dispenser, but not more than fifty (50) feet from the most remote dispenser. The attendant shall be in a location whereby all dispensing units are clearly visible.

(vii) Only dispensing nozzles of the self-closing type shall be permitted for self-service dispensing devices. There shall be no latch-open device on any self-service dispensing nozzle.

(viii) Plans for the installation of self-service gasoline dispensing installations shall be submitted to the Fire Marshal for approval prior to commencement of installation.

(ix) Dispensing devices that are in compliance with standards set by the Underwriters' Laboratories, Inc., or Factory Mutual Engineering Division, shall be deemed acceptable.

(x) The number and type of fire extinguishers shall be provided as indicated on plans submitted to the Fire Marshal as required by paragraph (viii) above, and located in the vicinity of the emergency controls.

(xi) An approved audible intercommunication system shall be required between the attendant and the dispensing area, and shall be maintained in proper operating condition.

Section 3.7 TANK VEHICLES

(a) Operations.

(i) All motor vehicles used on private property for the transportation of flammable or combustible liquids shall comply with all applicable provisions of the New York State Vehicle and Traffic Law as the same relates to operation of Public highways.

(ii) Each operator of a motor vehicle used for the transportation of flammable or combustible liquids shall be currently licensed to drive the vehicle, and such license shall be issued or recognized by the New York State Department of Motor Vehicles.

(b) Parking.

(i) No vehicle used for the transportation of flammable or combustible liquids shall be left unattended on any public street, road or highway, unless the brakes on such vehicles have been set. Parking shall be limited to one hour; however, during actual loading or discharging operations, the driver shall be present at the vehicle. When delivering fuel oil to storage tanks for oil heating equipment, the driver may remain at the fill location. After sunset such vehicles temporarily parked on public thoroughfares shall be required to have their parking lights turned on and shall be placed, where possible, in the vicinity where street lighting is of sufficient intensity to illuminate the vehicle.

(ii) Parking of vehicles used for the transportation of flammable or combustible liquids out of doors on private property, shall not be located closer than twenty-five (25) feet from any building used for public assembly, educational purposes, institutional purposes, or residential occupancy.

(iii) Vehicles used for the transportation of flammable or combustible liquids shall not be parked or garaged in any building or structure other than those specifically approved for such use, and subject to the fire safety conditions which might be imposed.

Section 3.8 GARAGES AND SIMILAR OCCUPANCIES

(a) Washing Parts with Flammable Liquids. No Class I flammable liquid shall be used in any garage or similar occupancy for washing parts to remove grime, grease, or dirt, unless the operation is performed in a machine listed by an approved testing laboratory for such purposes; or, in a separate, well ventilated room enclosed by walls having a fire resistance rating of not less than two (2) hours, with openings therein protected by approved fire doors or fire windows, and with no opening from such room to any upper or lower story, and where all heating, lighting, and electrical equipment is suitable for flammable liquid atmosphere.

(b) Waste Containers. Oily waste and/or wiping rags shall be deposited in approved, self-closing metal cans. Such cans shall have been tested by a competent, nationally recognized testing laboratory and found to be properly safeguarded against fire hazard. Underwriters' Laboratories, Inc. shall be deemed a competent laboratory.

Section 3.9 MAINTENANCE, INVENTORY, RECORDS, INSPECTIONS

(a) Maintenance. All bulk storage installations, tanks, piping, vehicles, structures, equipment, applications, and/or devices for the transportation, storage, sale, or use of flammable or combustible liquids, including fire protection equipment, watchman's clock system, plant emergency organizations, and electrical equipment, shall be properly maintained and kept in operating order.

(b) Inventories.

(i) Accurate daily inventory records shall be maintained and reconciled on all Class I liquid and diesel fuel storage tanks for indication of possible leakage from tanks or piping. The person, firm or corporation having control of the product contained in the tanks, hereinafter called "operator" shall be responsible for maintaining and reconciling this inventory. The records shall be kept at the premises available for inspection by the enforcing authority and shall include, as a minimum, records showing byproduct, daily reconciliation between sales, use, receipts, and inventory on hand. Both the owner of storage tanks and the owner of the property shall insure that daily inventory requirements are conducted by the operator using any suitable means including provisions of normal contractual arrangements and other agreements with the operator and by reporting to the Fire Marshal any evidence of failure of operator to properly perform the required inventory. If there is more than one system consisting of a tank(s) serving separate pump(s) or dispenser(s) for any product, the reconciliation shall be maintained separately for each tank system.

(ii) Unusual inventory variations (greater than one percent of any one product) shall be reported immediately by the operator to the Fire Marshal. Operators of retail outlets must also immediately notify both the owner and supplier.

(iii) Proof of inventory control records shall be available for inspection by the Fire Marshal for a minimum of five (5) years.

(iv) When an unusual inventory variation(s) occurs, a verification of the operator's inventory control records shall be performed by the owner of the tank within twenty-four (24) hours and if a loss of product is indicated a test for tightness on the underground tank shall be performed by the owner of the tank immediately. The tank test shall meet the following criteria titled Final Test.

Final Test. The Final Test will conclusively determine whether or not an underground liquid storage and handling system is leaking. The Fire Marshal may mandate the Final Test of an underground flammable or combustible liquid storage tank, whenever he has reason to believe a leak of flammable or combustible liquids exists. Any testing devices used for the Final Test shall be capable of detecting leaks as small as .05 gallons in one hour, adjusted for variables.

If the net change exceeds .05 gallons per hour, then the piping shall be isolated for further check. If the piping is tight, then the tank must be uncovered for inspection.

Any testing device for the Final Test shall be approved by the Fire Marshal.

The above requirements notwithstanding, the Fire Marshal may, at any time, mandate the above test of underground storage tanks.

(c) Records.

(i) Records required by the Fire Marshal relative to surveillance, inventories, product loss, inspecting and testing, shall be maintained on the premises of inspection by the Fire Marshal.

(ii) Any person, firm or corporation doing business in Nassau County who supplies flammable and/or combustible liquids to any flammable or combustible liquid storage location, must on request of the Fire Marshal, Assistant Fire Marshal or Fire Inspector, submit the addresses of all locations in Nassau County to which these products are delivered. Exception: Fuel oils, supplied for the sole purpose of fueling oil burning heating equipment are exempt from this provision.

(iii) All underground storage tanks containing flammable or combustible liquids, except those tanks connected to oil-burning equipment, shall be registered with the Nassau County Fire Marshal on forms provided by the Fire Marshal. Registration information shall consist of the ownership of tank(s), material of construction of tank(s), date of installation of tank(s), age of tank(s), age of other tanks in the installation, date of most recent hydrostatic test and the type of liquid contained. No tank shall be used for storage after one (1) year from the date of the adoption of this Ordinance, until it is duly registered with the Fire Marshal and a certification of registration obtained. Any tank that does not have specific proof of age, such as building department permits, or purchase/installation invoices, will be considered to be more than twenty (20) years old for the purposes of this Ordinance. A registration certificate will be issued for each tank or tank complex and must be posted in a conspicuous place at the operating facility.

However, any tank installed after the effective date of this Ordinance shall be individually registered and a registration certificate for each tank must be posted in a conspicuous place at the operating facility. Any applicant shall be required to pay a fee for the registration certificate as set forth by the County of Nassau.

1. The following registration fees are hereby established in connection with flammable and combustible liquids pursuant to Ordinance No. 426-1979.

A. A registration fee of $10.00 for each existing underground flammable and combustible liquid storage tank or tank complex.

B. A registration fee of $10.00 for each new underground flammable and combustible liquid storage tank or replacement tank.

(d) Testing. All underground tanks used for the storage of flammable or combustible liquids, which are subject to corrosion, and all piping connected thereto, shall be hydrostatically tested. Each tank shall be retested at intervals of not more than five (5) years from the previous inspection. All defects shall be corrected prior to subsequent use. A written copy of the test report, including information relative to repairs made, shall be filed with the Fire Marshal.

(e) Notification of Test. New, replacement or repaired tank(s) and/or piping used for the storage and dispensing of flammable/combustible liquids shall be tested prior to being put into active service. The Nassau County Fire Marshal's Office shall be notified of any test, a minimum of twenty-four (24) hours prior to the test.

(f) Tank Test Failure. In the event that an underground storage tank used to store flammable/combustible liquids and all and any associated piping fails any test procedure, the Nassau County Fire Marshal's Office shall be notified via telephone no later than the following working day, and in writing, no later than five (5) days after the test date by the person, firm or corporation performing this test.

(g) Inspection - Bulk Storage Plants. All aboveground tanks used for the storage of flammable and combustible liquids shall be emptied, cleaned, purged, and inspected by a competent person whenever conditions warrant. Such inspection shall be made at least once every ten (10) years. All defects shall be corrected prior to subsequent use. A written copy of the inspection report, including information relative to repairs made shall be filed with the Fire Marshal.

Section 3.10 PERMITS AND CERTIFICATES OF FITNESS

(a) Permits Required. Any person, firm or corporation installing flammable or combustible liquid storage tanks, excluding those connected exclusively to oil burning equipment must secure a permit to install tanks from the Nassau County Fire Marshal.

(i) Application For Permit. Applications for permits shall be made to the Fire Marshal on forms provided and shall include the applicants answers in full to inquiries set forth on such forms. Applications for permits shall be accompanied by such data as may be required by the Fire Marshal. A fee of $25.00 for a three (3) year permit, is required.

(ii) Review and Issuance. The Fire Marshal shall review all applications submitted, determine compliance with applicable provisions of the Code and issue permits. If an application for a permit is rejected by the Fire Marshal, he shall advise the applicant of the reasons for such rejection. Permits for activities requiring evidence of financial responsibility by the County of Nassau shall not be issued unless proof of required financial responsibility is furnished.

(iii) Display of Permits. A copy of the permit shall be posted or otherwise readily accessible at each place of operation or carried by the permit holder as specified by the Fire Marshal.

(iv) Permits shall be given full force and effect for a period of three (3) years.

(b) Certificate of Fitness Required. Any person performing a test to determine the tightness of underground or aboveground flammable or combustible liquid handling equipment including storage tanks and piping shall be required to hold a valid Certificate of Fitness issued by the Fire Marshal. Such certificate is subject to revocation by the Fire Marshal at any time where the certificate holder displays evidence of non-compliance with the provisions of this Ordinance.

(i) Application. All applications for a Certificate of Fitness shall be filed with the Fire Marshal on forms provided by the Fire Marshal and accompanied by a $10.00 per person fee for a three (3) year permit.

(ii) Proof of Qualifications. Every person applying for a Certificate of Fitness shall furnish satisfactory proof to the Fire Marshal that he is familiar with materials, formulas, tools, techniques, standards, laws, ordinances, recognized good practices, safety precautions and manufacturer's recommendations pertaining to the particular system, materials, devices or operations he will be involved with and for which the Certificate of Fitness is issued. He shall further prove that he is physically competent to perform any and all actions necessary for incidental to the operation for which the Certificate of Fitness is issued.

(iii) Investigation and Examination. The Fire Marshal shall investigate every new application for a Certificate of Fitness. The investigation shall include a written examination regarding the use, makeup, and handling of flammable and combustible liquids and such examination shall include a practical test. When the Fire Marshal determines that the applicant conforms to all the requirements of this Ordinance, he shall issue the Certificate of Fitness.

(iv) The Certificate of Fitness shall be given full force and effect for a period of three (3) years.

(v) Refusal of Certificate of Fitness. When the Fire Marshal determines that a candidate has failed an examination for a Certificate of Fitness, he shall refuse to issue the Certificate of Fitness. An applicant may not apply again for the Certificate of Fitness within a ten-day period following the examination.

(vi) Transferability. Certificate of Fitness shall not be transferable.

(vii) Renewal of Certificate of Fitness. Applications for renewal of a Certificate of Fitness shall be filed in the same manner as an application for an original certificate. Each such application shall be accompanied by applicable fees. The granting of a renewal of a Certificate of Fitness shall be accomplished in the same manner as for an original certification of fitness, except that any person continuously engaged in any activity for which a Certificate of Fitness is required, will not, upon renewal, be required to take a written examination.

(viii) Change of Address. Each person holding a Certificate of Fitness shall notify the Fire Marshal in writing of any change in his business, residential or other notification address within ten (10) days after such change. Failure on the part of a person to given such notification shall constitute grounds for revocation of said Certificate of Fitness.

(ix) Contents of Certificate of Fitness, A Certificate of Fitness issued by the Fire Marshal shall be in the form of an identification card. Said card shall contain the following information to be valid:

A. The purpose for which the Certificate of Fitness has been issued.

B. The date Certificate of Fitness is issued and the date of expiration.

C. Other information as may be necessary to properly identify the person to whom the Certificate of Fitness is issued.

D. The signature of the person to whom the Certificate of Fitness is issued.

E. The name and signature of the Fire Marshal who issued the Certificate of Fitness, or the Fire Marshal's name and countersignature of his designated representative.

F. Printed thereon in bold type the following: "THIS CERTIFICATE DOES NOT EXCLUSIVELY RECOMMEND THE BEARER."

(x) Requirement to Display Certificate of Fitness. Any person to whom a Certificate of Fitness has been granted in conformance with this Ordinance shall upon request produce and show proper identification and his Certificate of Fitness to anyone for whom he seeks to render his services or to the Fire Marshal.

Section 3.11 PENALTIES

Any person or business entity other than a corporation violating any provision of this Article, or failing to comply therewith, or violating or failing to comply with any order or regulation made thereunder, shall upon conviction be guilty of a misdemeanor punishable by a fine not exceeding one thousand dollars ($1,000.00) or, by imprisonment for not more than one (1) year or, both, for each and every offense. A corporation violating any provision of this Article, or failing to comply therewith, or violating or failing to comply with any order or regulation made thereunder, shall upon conviction be guilty of a misdemeanor punishable by a fine not exceeding five thousand dollars ($5,000.00) for each and every offense. The imposition of the penalty for any violation of this Article shall not excuse the violation or permit it to continue, and each fifteen (15) days that the prohibited conditions are maintained shall constitute a separate offense.

2. This Ordinance shall take effect immediately.

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DOE/BETC/PPS-81/3

MOTOR GASOLINES, WINTER 1980-81

By

Ella Mae Shelton

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Bartlesville Energy Technology Center
Department of Energy
Bartlesville, Oklahoma

UNITED STATES DEPARTMENT OF ENERGY

TABLE 1. - Summary of values, motor gasoline survey, winter 1980-81

Test	ASTM method	Grades of motor gasolines: Unleaded Average (R+M)/2 below 90.0	Unleaded Average (R+M)/2 90.0 and above	Leaded Average (R+M)/2 below 93.0	Leaded Average (R+M)/2 93.0 and above
Gravity, °API	D287	61.1	58.1	62.3	58.4
Corrosion, No.	D130	1	1	1	1
Sulfur content, wt %	D1266	0.026	0.012	0.042	0.016
Gum, mg/100 ml	D381	1	1	1	1
Benzene	D3606	1.01	1.21	1.00	1.08
Lead, g/gal		--	--	0.94	1.49
Octane number, Research	D2699	91.9	96.1	92.8	97.3
Octane number, Motor	D2700	83.3	86.5	85.4	89.2
Antiknock index [(R+M)/2]		87.6	91.4	89.1	93.3
Reid vapor pressure, lb	D323	12.7	12.6	12.4	11.4
Vapor-liquid ratio of 20, °F	D439	120	123	120	127
Distillation	D86				
Temp, °F					
IBP		82	83	84	84
5% Evaporated		92	93	95	101
10% Do.		107	109	107	116
20% Do.		130	137	128	138
30% Do.		156	169	151	162
50% Do.		211	220	200	208
70% Do.		264	260	256	253
90% Do.		333	320	334	324
95% Do.		362	350	365	360
End point		408	405	413	403
Residue, vol %		1.0	1.0	1.0	1.3
Loss, vol %		3.1	3.6	2.7	1.6

TABLE 2. - Summary of values, motor gasoline survey, winter 1979-80

Test	ASTM method	Grades of motor gasolines: Unleaded (R+M)/2 below 90.0 Average	Unleaded (R+M)/2 90.0 and above Average	Regular Average	Premium Average
Gravity, °API	D287	60.9	58.8	62.1	61.4
Corrosion, No.	D130	1	1	1	1
Sulfur content, wt %	D1266	0.028	0.020	0.042	0.022
Gum, mg/100 ml	D381	1	1	1	1
Benzene	D3606	1.04	0.71	1.12	1.00
Lead, g/gal	D526	--	--	1.20	1.65
Octane number, Research	D2699	92.1	97.1	92.5	97.2
Octane number, Motor	D2700	83.7	87.0	85.5	89.3
Antiknock index [(R+M)/2]		87.9	92.1	89.0	93.3
Reid vapor pressure, lb	D323	12.4	12.2	12.3	11.8
Vapor-liquid ratio of 20, °F	D439	121	122	120	124
Distillation	D86				
Temp, °F					
IBP		82	82	82	83
5% Evaporated		93	95	94	95
10% Do.		105	106	106	108
20% Do.		129	129	126	132
30% Do.		157	158	149	159
50% Do.		212	215	200	210
70% Do.		261	259	256	257
90% Do.		332	317	335	330
95% Do.		366	348	372	367
End point		406	390	414	407
Residue, vol %		1.7	0.9	1.7	1.9
Loss, vol %		2.5	2.0	2.2	2.2

TABLE 3. - MOTOR GASOLINE SURVEY, WINTER 1980-81
AVERAGE DATA FOR DIFFERENT BRANDS--CONTINUED

DIST. 2 MID-ATLANTIC COAST
R.I., CONN., N.J., DEL., MD., VA., CENTRAL AND SOUTHERN N.Y., AND EASTERN PA.

UNLEADED GASOLINE-ANTIKNOCK INDEX (R+M/2) BELOW 90

ITEM	SAMPLES	GR., ASTM D287 API	SULF. ASTM D1266 WT %	GUM, ASTM D381 MG	BENZENE ASTM D3606 VOL. %	OCTANE NUMBER RES. ASTM D2699	OCTANE NUMBER MOT. ASTM D2700	OCTANE NUMBER (R+M)/2	RVP, ASTM D323 LB	20V/L ASTM D439 F	DISTILLATION, ASTM D86 TEMPERATURE, F (CORRECTED TO 760 MM HG) IBP	PERCENT EVAPORATED 5	10	20	30	50	70	90	95	EP	RES %	LOSS %
1	5	62.2	0.012	1	0.74	92.7	83.5	88.2	14.6	113	72	92	97	119	145	213	275	349	384	422	1.0	4.5
2	3	62.2	.058	1	.65	94.7	83.3	89.0	13.8	117	80	95	106	125	152	216	266	323	350	390	.8	2.7
3	5	61.9	.020	2	1.01	91.8	83.3	87.5	12.8	120	81	97	111	130	153	207	265	337	366	417	1.1	1.9
4	4	63.7	.022	2	.29	92.3	83.7	88.0	12.8	121	81	94	109	130	154	210	258	333	369	417	1.0	2.9
5	1	61.2	.030	1	.50	92.0	82.4	87.2	15.1	110	76	80	94	113	139	207	279	358	385	431	1.0	4.0
6	3	59.8	.024	1	1.26	92.0	82.9	87.5	13.0	120	81	95	106	130	158	218	272	337	363	418	.6	4.2
7	2	60.4	.004	1	-	91.9	82.9	87.4	12.0	125	85	97	110	134	160	217	269	346	378	417	.9	3.0
8	6	60.8	.053	2	1.18	92.6	83.1	87.9	13.6	115	81	90	102	122	143	202	265	336	364	408	1.3	3.4
9	1	60.5	.060	2	.90	93.1	82.8	88.0	12.9	121	82	88	107	131	157	216	272	337	366	400	1.0	3.5
10	7	62.2	.012	2	.88	92.4	83.0	87.7	12.9	119	82	92	105	126	151	208	262	319	343	364	1.0	2.6
11	4	61.7	.029	2	.90	91.8	82.9	87.4	12.8	118	79	89	102	124	150	207	265	340	370	414	1.0	3.5
12	5	64.0	.037	2	.65	92.5	83.3	87.9	13.0	116	81	92	103	121	142	196	251	326	359	405	1.0	2.8
13	2	61.5	.018	2	.50	92.4	82.7	87.6	15.4	111	74	68	95	116	145	215	282	362	393	431	1.0	4.0
14	3	61.1	.021	1	1.12	91.9	82.9	87.4	12.8	120	77	91	104	128	154	213	268	344	372	417	1.1	2.4
AVERAGE		61.9	.027	2	.84	92.4	83.1	87.8	13.3	118	80	92	104	125	150	209	266	336	365	409	1.0	3.2
MINIMUM		56.2	.001	0	.20	91.2	81.7	86.6	10.6	106												
MAXIMUM		67.2	.100	4	1.50	95.2	86.1	89.7	15.6	131												
SAMPLES	51																					

UNLEADED GASOLINE-ANTIKNOCK INDEX (R+M/2) 90.0 AND ABOVE

ITEM	SAMPLES	GR., ASTM D287 API	SULF. ASTM D1266 WT %	GUM, ASTM D381 MG	BENZENE ASTM D3606 VOL. %	OCTANE NUMBER RES. ASTM D2699	OCTANE NUMBER MOT. ASTM D2700	OCTANE NUMBER (R+M)/2	RVP, ASTM D323 LB	20V/L ASTM D439 F	DISTILLATION, ASTM D86 TEMPERATURE, F (CORRECTED TO 760 MM HG) IBP	PERCENT EVAPORATED 5	10	20	30	50	70	90	95	EP	RES %	LOSS %
15	1	56.0	0.005	0	2.13	96.5	86.0	91.3	12.9	120	82	84	103	130	160	221	275	327	350	419	0.8	6.2
16	5	61.1	.019	3	.40	96.2	86.2	91.2	13.2	117	79	91	101	122	146	209	257	326	349	396	1.0	3.1
17	4	61.0	.008	1	1.23	96.1	85.3	90.7	13.4	118	79	91	103	126	154	216	266	320	344	389	1.1	3.6
18	4	62.3	.010	2	.17	96.5	87.3	91.9	12.9	123	81	94	110	138	173	226	261	327	357	410	1.0	3.1
19	6	55.3	.014	1	1.18	97.6	87.1	92.4	13.8	117	78	88	103	126	156	224	260	309	341	396	1.2	3.2
20	4	58.6	.011	1	.62	96.7	85.8	91.3	12.7	120	82	93	107	130	154	211	249	315	344	397	1.0	3.3
21	5	57.6	.012	3	.71	96.9	86.4	91.7	13.5	117	80	88	100	122	150	220	279	341	368	425	.8	4.0
22	3	65.3	.009	1	.56	96.6	87.2	91.9	14.1	114	79	89	100	119	146	209	256	325	358	407	1.0	3.0
23	3	57.5	.012	1	.35	98.7	87.5	93.1	12.9	11[illegible]	79	94	112	126	147	206	249	329	355	400	1.0	2.1
AVERAGE		59.4	.012	2	.71	96.9	86.6	91.7	13.3	[illegible]	80	91	104	126	154	21[illegible]	261	324	352	403	1.0	3.3
MINIMUM		51.7	.002	0	.10	94.8	83.5	90.2	12.1	108												
MAXIMUM		68.9	.030	6	2.13	99.1	88.1	93.4	15.3	125												
SAMPLES	35																					

TABLE 3. - MOTOR GASOLINE SURVEY, WINTER 1980-81
AVERAGE DATA FOR DIFFERENT BRANDS--CONTINUED

DIST. 2 MID-ATLANTIC COAST--CONTINUED
R.I., CONN., N.J., DEL., MD., VA., CENTRAL AND SOUTHERN N.Y., AND EASTERN PA.

LEADED GASOLINE-ANTIKNOCK INDEX (R+M/2) BELOW 93.0

ITEM	SAM-PLES	GR., ASTM D287 API	SULF. ASTM D1266 WT %	GUM ASTM D381 MG	BENZENE ASTM D3606 VOL. %	LEAD G/GAL	OCTANE NUMBER RES. ASTM D2699	OCTANE NUMBER MOT. ASTM D2700	OCTANE NUMBER R+M --- 2	RVP. ASTM D323 LB	20V/L ASTM D439 F	DISTILLATION, ASTM D86 TEMPERATURE, F (CORRECTED TO 760 MM HG) IBP	PERCENT EVAPORATED 5	10	20	30	50	70	90	95	EP	RES %	LOSS %
24	4	60.2	0.017	1	0.56	0.61	94.0	84.3	89.2	13.9	115	75	86	99	118	143	212	294	369	398	433	1.0	3.6
25	6	65.0	.019	1	.63	1.09	92.7	85.3	89.0	12.7	119	83	96	107	127	150	201	255	322	349	390	.9	3.3
26	4	62.9	.027	0	.94	1.35	93.1	85.8	89.5	11.8	123	82	96	110	130	153	203	260	334	367	412	1.2	2.4
27	4	64.4	.043	1	.36	1.03	93.0	85.1	89.0	13.2	117	82	95	107	127	148	197	257	337	372	420	.9	2.4
28	1	62.8	.010	1	.90	1.25	92.4	85.4	88.9	12.6	120	84	98	110	130	152	204	262	340	376	431	1.0	1.0
29	5	65.6	.036	2	.55	1.02	93.6	85.8	89.7	12.9	116	83	94	106	124	144	190	244	323	356	414	1.0	2.5
30	3	63.3	.022	2	1.00	1.25	93.1	85.7	89.4	13.3	115	79	90	103	122	143	194	263	347	381	426	1.0	3.0
31	5	62.2	.019	1	1.04	.83	92.7	85.9	89.3	12.9	118	85	96	107	127	148	199	258	332	361	414	1.0	2.1
32	1	60.8	.020	1	.50	.67	94.1	84.6	89.4	14.2	112	77	84	96	114	140	209	285	364	393	438	1.0	3.0
33	2	60.4	.019	2	.50	.58	94.1	84.8	89.5	14.5	111	77	90	105	117	141	210	294	371	401	433	1.0	4.0
34	2	62.0	.004	2	-	1.61	93.2	85.7	89.4	11.5	125	84	99	110	131	155	206	265	346	380	423	1.0	2.1
35	6	62.2	.052	1	1.11	.77	93.9	85.3	89.6	13.8	113	79	88	101	120	140	191	256	335	362	409	1.3	3.2
36	3	64.1	.030	0	.78	1.33	92.5	86.0	89.3	12.7	119	80	96	108	128	149	201	261	342	372	417	1.1	2.1
AVERAGE		63.1	.026	1	.76	1.01	93.2	85.4	89.3	13.1	117	81	93	105	125	146	199	262	339	370	415	1.0	2.6
MINIMUM		59.9	.001	0	.20	.47	91.2	84.0	88.7	10.4	106												
MAXIMUM		68.2	.090	5	1.50	2.32	94.7	87.0	90.2	15.0	128												
SAMPLES	46																						

LEADED GASOLINE-ANTIKNOCK INDEX (R+M/2) 93.0 AND ABOVE

ITEM	SAM-PLES	GR., ASTM D287 API	SULF. ASTM D1266 WT %	GUM ASTM D381 MG	BENZENE ASTM D3606 VOL. %	LEAD G/GAL	OCTANE NUMBER RES. ASTM D2699	OCTANE NUMBER MOT. ASTM D2700	OCTANE NUMBER R+M --- 2	RVP. ASTM D323 LB	20V/L ASTM D439 F	DISTILLATION, ASTM D86 TEMPERATURE, F (CORRECTED TO 760 MM HG) IBP	PERCENT EVAPORATED 5	10	20	30	50	70	90	95	EP	RES %	LOSS %
37	3	64.5	0.037	1	1.10	1.36	97.7	88.9	93.3	12.8	120	80	95	109	131	156	205	245	310	344	396	1.0	2.7
AVERAGE		64.5	.037	1	1.10	1.36	97.7	88.9	93.3	12.8	120	80	95	109	131	156	205	245	310	344	396	1.0	2.7
MINIMUM		64.1	.020	1	.80	1.20	97.1	88.4	93.2	11.9	118												
MAXIMUM		65.2	.061	1	1.40	1.55	98.1	89.8	93.5	13.6	123												
SAMPLES	3																						

API Ponders Tank Leak Strike Forces

If all goes well this spring and summer, gasoline marketers soon may have a half dozen or more regional strike forces to respond immediately to any and all underground tank leaks, to clean them up and figure out later who has to pay for them.

It's a serious problem now—"literally a million time bombs in the form of underground tanks waiting to leak," according to one recent study.

This estimate says between 50,000 to 70,000 underground tanks are leaking at present—"and this is a very conservative number." Some research, it says, indicates that as many as 30% of all tanks now in place are leaking or will leak within the next few years.

The American Petroleum Institute's (API) marketing affairs committee came to grips with the problem at its annual meeting in Chicago this past November. It created a high-level task force to determine if a voluntary alliance could be set up to cope with the growing number of underground tank leaks before things get out of hand.

The task force's membership roll is tacit recognition of the seriousness of the situation. Its members include M.M. Smith, Chevron's general manager of marketing, as chairman; E.F. Eisemann, Jr., executive VP of Gulf; Ellis W. Gunnels, marketing VP of Texaco; T.E. Matthews, general manager of marketing, Union Oil; Thomas McJoynt, general manager of marketing, Amoco; and M.B. Harrington, general manager of engineering, Shell.

Chevron's marketing VP Don Mulit, retiring chairman of API's marketing affairs committee, urged the group to tackle the problem as quickly as possible, noting that his company was only one of a number of firms that had been clobbered in the courts and held responsible for underground leaks at hinterland service stations [NPN—Sept. '81, p26]. Clean-up costs are astronomical, involving millions of dollars in some cases.

At the meeting, Chevron's Merriam Smith painted the broad outlines of a voluntary oil industry alliance that would respond to all leak problems and begin clean-up operations immediately.

"To handle this problem" he explained, "we would propose that the country be divided geographically. One company in each area would volunteer to respond, upon request, to every undetermined situation which occurs in that area.

"Geographical areas would be divided among members, using taxable gallonage, number of stations or some other criteria, so that a balance would be achieved with regard to risk and exposure.

"The alliance would also encourage the participation of those companies that do not have the resources to serve as a 'responding company.' In addition, a backup company to handle overloads will probably be required."

Smith said the primary responsibility of the alliance would be to determine the source of the leak, adding: "It is not intended that responding companies assume any responsibility or liability that may result from the spill and this will be made clear at the start of the response effort."

He said that once the source is identified, it is hoped that the responsible party would assume clean-up duties. "However, if the spiller is unwilling and/or unable to clean up the leak or prefers that the alliance continue, the alliance would, upon request, finish the clean-up.

"The costs incurred to handle this action would initially be borne by the responding company [but] periodically these costs would be divided among the members of the alliance."

Why an alliance? "Generally," according to Smith, "the petroleum industry's response [to underground leaks] has been less than supportive. Most companies will check their own inventory records and inspect their own facilities to determine if they are the cause. If the source is proven, then the company will step in to handle the situation. But if the company believes it is not responsible, no action is taken.

"No one steps forward to assist the community. And, few companies are willing to accept responsibility until the cause is determined without a doubt. This defensive attitude is based on legal advice which seeks to minimize liability."

As time passes, those who have been harmed by the leak grow frustrated and angry, precipitating law suits for inflated damages and injuring the industry's reputation, Smith said. Sometimes this results in new laws that are excessively restrictive and costly to the industry as a whole.

Especially alarming, in Smith's opinion, is that most leaks go undetected until they become a serious problem.

"Often, station operators do not monitor their inventories," Smith explained. "This is a historical problem which will be slow to show improvement. The operators attribute small volume changes to product contraction or expansion due to temperature changes.

"However, while the station operator may be negligent for not reporting a leak, the courts have ruled that the responsibility for the leak lies with whomever owns the tank. In essence, the dealer is the agent and the supplier must control the agent's performance in stock control matters."

In the meantime, Smith concedes, insurance concerns will continue to pose a problem. But a voluntary alliance might be able to work something out once it demonstrates it is actively working on the problem as a group.

For the moment, the task force is looking at the situation as it exists at service stations only. Whether it adds terminals and other operations to the scope of the alliance will be determined later.

Gasoline leaks are considered to be a potential time bomb because of the product's toxicity and explosiveness. NPN

Oil Industry Tank Leak Alliance?

- The purpose of the alliance is to provide an immediate response, upon the request of an appropriate authority, to any underground petroleum leak. This will be handled by geographically dividing the country and designating one company in each area to respond to every leak situation.
- Each member of the alliance would be responsible for a percentage share of the unrecovered costs incurred. The share would be determined by a common denominator such as taxable motor fuel.

The Alliance Would Be Organized as Follows:

Responding Companies	Member Companies	Central Organization
• Would have the responsibility for a geographical area. • Response procedure would include: —Providing community support. —Design field investigation. —Carry out investigation. —Do clean up, if requested. • Would handle initial costs incurred in handling the leak situation. • Would provide financial support in other areas.	• Provide financial support. • Cooperate with responding companies, if requested.	• Independent from all companies. • Small staff. • Record costs. • Insure uniformity. • Arbitrator.

Source: API Marketing Affairs Committee.

MEMO

NEW JERSEY STATE DEPARTMENT OF ENVIRONMENTAL PROTECTION

TO Haig Kasabach, Chief, Bureau of Groundwater Management

FROM Thomas J. Allen, Chief, Bureau of Emergency Response DATE February 26, 1982

SUBJECT Underground Tank Leaks

Below is a summary of the information you requested, relating to underground tank leaks. Also, included is a synopsis of current active cases and the relationship underground tank leaks have with this case load. Attached you will find all substantiating documentation for this summary.

CURRENT

Total number of active cases in the Bureau of Emergency Response 473

Total number of active cases pertaining to underground tank leaks 168

Percent of active cases related to underground tank leaks. 36%

Total estimated gallons of leakage from underground tanks on active cases. . . 537,108 Gallons
1978 thru Feb. '82

	# OF SPILLS RECEIVED	# U/G TANK LEAKS	# U/G TANK LEAKS (GAS STATIONS)	# U/G TANK LEAKS INDUSTRY	# U/G TANK LEAKS PRIVATE HOMES	% OF TOTAL CASES RECEIVED RELATED TO U/G TANK LEAKS
1982 (Jan.-Feb.)	315	54	30 55%	9 17%	15 28%	17%
1981	2278	166	103 62%	8 5%	55 33%	7%
1980	2377	195	108 55%	57 29%	30 15%	8%
1979	1894	93	66 71%	14 15%	13 14%	5%
1978	1483	117	54 46%	16 14%	47 40%	8%

TJA:GMA:dg
Attachment

Total number of active cases in the Bureau of Emergency Response 473

Total number of active cases pertaining to underground tank leaks 168

Percent of active cases related to underground tank leaks. 36%

Total gallons of leakage from underground tanks on active cases. . . . . . .537,108 Gallons

All the above figures are as of February 25, 1982

UNDERGROUND TANK LEAKS

#81-5-7-6	B&B Exxon	Asbury Park	1200	Gasoline
#81-5-13-6	Exxon	Dover	1788	Gasoline
#81-5-21-1	4 Powderhorn Rd.	Flemmington	100	Fuel Oil
#81-5-27-11	Citgo	ATCO	200	Gasoline
#81-6-4-3	Schiele Residence	Mt. Olive Twp.	200	Fuel Oil
#81-6-5-5	Rt. 28 and Adams-ville Road	Bridgewater	500	Gasoline
#81-6-9-3	2306 Tudor Ct.	Somerville	100	Fuel Oil
#81-6-15-3	LeMassa Residence	Neshamic Station	150	Fuel Oil
#81-6-16-4	T&C Animal Hospital	Montgomery Twp.	100	Fuel Oil
#81-6-24-1	Jozwick's Arco	S. Plainfield	500	Gasoline
#81-6-26-6	Exxon	W. Caldwell	500	Gasoline
#81-7-9-8	Bridenburg Residence	Vernon	100	Fuel Oil
#81-7-20-3	Columbus Exxon	Newark	500	Gasoline
#81-8-5-7	Mellor's Texaco	Richfield	1100	Gasoline
#81-8-7-4	R&R Exxon	W. New York	10	Gasoline
#81-8-14-5	Middlesex Mosquito Commission	S. Brunswick	2000	Gasoline
#81-8-20-5	Texaco	Englewood	300	Gasoline
#81-8-27-3	Wm. Penn	Clinton	100	Gasoline
#81-8-27-5	Getty	Edison	100	Gasoline

UNDERGROUND TANK LEAKS

(CONTINUED)

#81-9-8-2	Rockoff Residence	Highland Park	100	Fuel Oil
#81-9-9-5	Shell	Trenton	250	Gasoline
#81-9-11-4	Madison Car Care Exxon	Madison	1152	Gasoline
#81-9-23-4	Marone Residence	Parsippany	100	Fuel Oil
#81-10-6-5	G.E.C. Exxon	Denville	50	Waste Oil
#81-10-12-4	Styertown Exxon	Clifton	200	Gasoline
#81-10-16-2	3 Jennings Road	Manahawkin	50	Waste Oil
#81-10-16-4	Pavan's Exxon	Clifton	200	Gasoline
#81-10-16-5	Exxon	Rockleigh	200	Gasoline
#81-10-29-9	Shell	Maplewood	300	Gasoline
#81-10-31-2	Chet's Tire World Getty	Old Bridge	300	Gasoline
#81-11-6-4	W. Tuckerton Liquor Store	Little Egg Harbor	100	Gasoline
#80-2-7-6	Shotmeyer Mobil	Wanaque	1000	Gasoline
#80-2-8-5	Alert	W. Orange	200	Gasoline
#80-2-28-3	Exxon	Woodbridge	1000	Gasoline
#80-3-4-6	Candlewood Exxon	Howell	1000	Gasoline
#80-3-10-8	Orange Exxon	Newark	500	Gasoline
#80-4-7-6	LRHS	Wanaque	400,000	Fuel Oil
#80-5-2-3	Difsen Oil Co.	Scotch Plains	100	Fuel Oil
#80-5-29-2	36 Patterson Rd.	Hewitt	300	Fuel Oil
#80-5-30-8	Chimney Rock Exxon	Bound Brook	500	Gasoline
#80-9-11-4	Shell	Millburn	3000	Gasoline
#80-9-18-12	Exxon	Newark	1644	Gasoline
#80-9-29-7	Exxon	E. Orange	1035	Gasoline
#80-10-16-4	Shell	Mahwah	300	Gasoline

UNDERGROUND TANK LEAKS

(CONTINUED)

#80-10-17-7	Shell	Parsippany	4000	Gasoline
#80-10-24-8	NJ Bell	E. Brunswick	500	Fuel Oil
#80-10-27-7	Shell	Convent Station	700	Gasoline
#80-10-29-7	Shell	Fort Lee	600	Gasoline
#80-11-5-8	14 Foxdown Rd.	Wanaque	200	Fuel Oil
#80-11-7-12	19 Logan Dr.	W. Windsor	500	Gasoline
#80-12-8-1	S&M Shell	Wayne	500	Gasoline
#81-2-20-10	Exxon	Clifton	500	Gasoline
#81-3-2-10	Arco	Hackensack	200	Gasoline
#81-3-25-9	Sina's Exxon	Orange	107	Gasoline
#81-3-27-4	Di Gas	Hopelawn	50	Gaso ine
#81-4-1-2	New Egypt Exxon	New Egypt	300	Gasoline
#81-4-1-3	Cresskill Exxon	Cresskill	500	Gasoline
#81-4-2-5	Bordentown Junction	Bordentown	500	Diesel
#81-4-2-7	Exxon	New Brunswick	200	Gasoline
#81-4-30-12	Pata's Exxon	Fort Lee	700	Gasoline
#81-5-7-3	Tab Exxon	Pompton Lakes	100	Gasoline
#81-11-12-2	Shell	E. Brunswick	300	Gasoline
#81-11-17-5	U-Save	Morristown	300	Gasoline
#81-12-14-4	Gulf	S. Orange	1000	Gasoline
#81-12-15-9	Wallwood Exxon	Manasquan	100	Diesel
#82-1-7-5	Asbury Park Exxon	Asbury Park	200	Gasoline
#82-2-16-9	Manfredi Residence	Princeton	50	Fuel Oil
#80-10-30-6	Exxon	Clark	200	Gasoline
#80-11-25-12	J&J Exxon	Burlington	200	Gasoline
#81-1-13-2	Texaco (Marina)	Edgewater	100	Gasoline
#81-1-15-3	Exxon	Marlton	200	Gasoline

UNDERGROUND TANK LEAKS

(CONTINUED)

#81-2-23-6	Getty	Bridgewater	300	Gasoline
#81-2-28-7	Texaco	Somerville	200	Gasoline
#81-3-2-15	44 Grand St.	Garfield	400	Gasoline
#81-3-2-4	Texaco	Irvington	200	Gasoline
#81-3-4-2	Mayfair Exxon	Kenilworth	300	Gasoline
#81-3-17-8	B&L Tire (Exxon)	Carteret	300	Gasoline
#81-3-19-8	County Road	Tenafly	200	Gasoline
#81-3-20-5	Getty	Dover	100	Gas and Fuel Oil
#81-5-13-2	D'Allessio Shell	Somerville	50	Gasoline
#81-6-4-4	Tucker Residence	Budd Lake	100	Fuel Oil
#81-10-1-2	Columbia Exxon	Jersey City	200	Gasoline
#81-7-4-3	Manhole #30	Hanover Twp.	1100	Gasoline
#80-7-2-8	Ace Scientific	Linden	400	#2 Oil
#81-9-30-2	Sunoco	Lyndhurst	3000	Gasoline
#81-6-12-7	NL Industries	Bayonne	200	#6 Oil
#81-10-16-2	Private Well	Hamonton	Unk.	Fuel Oil
#80-6-27-3	Exxon	Franklin Twp.	300	Gasoline
#80-9-15-11	Shell	Wall Twp.	8000	Gasoline
#81-12-11-2	Extra Gas Station	Franklinville	2600	Gasoline
#82-1-4-3	Stokley Van Camp	Kearney	2000	#6
#82-1-13-4	Hess Station	Pennsaukent	750	Gasoline
#81-8-5-6	Private Homeowners Well	Franklinville	Unk.	Gasoline
#82-2-22-3	Unk. Gas Station	Passaic	Unk.	Gasoline
#82-2-16-10	Exxon Station	Andover	4800	Gasoline
#82-1-29-2	Town & Country Stat.	Budd Lake	10,000	Gasoline
#82-1-26-3	S.O.S.	New Brunswick	100	Gasoline
#82-1-12-4	Private Homeowner	Randolph Twp.	550	Fuel Oil

UNDERGROUND TANK LEAKS

(CONTINUED)

#81-12-12-1	Private Homeowner	Bloomfield	220	Fuel Oil
#81-7-22-7	Private Homeowner	Atlantic City	200	Fuel Oil
#81-10-29-8	Cary Chemical	Edison	800	Fuel Oil
#81-10-20-4	Rodig Mfg. Co.	Kenworth	1000	#2 Oil
#81-10-21-7	Unk. Gas Station	E. Brunswick	Unk.	Gasoline
#80-9-17-9	Exxon Station	Mt. Holly	2800	Gasoline
#80-12-30-5	Texaco Station	Rosedale	5200	Gasoline
#80-10-7-6	Turnpike Authority	E. Brunswick	800	Gasoline
#81-12-10-3	Private Homeowner	Maurice Twp.	200	Fuel Oil
#81-12-21-2	Gentech	Linden	3000	#4 Oil
#81-12-15-5	Shell	Dover	Unk.	Gasoline
#81-12-13-2	Exxon	Engelwoon	3000	Gasoline
#81-10-12-3	Exxon	Pennsauken	300	Gasoline
#80-11-7-6		Lakehurst	Unk.	JP4-JP5
#81-11-10-1	Fred's Exxon	Dover	529	Gasoline
#81-12-7-7	Texaco	Montclair	375	Gasoline
#82-1-8-6	Shell	Byram Twp.	Unk.	Gasoline
#81-12-7-2	Shell	Midland Park	3000	Gasoline
#82-2-1-3	Jerry Stones	Rockaway Twp.	Unk.	Waste Oil
#82-2-10-6	Exxon/Getty	Montclair	Unk.	Gasoline
#81-05-29-006	Citgo	Egg Harbor	Unk.	Gasoline
#81-02-12-2	Exxon	Mt. Arlington	9000	Gasoline
#81-02-19-12	Shaler Texaco		1000	Gasoline
#81-3-16-3	Chals Place	Leonia	400	Diesel
#81-3-20-2	18 Metro Pl.	Lake Hopatcong	600	Fuel Oil
#81-6-24-9	Shell	Paterson	650	Gasoline
#81-7-31-7	Shell	Rt. 206 Stanhope	5200	Gasoline

UNDERGROUND TANK LEAKS

(CONTINUED)

#81-08-17-11	Exxon	Rochelle Park	238	Gasoline
#81-9-25-4	Taffaro Lumber Co.	W. New York	Unk.	Unk.
#81-9-29-6	Rt. 537	Clarksburg	250	Fuel Oil
#81-10-15-6	Exxon	Palisades Park	2800	Gasoline
#81-10-19-5	Great Bear	Teterboro	3000	Fuel Oil
#81-11-25-006		Perth Amboy	1200	Fuel Oil
#81-01-21-4	Exxon	Burlington	1000	Gasoline
#81-12-08-2	Mr. Sisco		1400	Gasoline
#81-11-4-9	Exxon Station	Denville	1200	Gasoline
#82-1-23-4	X-Tra Station	Lindenwold	100	Gasoline
#81-12-11-5	Private Home	Lake Hopatcong	200	Fuel Oil
#81-12-5-2	Citgo Station	Freehold	700	Gasoline
#81-10-29-2	Exxon Station	Forked River	1200	Gasoline
#81-4-27-3	Unk. Gas Station	Washington Twp.	Unk.	Gasoline
#81-3-13-10	M&S Auto Service	Lyndhurst	4000	Gasoline
#81-11-3-2	Petro Mart	Lyndhurst	2000	Gasoline
#81-11-13-1	Citgo Station	South River	800	Gasoline
#81-3-13-7	Municipal Garage	N. Brunswick	600	Gasoline
#81-2-24-9	Army Gas Station	Ft. Monmouth	2500	Gasoline
#81-1-2310	Private Home	Union City	200	Fuel Oil
#81-12-15-4	Shell Station	Hawthorne	1000	Gasoline
#81-11-10-5	Private Home	Middlebush	200	Fuel Oil
#81-9-16-5	1st National Bank	Barnegat	150	Fuel Oil
#81-12-9-1	Exxon Station	Linden	200	Gasoline
#82-1-5-2	Alco Oil Company	Haskill	200	Fuel Oil
#82-1-12-3	Unk. Gas Station	N. Brunswick	Unk.	Gasoline
#81-12-4-3	Bell Manhole	Hanover	260	Gasoline
#81-1-12-4	Montclair Savings Bank	Montclair	Unk.	Gasoline

UNDERGROUND TANK LEAKS

(CONTINUED)

#82-1-4-4	Agway Petroleum	Howell Twp.	250	Gasoline
#82-2-6-1	Chevron Station	N. Brunswick	1200	Gasoline
#82-2-8-2	Exxon Station	Wayne	150	Gasoline
#82-2-8-6	Exxon Station	Weehawken	300	Gasoline
#81-11-4-9	Exxon Station	Denville	200	Gasoline

1978

Total number of spills received in 1978 1483

Total number of underground tank leaks in 1978 117

Total number of underground tank leaks in 1978 related to gasoline stations . 54

Total number of underground tank leaks in 1978 related to private homes . . . 47

Total number of underground tank leaks in 1978 related to industry 16

Percent of total cases received that pertain to underground tank leaks . . . 8%

UNDERGROUND PRIVATE HOME AND INDUSTRY LEAKS

#78-1-13-3		Atlantic City	Oil	Unknown
#78-1-16-1	Amoco	Vineland	Gas	481 Gal.
#78-1-14-4	Shell	Bayonne	Gas	1140 Gal.
#78-1-30-4	Amoco	Camden	Gas	Unknown
#78-1-30-7		Cliffside Park	#2	Unknown
#78-1-30-9		Clayton	Gas	Unknown
#78-1-31-1	Exxon	Hopewell	Gas	50 Gal.
#78-2-8-2		Oaklyn	#2	Sheen
#78-2-10-4		Camden	#2	1000 Gal.
#78-2-13-1	Chevron	Perth Amboy	#2	3 Gal.
#78-2-14-1	Agricultural Transport	Cherry Hill	Gas	5 Gal.
#78-2-14-7		Maple Shade	Kerosene	30 Gal Pipe Leak
#78-2-15-2		Netcong	#2	800 Gal.
#78-2-16-2	Cumberland Farms	Hamilton Square	#2	Unknown Line break
#78-2-24-9	Shell	Haddon	Gas	Unknown
#78-3-4-1	Ocean Leather Co.	Newark	#6	200 Gal.
#78-3-7-1	Texaco	Long Branch	Gas	Unknown

UNDERGROUND PRIVATE HOME AND INDUSTRY LEAKS

(CONTINUED)

#78-3-7-2	R.L. Service Station	Teaneck	Gas	25 Gal.
#78-3-9-2	Home Owner	Wayne	#2	Unknown
#78-3-15-5	Trenton State College	Trenton	Oil	2 Gal. Line break
#78-3-15-6		Lake Hopatcong	#2	100 Gal.
#78-3-17-5	W.R. Grace	Woodbury	#2	50 Gal. Line break
#78-3-20-6	Exxon	Hasbrook Hts.	Gas	Unknown
#78-3-20-10	Minnisink Oil	Whippany	#2	Unknown
#78-3-22-5	Exxon	Franklin	Gas	Unknown
#78-3-23-5	Purilator	Rahway	#6	1000 Gal.
#78-3-23-6		Colingswood	#2	10 Ga.
#78-3-29-4	N.J. Turnpike	Hamilton Twp.	Gas	Unknown
#78-3-21-5		Sparta Twp.	#2	500 Gal.
#78-4-3-1	Exxon	Yardville	Gas	3000 Gal.
#78-4-5-3	Port Side Term.	Jersey City	Oil	5 Gal.
#78-4-6-8	Boval Inc.	Washington Twp.	#2	300 Gal.
#78-4-7-5	Shell	Trenton	Gas	10,000 Gal.
#78-4-10-3	Chevron	Sussex	Gas	200 Gal.
#78-4-10-4	Arco	Brigentine	Gas	4000 Gal.
#78-4-17-5	Union Cty. Road Dept.	Scotch Plains	Hydrocarbon	Unknown
#78-4-20-3	Countryside Developers	Hazlet	#2	100 Gal.
#78-4-21-2	Mid-East Aluminum	Dayton	Oil	Unknown
#78-4-25-1	Village Green Apt.	Hazlet	#2	Unknown
#78-4-28-4	PSE&G	National Park	Oil	Unknown
#78-4-28-7	Beattie Inc.	Little Falls	#6	Unknown
#78-5-1-6	Exxon	Brielle	Gas	Unknown

UNDERGROUND PRIVATE HOME AND INDUSTRY LEAKS

(CONTINUED)

#78-5-5-1		S. Orange	Oil	Unknown
#78-5-6-5	Nutley City Garage	Nutley	#2	15 Gal.
#78-5-12-5	Factory	Newton	#2	Unknown
#78-5-15-2	Acme	Westmont	#2	Unknown
#78-5-22-2	Harrietts Oil	Medford Lake	Oil	Unknown
#78-5-25-6	Exxon	Camden	Gas	150 Gal.
#78-5-25-7	Home Owner	Byram Twp.	#2	Unknown
#78-5-26-5	Parkway Garden AP7	Edison	#2	200 Gal.
#78-5-30-10	U.S. Steel	Trenton	Muriatic Acid	8000 Gal.
#78-5-31-3		Whitehouse Station	Gas	Unknown
#78-6-2-6	Chevron	Riveredge	Gas	Unknown
#78-6-2-7	Scientific Chem.	Carlstadt	Phosphoric Acid	11,000 Gal.
#78-6-8-1	Bodell	Clifton	Dye	Unknown
#78-6-12-6		S. Orange	#2	Unknown
#78-6-16-3	Cities Services	Linden	#2	Unknown
#78-6-17-3	Hewett Robbins Co.	Passaic	#4	200 Gal.
#78-6-26-5	Exxon	Westfield	Gas	Unknown
#78-6-28-4	Essex Chem.	Sayreville	Dioctylthalate	100 Gal.
#78-6-28-5	Municipal Garage	Nutley	#2	Unknown
#78-7-2-4	Amoco	Carteret	#2	Unknown
#78-7-5-4	Gulf Oil	Linden	#2	Unknown
#78-7-6-7	Church	Paterson	#2	275 Gal.
#78-7-8-1	Hess	Newark	#2	Unknown

#78-7-13-1	Renora	Edison	Oil	
#78-7-13-8	Mobil	Clifton	Gas	Unknown
#78-7-15-1	Cumberland Farms	Hightstown	Gas	Unknown
#78-7-20-7		Clayton	Gas	Unknown
#78-7-21-2		Port Reading	Crude Oil	Unknown
#78-7-25-5	Interplast Universal	Lodi	#2	25 Gal. Line leak
#78-7-27-6	Alert Gas	W. Orange	Gas	2000 Gal.
#78-7-27-8	Home Owner	Wayne	#2	Unknown
#78-8-1-4		Morristown	Gas	Unknown
#78-8-8-2	Coastal Oil Co.	Passaic	#2 Oil	Tank leak
#78-8-7-4	Burlington County Office Building	Mt. Holly	#4 Oil	Line leak
#78-8-23-3	Exxon	Dean	Gas	U/G Tank
#78-9-6-4	Exxon	Haledon	Gas	Tank leak
#78-10-4-1	Firestone Rubber	Cranbury	#2 Oil	Tank leak 5000 Gal.
#78-10-5-2	Hoecanaes Corp.	Burlington	#2 Diesel Fuel	Line break
#78-10-10-3	Martinizing Co.	Edgewater Park	Perchloro-ethylene	200 Gal. Tank leak
#78-10-19-3	Cities Services Station	Edison	Gas	6000 Gal. Tank leak
#78-10-28-1	Young Rubber Co.	Lawrence Twp.	#6 Oil	200 Gal. Line
#78-10-30-1	Montclair Stove	Montclair	#6	Line
#78-11-2-5-	YMCA	Freehold	#2	Leak
#78-11-9-3	Penick Corp.	Mt. Olive	HCl	Tank leak
#78-11-14-6	Shell	Maplewood	Gas	Tank 300 Gal.

UNDERGROUND PRIVATE HOME AND INDUSTRY LEAKS

(CONTINUED)

#78-11-22-1	DuPont	Carneys Point	#6	U/G Line 1000 Gal.
#78-11-30-1	Private Home	S. Brunswick	#2	Tank
#78-12-4-2	Arco	Hamilton Twp.	Unleaded Gas	Tank 1000 Gal.
#78-12-4-4	Exxon	Bayonne	#2 Fuel Oil	Tank 5000 bbls
#78-12-4-5	Wonder Bread	E. Brunswick	#2 Fuel Oil	Line leak
#78-12-6-8	Chevron	Paterson	Unleaded Gas	Tank 3000 Gal.
#78-12-15-5	Koraline-Sanderson	High Bridge	#2 Fuel Oil	Line leak 2000 Gal.
#78-8-16-4	Texaco	N. Arlington	Gas	Overfill
#78-8-16-8	Private	Orange	Gas	Overfill 100-200 Gal.
#78-8-18-4	Exxon	Irvington	Gas	Tank 500+
#78-8-30-5	Exxon	Lyndhurst	Gas	Tank 3500 Gal.
#78-8-31-1	Merit	Mt. Ephraim	Gas	Overfill 200 Gal.
#78-9-1-2	Texaco	Audubon	Gas	Line leak 1000 Gal.
#78-9-1-4	Exxon	Cookstown	Gas	
#78-9-13-4	Exxon	East Windsor	Gas	200 Gal.
#78-9-14-2	Shell	Oradell	Gas	1100 Gal. Tank leak
#78-9-18-6	Exxon	West Trenton	Gas	Tank leak
#78-10-24-4	Texaco	W. Long Branch	Gas	Unknown
#78-10-25-1	Texaco	Pompton Lakes	Gas	1500 Gal. Tank
#78-10-27-1	Shell	Newfoundland	Gas	Unknown
#78-11-6-3	Exxon	Hackensack	Gas	Tank leak
#78-11-20-2	Exxon	Scotch Plains	Gas	U/G Tank leak
#78-12-11-2	Getty	Jersey City	Gas	1000 Gal. Tank leak

UNDERGROUND PRIVATE HOME AND INDUSTRY LEAKS

(CONTINUED)

#78-12-14-2	Getty	Mt. Arlington	Gas	Tank leak
#78-12-18-3	Sunoco	Toms River	Gas	7000 Gal. Tank
#78-12-19-1	Citgo	Caldwell	Unleaded Gas	4000 Gal. Tank
#78-12-27-3	Shell	Ewing Twp.	Reg. Gas	90 Gal. Line leak
#78-12-28-5	Amoco	Gillette	Gas	Tank
#78-12-30-1	Lakeland H.S.	Wanaque	#2 Oil	U/G Tank
#78-12-31-4	Gulf Station	Yardville	Gas	U/G Tank

1979

Total number of spills received in 1979 1894

Total number of underground tank leaks in 1979 93

Total number of underground tank leaks in 1979 related to gasoline stations . 66

Total number of underground tank leaks in 1979 related to private homes . . . 13

Total number of underground tank leaks in 1979 related to industry 14

Percent of total cases received that pertain to underground tank leaks . . . 5%

UNDERGROUND PRIVATE HOME AND INDUSTRY LEAKS

#79-12-3-2	Private Oil Tank	Hopatcong		
#79-12-12-9	Harbour House Marina	Ocean City	Gasoline	
#79-12-14-2	Bergen Place	Red Bank	Fuel Oil	200 gal.
#79-11-12-4	Union Twp. School		Fuel Oil	
#79-11-2-1	Barton Run Apts.		Fuel Oil	
#79-11-6-2	Holiday City	Toms River	Fuel Oil	
#79-11-14-1	Stratford Plaza Apts.	Stratford	Fuel Oil	
#79-11-28-5	Rockaway Methodist Church	Boonton	Fuel Oil	
#79-10-24-4	Hercules Inc.	Kenvil	Hydraulic Fluid	13,000 gal.
#79-9-7-8	Tenneco	Carlstadt	Mineral Spirits	
#79-8-8-6	Kegan - Dixon	Avenel	Machine Oil	10 gal.
#79-8-17-6	Private Home	E. Brunswick	Oil	
#79-7-2-5	Private Home	Lake Hopatcong	Fuel Oil	275 gal.
#79-6-1-7	Squibb	New Brunswick	Gasoline	
#79-6-8-2	Private Home	Andover	Fuel Oil	
#79-6-28-6	Private Home	Jefferson Twp.	Fuel Oil	
#79-5-6-1	Parker Florests	Scotch Plains	Fuel Oil	4000 gal.

UNDERGROUND PRIVATE HOME AND INDUSTRY LEAKS (CONTINUED)

#79-5-14-4	Burlington Ind.	No. Bergen	#2	
#79-5-25-5	Wanaque High School	Wanaque	Fuel Oil	
#79-4-11-2	Somerset County Garage	Somerville	Gasoline	200 gal.
#79-4-21-4	Private Home	Burlington	Fuel Oil	
#79-3-6-4	Private Home	Parsippany	Fuel Oil	
#79-3-8-6	Private Home	Atlantic City	Fuel Oil	
#79-3-27-4	Private Home	Mt. Olive	Fuel Oil	
#79-2-18-2	Point Pleasant Hospital	Pt. Pleasant	Fuel Oil	2500 gal.
#79-2-25-2	Private Home	Sweetsboro	Fuel Oil	
#79-2-26-3	Private Home	Woodbridge	Fuel Oil	

UNDERGROUND GASOLINE STATION LEAKS

#79-12-5-4	Shell Station	Jersey City		1400 ga.
#79-12-5-6	Scotts Gulf	Newton		100 gal.
#79-12-6-4	Gulf Station	Newton		
#79-12-10-2	Shell Station	Summit		1800 gal.
#79-12-15-5	Unk. Station	Hillside	Gasoline	
#79-12-15-2	Crown Station	Toms River		700 gal.
#79-12-20-8	Texaco Station	Cresskill		1700 gal.
#79-12-26-5	Getty Pipeline	Carteret	#2 Oil	
#79-11-2-2	Exxon Station	Hacketstown		
#79-11-6-2	Exxon Station	Freling Huysen		
#79-11-8-3	Kregs Exxon	Newark		
#79-11-9-2	Getty Pipeline	Oldwich	Fuel Oil	
#79-11-15-7	Old Citgo	Jersey City		

UNDERGROUND GASOLINE STATION LEAKS (CONTINUED)

#79-11-18-1	Getty Pipeline	Tewksburg	Fuel Oil	
#79-10-29-5	Keyport Exxon	Hazlet		1000 gal.
#79-10-29-6	Franklin Hills Exxon	Somerset		
#79-10-30-14	AAMCO Transmission	Toms River	#2	
#79-10-22-5	Exxon	North Bergen		
#79-10-23-7	Exxon	Bloomfield		
#79-10-19-5	Sunoco	Califon		550 gal.
#79-10-17-2	Andys Exxon	Johnsonburg		
#79-10-5-11	Shell Station	Newark		
#79-10-1-13	Unk. Private Home	Bridgewater	Gasoline	
#79-9-4-12	Georges Exxon	Hasbrook Hts.	″	
#79-9-27-1	Arlington Sunoco	West Orange		
#79-9-29-4	Dinardos Gas Station	Warren Twp.		
#79-8-2-4	Barks Exxon	Jersey City		200 gal.
#79-8-6-1	Arco Station	Mt. Holly		300 gal.
#79-8-6-2	Arco Station	Pitman		
#79-8-21-4	Mobil Station	Atlantic City		2000 gal.
#79-8-23-5	Exxon	Paramus		100 gal.
#79-8-25-1	Shell Station	New Brunswick		100 gal.
#79-8-29-5	Texaco Station	Sayreville		1000 gal.
#79-8-31-4	Citgo Station	Flanders		1500 gal.
#79-7-2-4	Bi-lo Gas Station	Millville		5000 gal.
#79-7-10-2	Amoco Station	Newark		
#79-7-14-5	Getty Station	Washington Twp.		
#79-7-16-5	Chevron Station	Piscataway		

UNDERGROUND GASOLINE STATION LEAKS (CONTINUED)

#79-7-19-8	Texaco	Newark	#6 Oil	100,00 bbls.
#79-7-24-2	BP Oil	Linden	#2 Oil	250 gal.
#79-7-24-8	Dans Gulf	E. Orange		
#79-7-27-3	Hess Station	Hillside		5700 gal.
#79-6-12-3	Bi-lo Station	Millville		5000 gal.
#79-6-21-4	Tunnel Exxon	Jersey City		1000 gal.
#79-6-25-4	Getty Pipeline	Woodbridge	#2 Oil	8000 gal
#79-5-21-8	Exxon Station	Paulsboro		
#79-4-10-2	Shell Station	Rutherford		3000 gal.
#79-4-17-2	Amoco Station	Morristown		1000 gal.?
#79-4-17-4	Exxon Station	Hasbrook Hts.		6000 gal.
#79-3-1-3	James Exxon	Woodbridge	#2 Oil	
#79-3-6-8	Shell Station	Hackensack		400 gal.
#79-3-6-2	Gulf Station	Long Valley		
#79-3-8-4	Bayonne Exxon	Bayonne		
#79-3-8-6	Shell Station	Bridgewater		
#79-3-8-7	Bell Telephone Conduit	Cape May	Gasoline	
#79-3-8-16	Texs Texaco	Willingboro		
#79-3-20-3	Interstate Pipeline	Jacksonville	JP-4	
#79-3-23-2	Unknown Station	Clemonton		
#79-3-27-2	Unknown Station	Randolf Twp.		
#79-2-23-2	Shell Station	New Milford		500 gal.
#79-2-23-5	Sunoco Station	Franklin		
#79-2-26-7	Petes Service Station	Stockholm		
#79-2-26-10	Getty Station	Hillside		

UNDERGROUND GASOLINE STATION LEAKS (CONTINUED)

#79-2-28-3	Unknown Station	Jersey City
#79-1-2-1	Exxon Station	Cliffside PK
#79-1-31-3	Exxon Station	

1980

Total number of spill received in 1980	2377
Total number of underground tank leaks in 1980	195
Total number of underground tank leaks in 1980 related to gasoline stations	108
Total number of underground tank leaks in 1980 related to private homes	30
Total number of underground tank leaks in 1980 related to industry	57
Percent of total cases received that pertain to underground tank leaks	8%

UNDERGROUND GASOLINE STATION LEAKS

#80-4-28-1	New Newark Exxon	Newark	Gasoline
#80-4-29-3	Sunoco	NJTPK	Gasoline
#80-3-6-5	Springlake Exxon	S. Plainfield	Gasoline
#80-3-10-4	Texaco	Oakland	Gasoline
#80-3-10-8	Orange Exxon	Newark	Gasoline
#80-3-12-4	Casotinas Exxon	Newark	Gasoline
#80-3-12-6	Kingsland Street	Nutley	Gasoline
#80-3-14-4	Milton Shopping Center		Gasoline
#80-3-17-6	Freemans Exxon	Bernardsville	Gasoline
#80-3-17-2	Emils Gulf	Hazlet	Gasoline
#80-3-28-6	Route 27, Exxon	Edison	Gasoline
#80-2-4-9	Douglas and Ventnor	Margate	Gasoline
#80-2-4-9	Route 9 and Hulses	Howell	Gasoline
#80-2-7-1	Route 22, Exxon	Hillside	Gasoline
#80-2-7-6	Mobil	Wanaque	Gasoline
#80-2-8-5	Alert Street	West Orange	Gasoline
#80-2-14-7	Mobil Station	Wanaque	Gasoline

UNDERGROUND GASOLINE STATION LEAKS

(CONTINUED)

#80-2-25-8	Carmens Exxon	Linden	Gasoline
#80-1-3-6	Mobil	Route 36, Keyport	Gasoline
#80-1-8-2	Exxon	Boonton	Gasoline
#80-1-10-3	NJ Bell Telephone	Shersbury	Gasoline
#80-1-11-3	Unknown	Lyndhurst	Gasoline
#80-1-14-1	Unknown	Ealontown	Gasoline
#80-1-14-4	Interstate Shell	Rockaway	Gasoline
#80-1-18-1	Unknown	Bergenfield	Gasoline
#80-1-21-7	Unknown	Westfield	Gasoline
#80-1-2204	Wayne Exxon	Morris Plains	Gasoline
#80-7-18-5	Texaco 381 Broad St.	Leonia	Gasoline
#80-7-18-9	Shell Station, Rt. 27	Iselin	Gasoline
#80-7-21-2	N.J. Bell Telephone	Bricktown	Gasoline
#80-7-24-5	Capprellos Exxon	Rt. 175, Hass-brouks Heights	Gasoline
#80-7-30-8	Mobil Oil	Billingsport	Gasoline
#80-6-4-3		Buck Township	Gasoline
#80-6-17-4	Gas Station	Navesink	Gasoline
#80-6-9-7	Amoco Station	Middletown	Gasoline
#80-6-25-4	Lincoln & Landes Avenue	Vineland	Gasoline
#80-6-27-8	Exxon MM 79	NJTPK	Gasoline
#80-6-30-1	Exxon	Washington Twp.	Gasoline
#80-5-2-11	Garys Exxon	Orange	Gasoline
#80-5-14-3	Exxon	Linden	Gasoline
#80-5-15-2	Shell	Garfield	Gasoline
#80-5-15-3	Manor Exxon	Middlesex	Gasoline
#80-5-20-12	Maxs Amoco	Linden	Gasoline

UNDERGROUND GASOLINE STATION LEAKS

(CONTINUED)

#80-5-21-4	Exxon, Harrison Ave.	Harrison	Gasoline
#80-5-27-7	Cambackers Gulf	Walwick	Gasoline
#80-5-30-8	Exxon Route 22	Bound Brook	Gasoline
#80-5-27-15	Apple Bee Avenue	Old Bridge	Gasoline
#80-4-1-15	Exxon 60 Bdwy.	West, NY	Gasoline
#80-4-2-14	Getty Station	Rockaway	Gasoline
#80-4-11-1	Mutuchen Exxon	Lake & Amboy	Gasoline
#80-4-14-1	Chevron 11 W. Allendale	Bergen	Gasoline
#80-4-19-1	Sanos Service	Palisades Park	Gasoline
#80-4-22-3	Lead Betters Gulf	Kearny	Gasoline
#80-4-24-3	Exxon Station	Jutland	Gasoline
#80-12-8-1	163 Hamburg TPK Shell		Gasoline
#80-12-11-5	Highway 9, Block 28 and Lot 61		Gasoline
#80-12-12-4	Exxon	Route 31	Gasoline
#80-12-12-6	Berkshire Shell	Route 15	Gasoline
#80-12-14-1	Main & Tillside South River Citgo		Gasoline
#80-12-18-2	Citgo Route 206	Flanders	Gasoline
#80-12-18-9	161 West Englewood	Engle	Gasoline
#80-12-22-8	Walter's Exxon	Summit	Gasoline
#80-12-30-5	Route 38 Texaco	Mt. Holly	Gasoline
#80-12-31-8	Star Exxon	West NY	Gasoline
#80-11-7-5	Exxon	South Orange	Gasoline
#80-11-7-2	Route 33 and Neptune Blvd.		Gasoline
#80-11-25-12	J & D Exxon	Burlington	Gasoline

UNDERGROUND GASOLINE STATION LEAKS

(CONTINUED)

#80-11-26-4	Mobil Route 31	Ewing	Gasoline
#80-11-26-5	Mobil Spruce St.	Ewing	Gasoline
#80-10-1-4	Blue Star Exxon	Scotch Plains	Gasoline
#80-10-2-9	Exxon Hooper Avenue	Toms River	Gasoline
#80-10-3-4	Andy Exxon	Johnsburg	Gasoline
#80-10-6-4	31 King Road	Madison	Gasoline
#80-10-7-4	Exxon 132 Millburn		Gasoline
#80-10-7-6	Exhange 9	E. Brunswick	Gasoline
#80-10-15-6	N.J. Bell Manhole	Newark	Gasoline
#80-10-16-4	Shell, 62 Franklyn TPK		Gasoline
#80-10-17-5	Exxon 685 Orange Avenue	S. Orange	Gasoline
#80-10-17-7	Shell Station N. Berverwick Rd.	Parsippany	Gasoline
#80-10-22-4	American Gasoline	Lindhurst	Gasoline
#80-10-24-8	NJ Bell	E. Brunswick	Gasoline
#80-10-27-7	Shell Station	Convent	Gasoline
#80-10-28-1	14 Stewart Avenue		Gasoline
#80-10-29-3	Getty Station	Lyndhurst	Gasoline
#80-10-30-5	Arco Route 31	Ewing Twp.	Gasoline
#80-10-30-6	Exxon	Clarktown	Gasoline
#80-9-3-2	Exxon	W. Paterson	Gasoline
#80-9-4-3	Exxon, 703 30th	Union	Gasoline
#80-9-11-4	Shell, Millburnt & Holmes		Gasoline
#80-9-12-3	Exxon, 122 Main St.	Madison	Gasoline
#80-9-15-10	Exxon	Linden	Gasoline
#80-9-15-11	Shell	Wall Twp.	Gasoline
#80-9-17-5	Shell	Millburn Ave.	Gasoline
#80-9-17-6	Asbury Park	Toll Plaza	Gasoline

UNDERGROUND GASOLINE STATION LEAKS

(CONTINUED)

#80-9-18-12	Exxon, Lafayette St.	Newark	Gasoline
#80-9-23-1	Baxter's Exxon	Paramus	Gasoline
#80-9-25-3	239 5th St.	Newark	Gasoline
#80-9-29-9	Hess Station	806 St. Hwy. 35	Gasoline
#80-9-30-6	Exxon Station	Route 46-Hope Rd.	Gasoline
#80-8-1-5	Exxon Station	Kennedy Blvd. Bayonne	Gasoline
#80-8-4-1	Crown Street	Manasquan	Gasoline
#80-8-8-8	Saddle River Exxon	W. Orange	Gasoline
#80-8-15-9	Exxon Station	Englewood	Gasoline
#80-7-1-11	Exxon Station	Broad & Morgan	Gasoline
#80-7-3-7	Manhole, 89 Whippany Rd.	Morristown	Gasoline
#80-7-7-5	Exxon Station	Broad & Morgan	Gasoline
#80-7-9-4	Glendola Texaco	Wall Twp.	Gasoline
80-1-23-1	#1351 Paterson Plank Rd.	Secaucus	Gasoline

UNDERGROUND INDUSTRY LEAKS

#80-7-26-2	Sickenger Marina	Long Beach	Gasoline
#80-7-28-7	Cedar Mar Marina	Toms River	Diesel
#80-7-29-5	Burmal Castrol	Edison	Mineral Spirits
#80-6-3-6	Almo Cecmco	Clayton	#5 Oil
#80-6-4-11	Kem-Kal Trucking	Netcong	Xylene
#80-6-18-9	Dana Transport	Linden	HCL
#80-6-24-5	1307 Highway 71	Belmar	Oil
#80-6-24-8	Hunt Chemical	Bergen County	Aliphatics
#80-6-26-1	South Orange Avenue	Newark	#2 and #4 Oil

UNDERGROUND GASOLINE STATION LEAKS

(CONTINUED)

#80-5-2-11	Ross Agency	Montclair	Fuel Oil
#80-5-6-3	Ryder Truck	Carlstadt	PCE
#80-5-7-5	Tenneco Chemical	Rockaway	#2 Fuel Oil
#80-5-7-7	Pazzas Hair Salon	Manasquan	Fuel Oil
#80-5-8-4	Gavazzi Tire Company	Sommerville	Gas
#80-4-14-4	Shell	Leonia	Diesel
#80-4-15-7	504 Raritan Street	Sayreville	Cleaning Solution
#80-4-17-7	American Cyanamid	Bridgewater	H_2SO_4
#80-3-3-8	Royal Petroleum	Cliff Road	#2 Fuel Oil
#80-3-10-1	69 Glassgow Terrace		#2 Fuel Oil
#80-3-19-2	Metal Workers Union	Cranford	#2 Fuel Oil
#80-3-21-4	Hills Refrigerator	Trenton	#2 Fuel Oil
#80-3-24-11	Chevron	Hazlet	Gas
#80-3-27-2		Newark	#2 Fuel Oil
#80-2-5-2	Clifton Maintenance Yard		Gas
#80-2-13-2	Bayonne Industry	Bayonne	#2 Fuel Oil
#80-2-13-8	301 Blan Road	Woodbridge	#2 Fuel Oil
#80-2-25-4	Yates	Bordentown	H_2SO_4

UNDERGROUND GASOLINE INDUSTRY LEAKS

#80-12-3-16	GP Auto Center		Gasoline
#80-11-10-10	Singer Company	Little Falls	Waste Oil
#80-11-3-2	Petro Mart	Lyndhurst	Gas
#80-11-12-6	Magullan Oil Company		#2 Fuel Oil
#80-11-15-1	Conrail	Millville	Diesel Fuel
#80-10-2-2	Hecht Brothers	Toms River	Diesel and Gas
#80-10-13-1	Lowe Paper Co.	Ridgefield	Gas

UNDERGROUND GASOLINE INDUSTRY LEAKS

(CONTINUED)

#80-10-14-5	Tank Barge, Lindsey Frank		#2 Fuel Oil
#80-10-14-6	BASF 50 Central Road		#6 Fuel Oil
#80-10-20-5	Winslow		Acid Waste
#80-10-20-8	DPW Garage	Hasbrouk Hts.	Gas
#80-10-21-2	EC Electro Plating		Chromic Acid
#80-10-24-6	Metex Corp	Edison	TCE
#80-10-31-4	Pluckman Shopping Center		#2 Fuel Oil
#80-9-3-6	Ek Squibb and Sons		Fuel Oil
#80-9-12-5	Gasse Environmental Service		Corrosive Liquid
#80-9-17-9	Joe Tantorno	Rt. 38, Mt. Holly	Gas
#80-9-22-3	Globe Petco	Red Bank	Gas
#80-9-23-1	Freedman	Medford	#2 Fuel Oil
#80-9-25-8	Polrez Corp.	Woodbury	Unknown
#80-8-7-5	11 E. Cedar Ave.	Haddon Twp.	Oil
#80-8-22-5	Ho Jo Route 46 East		Oil
#80-8-27-8	Rt. 93 and 35	Eatontown	Gas
#80-7-2-8	Are. Scientific	Linden	#2 Fuel Oil
#80-7-13-1	Quadrel Bros.	Port Elizabeth	HCL
#80-2-26-3	Alcove Oil & Tank	Yardville	Sludge oil
#80-2-28-3	Bobs Exxon	Woodbridge	Gas
#80-1-2-4	Jason Fuel Oil Supply		#2 Fuel Oil
#80-1-8-1	Holland Manufacturing	Succasunna	#2 Fuel Oil
#80-1-30-3	NJ Hwy. Authority	Woodbridge	Gas

UNDERGROUND PRIVATE HOME LEAKS

#80-12-12-5	James Reilly	Cranbury	#2 Fuel Oil
#80-12-31-6	Volz Box 699	Fredon Twp.	#2 Fuel Oil
#80-11-14-7	Patricia Coan 22 Old Mill Rd.	Tinton Falls	#2 Fuel Oil
#80-11-20-5	Reilly Residents	Sussex	Fuel Oil
#80-11-21-7	Rt. 101, Woodport Lake	Hopatcong	#2 Fuel Oil
#80-11-24-2	Juan Labady	Oakridge	#2 Fuel Oil
#80-11-24-6	120 E. Hanover St.	Trenton	#2 Fuel Oil
#80-10-1-2	Norma Chiarella	Hopatcong	#2 Fuel Oil
#80-10-6-3	Rt. 40	Salem County	Oil
#80-8-1-10	168 Laurell Circle	Princeton	#2 Fuel Oil
#80-8-10-2	165 Lakeside Blvd.		#2 Fuel Oil
#80-8-13-7	United Methodist Church		#2 Fuel Oil
#80-7-1-6	1311 Hwy. 71		Gas
#80-7-8-8	Mrs. Bosskor	Jefferson Twp.	Fuel Oil
#80-7-17-5	Bay & Lete	Manahawkin	Fuel Oil
#80-7-29-11	Box 111, Sylvan Blvd.		#2 Fuel Oil
#80-5-23-3	1117 South Avenue	West Field	Fuel Oil
#80-4-3-7	252 Hance Pl.		#2 Fuel Oil
#80-4-8-5	Harrison Avenue	Englishtown	Fuel Oil
#80-4-9-2	125 Bartley Rd.	Long Valley	Fuel Oil
#80-4-18-5	8 Spalding Plaza		#2 Fuel Oil
#80-4-23-9	140 Mt. Neuman	Ocean Grove	#2 Fuel Oil
#80-4-28-3	24 Sandra Dr.	Totowa Boro	Fuel Oil
#80-3-9-3	JR Andreaggie	Millburn	#2 Fuel Oil
#80-3-10-7	Rt. 15	Woodbury	#2 Fuel Oil
#80-3-12-3	81 Poplar St.	Trenton	#2 Fuel Oil

UNDERGROUND PRIVATE HOME LEAKS

(CONTINUED)

#80-3-21-1	141 Morningside Ave.		#2 Fuel Oil
#80-2-4-5		Atlantic City	#2 Fuel Oil
#80-1-18-3	Manasquan		#2 Fuel Oil
#80-1-21-2	158 Mahar St.	S. Plainfield	#2 Fuel Oil

Total number of spills received in 1981..............................2278

Total number of underground tank leaks in 1981.......................166

Total number of underground tank leaks in 1981 related to gasoline stations...103

Total number of underground tank leaks in 1981 related to private homes..55

Total number of underground tank leaks in 1981 related to industry...8

Percent of total cases received that pertain to underground tank leaks..7%

81-12-28-6		Readington Twp.	#2 oil	700 gal	
81-12-16-4	College Tire & Supply	N. Brunswick	Gasoline	unknown	
81-12-13-2	Exxon	Englewood	Gasoline	3,000 gal.	
31-12-15-4	Shell	Hawthorne	Gasoline	1,000 gal.	
81-12-11-5		LK. Hopatcong	Fuel Oil	200 gal.	
81-12-10-1	Exxon	Englewood	Gasoline	unknown	
81-12-10-3		Maurice Twp.	Fuel oil	200 gal.	line leak
81-12-11-2		Franklinville	Gasoline	unknown	
81-12-7-7	Texaco	Montclair	Gasoline	375 gal.	
81-11-3-1		Elizabeth	#2 Fuel	200 gal.	
81-11-4-6	AT & T Maintenance	Bedminster	Gasoline	unknown	
81-11-5-1	Exxon	Forked River	Gasoline	300 gal.	line leak
81-11-10-1		Dover	Gasoline	529 gal.	
81-11-11-4	Exxon	Howell Twp.	Gasoline	100 gal.	
81-11-13-1	Citgo	South River	Gasoline	unknown	
81-11-16-4	Ammoco	Green Creek	Gasoline	3,000 gal.	
81-11-17-5	U-Save	Morristown	Gasoline	unknown	
31-11-23-6	Meadowland Truck Stop	E. Rutherford	Diesel	unknown	
31-11-30-2		Rockaway Twp.	Gasoline	unknown	

81-10-7-1	Exxon	Trenton	Gasoline	1420 gal.	broken line
81-10-12-3	Exxon	Pennsauken	Gasoline	300 gal.	
81-10-12-4	Exxon	Clifton	Gasoline	200 gal.	
81-10-14-1		S. Orange	Diesel	30 gal.	
81-10-14-6		Ft. Lee	Oil	unknown	
81-10-16-4		Clifton	Gasoline	164 gal.	
81-10-16-5		Rockliegh	Gasoline	193 gal.	
81-10-29-9	Shell	Maplewood	Gasoline	unknown	
81-10-30-4	Exxon	Denville	Oil	unknown	
81-9-29-6		Clarksburg	Gasoline	unknown	
81-9-21-5	Hess	Roselle	Gasoline	unknown	
81-9-23-2		Matawan	#4	40 gal.	
81-9-23-4		Parsippany	Oil	unknown	
81-9-11-4	Exxon	Madison	Gasoline	1,152 gal.	
81-9-14-1	Shell	Leonia	Gasoline	148 gal.	
81-9-7-2		Lacey Twp.	Waste Oil	unknown	
81-8-27-11	Squibb Co.	New Brunswick	Methanol	unknown	
81-8-28-3	Getty	Edison	Gasoline	unknown	
81-8-28-8	Shell	Belleville	Gasoline	600 gal.	
81-8-28-5	Getty	Edison	Gasoline	unknown	
81-8-27-7	Exxon	Princeton	Gasoline	unknown	
81-8-26-6	Exxon	Great Meadows	Gasoline	unknown	
81-8-24-6	Home Owner	Princeton	Gasoline	unknown	
81-8-20-5	Texaco	Bergen	Gasoline	300 gal.	
81-8-17-11		Rochelle Park	Gasoline	238 gal.	
81-8-17-8		Marlton	Fuel	unknown	
81-8-14-5		S. Brusnwick	Gasoline	20,000 gal.	
81-8-14-8	Exxon	Sommerville	Waste Oil	1,000 gal.	
81-8-13-1	Shell	Sussex County	Gasoline	unknown	

81-8-7-4	Exxon	W. New York	Gasoline	unknown	
81-8-5-7	Texaco	Richfield	Gasoline	1,100 gal.	
81-7-31-7	Shell	Stanhope	Gasoline	5,200 gal.	
81-7-30-3	Bell Tel.	Newark	Fuel Oil	unknown	
81-7-30-5	Fairfield Textile	Passaic	#2	unknown	
81-7-31-4		Montville	#2	300 gal.	
81-7-28-1		W. Amwell	Oil	unknown	
81-7-28-7	Shell	Summit	Gasoline	190 gal.	
81-7-29-3	N.J. Turnpike	Burlington	Diesel	400 gal.	
81-7-27-6	MRI	Elizabeth	#6	100 gal.	
81-7-20-3	Exxon	Newark	Gasoline	unknown	
81-7-15-13		Toms River	Gasoline	unknown	
81-7-9-8	Home Owner	Vernon	#2	unknown	
81-7-6-3	Hoffman Laroche	Nutley	Gasoline	unknown	
81-6-26-6	Exxon	W. Caldwell	Gasoline	406 gal.	
81-6-23-5		Toms River	Gasoline	unknown	
81-6-24-1	Arco	S. Plainfield	Gasoline	unknown	
81-6-20-5	Mobil	Wildwood	Gasoline	7,200	
81-6-16-7	Shell	Scotch Plains	Gasoline	600 gal.	line leak
81-6-17-1	Arco	Cherry Hill	Gasoline	100 gal.	
81-6-15-3		Neshanic Station	#2	150 gal.	
81-6-11-7	Kay-O	Pennsauken	Gasoline	1,000 gal.	Fuel line
81-6-11-8		Long Branch	Gasoline	175 gal.	
81-6-5-10		Linden	Diesel	100 gal.	
81-6-4-4		Budd Lake	Petroleum Hydrocarbon	1 ppm	
81-6-3-3		Bricktown	Gasoline	unknown	
81-6-1-2		Egg Harbor	Oil	unknown	
81-6-2-3		Jersey City	#2	80 gal.	

81-1-5-3	Tedreth Plastics Rt. 33 & Tinton Falls Road	Howell Twp.	#2 Oil	D.B.
81-1-6-2	Rt. 521 Old Mill Brook Rd	Hope Twp.	#2 Oil	E.L.
81-1-9-2	Main Street	Booton	Gasoline	*
81-1-12-4	Montclair Savings & Loan, 1400 E. Elizabeth Ave.	Linden	Gasoline	L.M. & D.B.
81-1-13-2	Richmond Chris-Craft River Road	Edgewater	Gasoline	*
81-1-15-3	Marlton Exxon Rt. 73 & 70	Marlton	Gasoline	*
81-1-20-5	Golfview Commons Apt. 5, Parker Rd.	Lakewood	#2 Oil	D.M.
81-1-22-5	West's Service Rt. 17 North	Maywood	Unleaded Gas	M.G.
81-1-22-6	Gulf Station Oak Tree & Front St.	Hackensack	Gasoline	*
81-1-23-4	Valley View Motors Berger Blvd.	Fort Lee	Diesel	*
81-1-26-3	Exxon Station 109 E. Main Street	Tuckerton	unleaded gas	*
81-1-26-6	Contex Oil Co. Woodport Rd & Johns Street	Lake Hopatcong	#2 Oil	*
81-1-28-12	Clinton Municipality Rte. 22	Clinton	#2 Oil	J.D.
81-1-29-4	Washington Crossing Exxon, Rte 29	Washington Crossing	Gasoline	*
81-1-29-5	McNulty's Exxon Admiral Wilson Blvd.	Camden	Gasoline	*
81-1-29-6	Egg harbor Bridge	Mays Landing	unk. oil	K.D.
81-1-29-9	Vormado, Mercury Rd. & Ridgedall Avenue	E. Hanover	pos. diesel	*
81-1-30-1	PSE&G Manhole Federal Street	Camden	light oil	*
81-1-30-4	Alexander Hamilton Sunoco, N.J. Turnpike 12S	Secaucus	Diesel	M.G.

* Unassigned or under phone investigation

81-2-4-4	371 Lake Street	Newark	#2 Oil	D.M.
81-2-9-5	L.S. Raggins Oil Co.	Mays Landing	Diesel	M.G.
81-2-9-10	224 Gates Avenue	Gillette	unknown oil	*
81-2-11-5	Godwin Exxon 178 Godwin	Wyckoff	Reg. Gasoline	*
81-2-12-2	Getty Mt. Arlington	Mt. Arlington	Gasoline	*
81-2-17-1	Anheuser-Busch Main Street	E. Brunswick Twp.	Gasoline	L.M. & M.G.
81-2-17-3	Mobil, Rio Grande & Hudson Sts.	Wildwood	Gasoline	L.M. & M.G.
81-2-18-12	200 Gregg St.	Lodi	Petroleum Solv.	G.W.
81-2-18-13	Julis Exxon 1129 S. Orange Ave.	Newark	Unleaded Gasoline	*
81-2-19-4	8 Grove St.	Buddlake	Fuel Oil	*
81-2-19-12	Shaler Texaco Broad St. & Shaler Street	Rich Field	Gasoline	*
81-2-20-8	739 Harrison Ave.	Harrison	Gasoline	E.L. & J.D.
81-2-20-10	Clifton Exxon Rte. 46W	Clifton	Gasoline	*
81-2-21-1	Raia Concrete 350 Franklin Tpk.	Mahwah	#2 Fuel Oil	B.C.
81-2-23-6	Dans Motor Fuel Rte 22	Branchburg	Gasoline	*
81-2-23-10	Rogers Motor Line Inc. U.S. Hwy. 46 & Johnson Roads	Hackettstown	#2 Fuel Oil & Gunk	*
81-2-24-6	118 Memorial St.	Mt. Laurel Twp.	Petroleum Prod.	*
81-2-24-9	Ft. Monmouth Army Post	Eatontown	Gasoline	D.B.
81-2-26-12	1759 Ratzer Road	Wayne	Gasoline	M.G.
81-2-27-4	Hunterdon State School, Pittstown Rd.	Clinton	#6 Oil	G.W.
81-3-2-10	89 State Street	Hackensack	Gasoline	M.G.
81-3-2-11	Chancellor & 10th	Irvington	Gasoline	*
81-3-2-12	Rt. 22 & Mercer Sc.	Somerville	Gasoline	M.G.

81-3-2-15	44 Grand Street	Garfield	Gasoline	D.B.
81-3-4-2	May Fair Exxon 700 Boulevard	Kennilworth	Gasoline	*
81-3-4-8	30 S. Plainfield Avenue	S. Planfield	Gasoline	G.W.
81-3-5-2	411 Kings Hwy.	ThoroFair	Petroleum Hydro-carbons	T.O.
81-3-6-7	1585 Bergen Blvd.	Leonia	Gasoline	*
81-3-9-5	106 Wintzer Rd.	Hopatcong	#2 oil	*
81-3-10-11	2254 S. Main Rd.	Vineland	Oil & Grease	*
81-3-12-10	461 Bloomfield Ave.	Bloomfield	Gasoline	*
81-3-13-2	Municipal Garage near 711 Herman Rd.	No. Brunswick	Gasoline & Diesel	D.B.
81-3-13-9	Rt. 22	Somerville	Gasoline	
81-3-13-10	Texaco, 100 Ridge Road	Lyndhurst	Reg. Gas	*
81-3-15-2	Simmons Oldsmobile Rte. 17N	Ramsey	Unk. Oil	J.D.
81-3-17-8	B & C Tire & Auto 1159 Roosevelt Ave.	Carteret	Unleaded Gas	*
81-3-19-8	County Rd. & Hudson Street	TenaFly	Gasoline	M.G.
81-3-20-2	18 Metro Lane	Hopatcong	#2 Oil	J.D.
81-3-20-5	888 E. McFarlam St. Getty	Dover	Petroleum	*
81-3-20-13	Shamrock Exxon Dean & Demarest Avenue	Englewood	Unleaded Gasoline	M.G.
81-3-23-10	766 Rte. 17N	Ramsey	#2 Oil	M.G.
81-3-25-4	Watchung & Lakeside Avenue	Orange	oil	*
81-3-25-6	26 N. Morris Street	Rockaway	oil	J.D.
81-3-25-9	Sina's Exxon 67 S. Orange Avenue	Orange	Reg. Gasoline	*
81-3-26-1	26 N. Morris St.	Rockaway	Oil	*
81-3-27-4	49 Pennsylvania Ave.	Hopelawn	Gasoline	*
81-3-27-7	304 Hunterdon St.	Newark	Oil	*

81-3-27-11	River Road Exxon	Middlesex	Gasoline	*
81-3-27-13	Imperial Oil Orchard Place	Marlboro Twp.	Oil	D.M.
81-4-1-2	New Egypt Exxon 55 N. Main Street	New Egypt	Reg. Gas	*
81-4-1-3	Cresskill Exxon Piermont & Madison Avenue	Cresskill	Reg. Gas	*
81-4-2-5	Bridge over Hedding Rd Same as 81-2-20-11	Mansfield Twp.	#2 Diesel	N.G.
81-4-2-7	French St. Exxon 189 French Street	New Brunswick	Gasoline	*
81-4-6-5	Ratzer Road	Wayne	Gasoline	M.G.
81-4-13-6	Marco Pici Shell 725 S. Orange Ave.	Newark	Reg. Gas	M.G.
81-4-16-1	Shell McCarter Hwy. and Third Street	Newark	Gasoline	*
81-4-16-7	Exxon 101 Rte. 4E	Englewood	Gasoline	D.M.
81-4-29-3	near Shop Rite, Nottingham Way	Hamilton Twp.	unk oil	*
81-4-30-7	Exxon	Clifton	Gasoline	E.L.
81-4-30-11	63 Foxhill Rd.	Denville	#2 oile	D.B.
81-4-30-12	Pata's Exxon Rte. 46W	Fort Lee	reg. gas	M.G.
81-5-1-1	Sunrise Texaco 101 Park Avenue	Lyndhurst	gasoline	*
31-5-7-6	B&B Exxon Rte. 35 Asbury Park Circle	Asbury Park	unleaded gas	M.G.
81-5-8-3	Cilento's Exxon	Patterson	unleaded gas	M.G.
81-5-13-6	Rockaway Mall Exxon 5 Mount Pleasant Ave.	Dover	gasoline	M.G.
81-5-13-7	Orange Towers Apts. 749 Scotland Rd.	Orange	#4 oil	*
81-5-14-6	Shell North Gaston& Union Street	Somerville	gasoline	*
81-5-15-2	Creskill Exxon same as 81-4-1-3	Cresskill	gasoline	M.G.

81-5-22-4	403 Park Ave.	Rutherford	Gasoline ordors	*
81-5-23-3	127 Hickory Corner Rd.	E. Windsor	#2 Oil	*

* not assigned and/or under investigation

bg

1982

Total number of spills received in 1982 315

Total number of underground tank leaks in 1982 54

Total number of underground tank leaks in 1982 related to gasoline stations . . . 30

Total number of underground tank leaks in 1982 related to private homes 15

Total number of underground tank leaks in 1982 related to industry 9

Percent of total cases received that pertain to underground tank leaks. 17%

UNDERGROUND TANK LEAKS

#82-2-23-2	Hoffman-LaRoche	Nutley	#2	Unknown
#82-2-23-9	Apartments	Cherryhill	#2	Unknown
#82-2-18-2	Kobbie and Flamey	Bergen	Unleaded Gas	85 Gal.
#82-2-18-3	Private Resident	Oxford Twp.	#2	Unknown
#82-2-17-6	Smith Motor	Washington	Gas	300 Gal.
#82-2-16-8	Coastal Oil	Port Newark	#6 and #2	300 Gal.
#82-2-16-9	Private Resident	Princeton	Fuel Oil	Unknown
#82-2-15-2	Private Resident	Mullica Twp.	Gas	Odors
#82-2-16-12	Private Resident	N. Bergen	Oil	Odors
#82-2-16-1	Ft. Dix	Ft. Dix	Oil	9000 Gal.
#82-2-11-5	Ft. Dix	Ft. Dix	Oil	150 Gal.
#82-2-10-4	Private Resident	Collingswood	Oil	Unknown
#82-2-8-5	Private Resident	Trenton	Oil	Unknown
#82-2-2-6	US Steel	Trenton	#6 Oil	140 Gal.
#82-2-3-2	Private Resident	Neshamic	Oil	300 Gal.
#82-1-31-3		Jackson	Oil (Lodge)	250 Gal.
#82-1-27-4	Firestone Tire	Edison	Gasoline	600 Gal

UNDERGROUND TANK LEAKS

(CONTINUED)

#82-1-28-5	Xylol Tank Leak	Woodbridge		200 Gal.
#82-1-29-2	Town & Country	Budd Lake	Gas	Unknown
#82-1-27-1	Private Resident	Toms River	#2	275 Gal.
#82-1-20-1	Private Resident	Margate	#2	250 Gal.
#82-1-18-3	Private Resident	Edison	Gas	6000 Gal.
#82-1-16-2	Beecher Co.	Bayonne	Oil	Unknown
#82-1-12-4	Private Resident	Randolph	Oil	Unknown
#82-1-8-6	Private Resident	Byram Twp.	Oil	Unknown
#82-1-4-4	Private Resident	Howell Twp.	Oil	Unknown

UNDERGROUND TANK LEAKS- GAS STATIONS

#82-2-17-5	Exxon	Lodi	Gasoline
#82-2-16-10	Exxon	Andover	Gasoline
#82-2-16-5	Sun Oil	Newark	Gasoline
#82-2-9-10	Exxon	Clifton	#2
#82-2-10-6	Private Resident	Montclair	Gasoline
#82-2-8-6	Exxon	Weehawkin	Gasoline
#82-2-6-1	Private Resident	North Brunswick	Gasoline
#82-2-5-8	Private Resident	Newark	Gasoline
#82-2-8-2	Exxon	Wayne	Gasoline
#82-2-7-2	Private Resident	No. Bergen	Gasoline
#82-2-4-7	Tank Leak	Franklin Twp.	Gasoline
#82-2-5-3	Exxon	Atlantic City	Gasoline
#82-2-5-2	Tank Leak	Bellville	
#82-1-29-4	Private Well	Mt. Ephraim	Gasoline
#82-1-25-4	BP Station	Rahway	Gasoline
#82-1-27-2	Exxon	Lakewood	Gasoline

<u>UNDERGROUND TANK LEAKS - GAS STATIONS</u>

(CONTINUED)

#82-1-26-3	Private Well	New Brunswick	Gasoline
#82-1-21-4	Exxon	Burlington	Gasoline
#82-1-21-5	Texaco	Parsippany	Gasoline
#82-1-21-7	Private Well	Edgewater	Gasoline
#82-1-20-2	Exxon	Linden	Gasoline
#82-1-13-4	Hess	Pennsauken	Gasoline
#82-1-14-2	Gulf	Bloomfield	Gasoline
#82-1-7-2	Getty	Jersey City	Gasoline
#82-1-2-3	Private Well		Gasoline
#82-1-8-2	Citgo	Westfield	Gasoline
#82-1-8-7	Exxon	Ramsy	Waste Oil
#82-1-7-4	Unknown Station	Linden	Gasoline

ARCO Petroleum Products Company
515 South Flower Street
Mailing Address: Box 2679 - T.A.
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Telephone 213 486 2876

B. S. DiGiovanni
Manager
Environmental and Health Coordination

March 1, 1982

The Honorable Ray Lesniak
Chairman Environment Committee
New Jersey Legislature
State Capital
Trenton, New Jersey 08608

Dear Mr. Lesniak:

Unfortunately, due to the short notice of the hearing on underground tank leaks, and the distance involved, we were unable to present our views in person at your hearing. However, in view of the importance of this legislation and the potential impact on our company we would like to take this opportunity to make our comments known for consideration by your committee.

First, I would like to say that our company has recognized the problem of underground leaks for some time and has been responding promptly and effectively when they occur. However, recognizing that prevention is much more desirable than any clean-up action after the fact, we have also instituted measures to minimize the potential for future leaks.

In 1981 we concluded a multi-year program of installing leak detectors in all of our pressurized gasoline lines at service stations nationwide. This provides immediate and effective notification to the dealer of any leakage in the lines from his underground tankage to the island dispensers. This was a big step in minimizing the potential amount of gasoline lost yearly inasmuch as a large volume of gasoline can be lost in a short period of time in a pressurized system when a leak in the system develops.

In 1981 we instituted a second program of testing the integrity of our existing underground service station tankage. We embarked on a 5 year cyclical program of physically testing all of our service station tankage.

If we discover a leak, we are replacing all of the tankage of comparable age with non-corrosive fiberglass tanks where soil conditions and local ordinances permit and the selection of material is appropriate. An outline of our many faceted program is attached.

Due to the limitations of contractor and equipment availability we do not feel testing all tanks in one year e.g. 1982 is feasible. We feel that a five year cycle is the minimum amount of time in which we can reasonably do all of the testing. Tank testing is a highly sophisticated operation today and there are a limited number of people with the equipment and competence to do it properly. Inasmuch as many of the major oil companies are embarked on some form of tank testing program there are physical limitations as to how many tests you can accomplish in any given period of time. In addition, a badly run test can be worse than no test at all and this will happen if testing is done by unqualified personnel.

Inventory control is without doubt the most effective leak control measure. It is absolutely necessary for the service station dealer to keep accurate, daily inventory records. Rigidly adhered to this will do more than any other single thing to uncover a leak promptly and before it becomes an environmental problem. Our company, as do other major oil companies, includes this requirement in our dealer leases and insist on its adherence. In addition, inventory records are verified periodically by our sales representatives.

Legislation and regulations should be based on performance standards rather than equipment standards. The section of the most appropriate construction should be left to the operator. Replacement of tanks because of construction material (e.g. steel) without regard to other factors such as age, environment, etc, should not be arbitrarily mandated. There are many locations where it is completely unsuitable to install fiberglass tanks. The installation of these tanks is critical not only in the workmanship procedure but also in the type of earth they are being installed in and the type of backfill used. Many soils are unsuitable and can result in failures of the tank due to the lack of proper support. In some areas, steel tanks properly coated or cathodically protected are more suitable.

In summary, it is our position that the following steps will provide the necessary protection for underground tankage.

1. Daily inventory reconciliation by the dealer with prompt notification when shortages are observed.

2. Leak detectors in any pressurized system with yearly testing to make certain they are functioning properly.

3. Testing of all existing steel tanks on a periodic basis (we recommend five years) to verify their soundness.

4. Replacement of all leaking tanks and other steel tanks of a comparable age at the same site with either fiberglass or protected steel tanks as local conditions warrant.

We would like to thank you for this opportunity to present our views to you and we would be happy to answer any questions you might have on this.

Sincerely,

B. S. DiGiovanni

BSD/clw

cc: Oliver Papps (New Jersey Petroleum Council)

MARKETING DEPARTMENT
ARCO PETROLEUM PRODUCTS COMPANY
DIVISION OF ATLANTIC RICHFIELD COMPANY

Updated 2/25/82

LEAK DETECTION, PREVENTION & CONTROL
SERVICE STATION UNDERGROUND SYSTEMS

SUMMARY - Because of the vast number of installations involved and the fact that their underground location permits only limited inspection and observation, the underground storage and dispensing systems at the 180,000 service stations in the country present a significant potential source of leakage. This is a concern shared by our Company, industry, regulatory agencies and the public. Action taken by Atlantic Richfield Company to prevent, detect and control leaks from underground tanks and steps taken to make dealers and Company personnel aware of the importance of leak control programs are summarized in this report.

LEAK DETECTION & PREVENTION PROGRAM

During the next five years our Marketing Department will spend upwards of 30 million dollars in a program which will include assessment of the leak potential of facilities at each station, installation of leak detection procedures and devices and testing of every tank and piping system, with replacement of equipment as required. Training to improve dealer and employee awareness of the potential problems are an important part of this program.

Since an effective inventory control program provides the most reliable early warning system and the most viable continuous monitoring for leaks, a requirement that each dealer maintain a daily inventory of all products is an important feature of each lease. All discrepancies of ½ of one percent or more are to be reported and investigated. If differences cannot be explained, the tank is to be tested.

To supplement the daily inventory control by the dealer, the inventory records are to be audited at least quarterly by sales personnel and pump and tank maintenance crews are to visually inspect all equipment annually and guage the water level in the bottom of each tank at least semi-annually.

ARCO Petroleum Products Company owns and leases approximately 3,000 service stations and owns & operates approximately 500 stations. Based on priorities of tank age, soil resistivity and moisture, facility location, etc., each of the approximately 12,000 underground storage tanks at these facilities will be tested in the 1980-1986 period to ascertain the integrity of each tank. If any one tank at a location is found to be defective, all tanks of the same age and construction at the site will be replaced or fiberglass lined. Periodic follow up testing of all tanks is planned.

In-line leak detectors at the remote pump provide a positive and immediate warning of leaks in the piping between the storage tanks and the dispensers for these systems. The drastically reduced pumping rate which occurs when the pump is unable to maintain pressure because of a leak in the line quickly alerts the operator to the leak.

All remote pumping systems at Atlantic Richfield Company stations are presently equipped with leak detectors.

A brochure providing information and drawings of a leak detector made by one pump manufacturer is attached.

LEAK TESTING RESEARCH

Several tank testing devices, using varied and innovative techniques, have recently been developed. These new systems and the widely used Kent Moore test have been studied and tested at our Harvey Technical Center (HTC). New concepts have also been investigated and a very practical and very accurate system which utilizes a floating sensor and a highly sensitive change in level indicator and recorder has been developed by our HTC.

Trial field testing of the device in the Phildelphia and San Francisco area has been completed. Comparing results using the HTC device with Kent Moore tests at the same site indicates equivalent or better reliability and better accuracy. The HTC system is being used on a program basis and information on the device is being circulated to industry and various control agencies. It is hoped development of the HTC Leak Detection Device will provide a new and reliable tool for underground tank testing at service stations.

Descriptive literature and drawings of the HTC leak testing device are attached.

TRAINING PROGRAMS

ARCO Petroleum Products Company Manual "Leak Detection: Underground Storage Facilities" outlines our program to alert dealers and field personnel to the importance of inventory control and physical inspections and to educate them to recognize signs of potential leaks early and what to do if a leak is suspected.

Copies of our manual on leak detection are attached.

Slide presentations covering procedures and methods for identifying and controlling leaks from underground tanks are periodically shown at dealer panel meetings and regional sales and engineering functions to keep dealers and Company personnel abreast of developments in technology and techniques for detecting and controlling leaks. Notification letters reminding all operators and field personnel of the importance of preventive procedures and monitoring are issued periodically to stress the need for concerted action to detect and prevent leaks.

SPILL CONTAINMENT & CONTROL

To insure that the environment is protected from petroleum product spills and to establish reliable communication systems for early and adequate response to spill incidents, Marketing Department Policy/Procedure A.37 "Product Spillage/Loss Due to Tank/Line Leakage at Service Stations and Consumer Accounts" was prepared and circulated to all personnel involved in service station activities. The policy outlines the responsibilities of each party potentially involved in a spill incident and provides proper procedures for reporting spills or leaks to appropriate Company personnel and regulatory agencies. Standard spill report forms and instructions for distribution of reports are provided in the policy.

A copy of Policy/Procedure A.37 is attached.

STANDARDS FOR NEW OR REPLACEMENT OF UNDERGROUND SYSTEMS

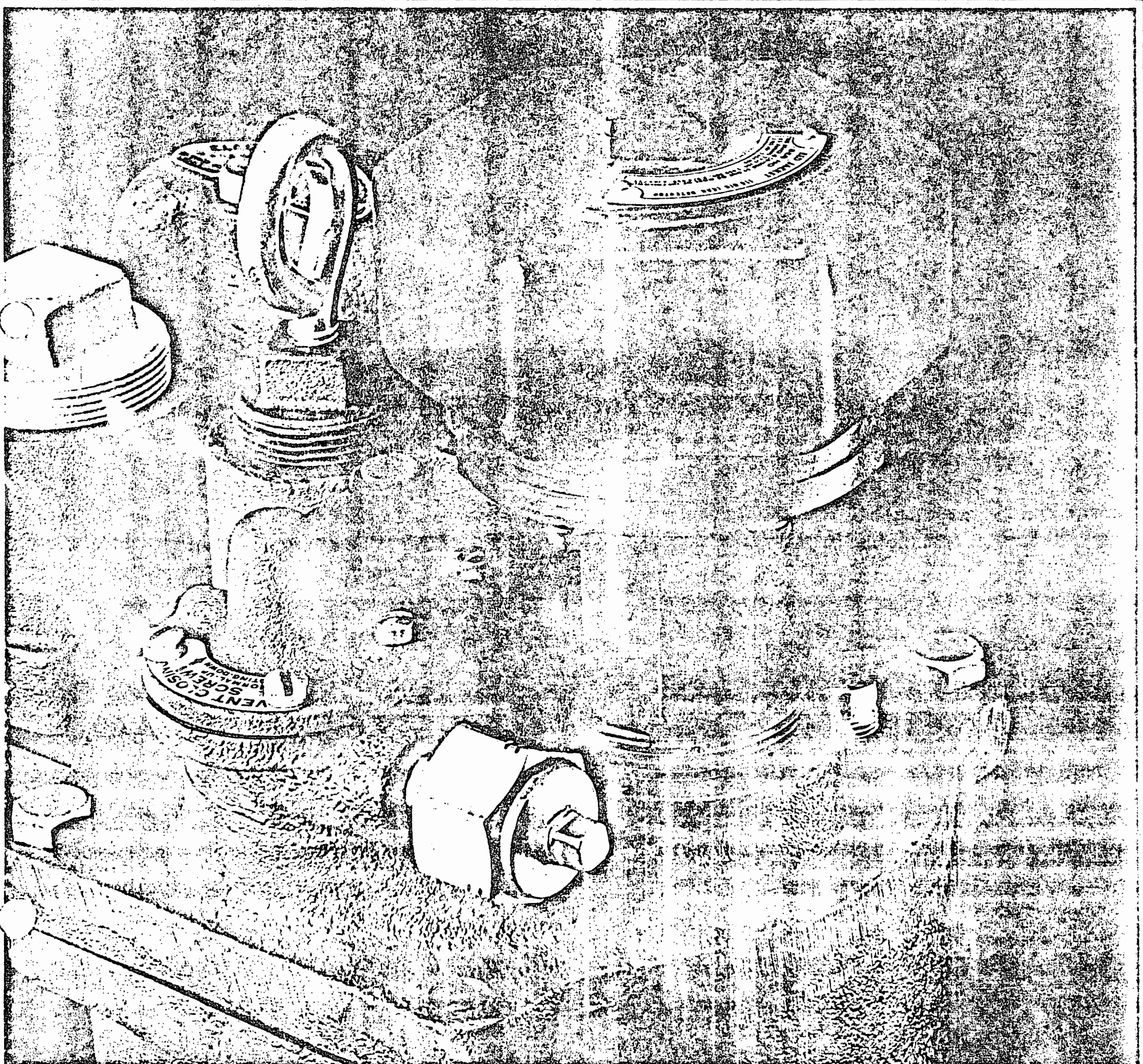
For approximately 10 years all new and replacement underground piping and storage tanks at Atlantic Richfield Company owned service stations have been fiberglass. Fiberglass continues to be our standard to minimize from these systems.

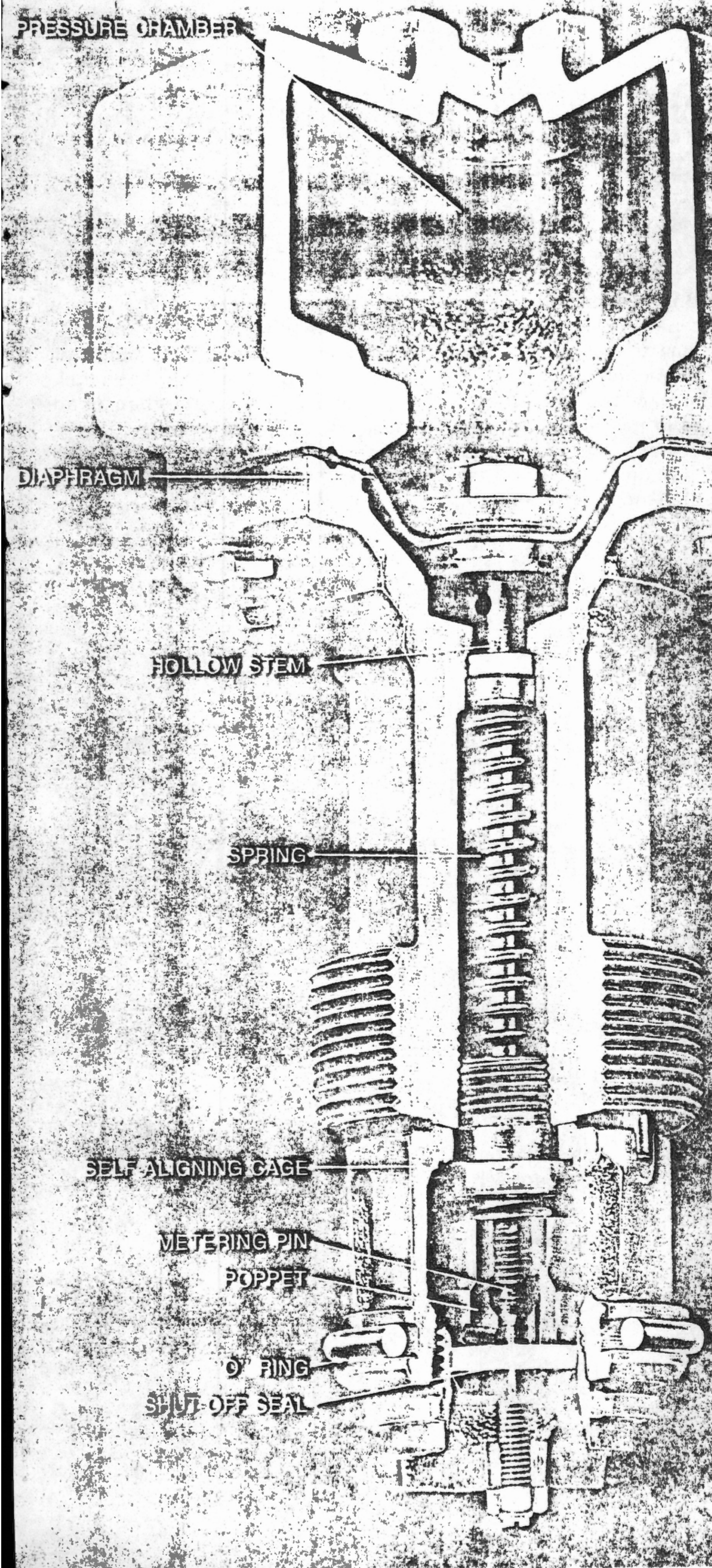
INDUSTRY STUDIES AND PUBLICATIONS

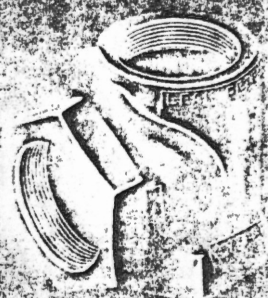
The API has been very active in the study of leakage from underground storage tanks and has published several manuals on spill containment and control and guidelines for installation of underground storage systems. These publications are widely circulated and used as a reference documents in our programs. Copies of the manuals and related information have been furnished to interested agencies by the API.

NEW RED JACKET "TWO-SECOND" LEAK DETECTOR

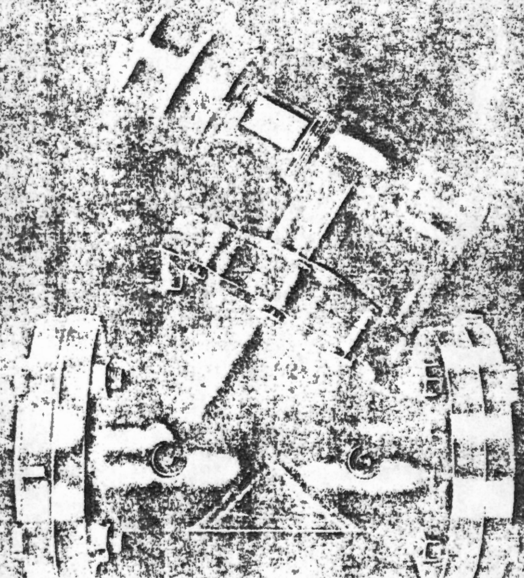
For remote Submersible Petroleum Pumping Systems







This simple adaptor allows Red Jacket Leak Detector to be used with any submersible pump unit.



For high capacity bulk plant applications, this "Big-Flo" Leak Detector Unit is mounted in standard 3" pipe flanges for easy installation. Same foolproof and maintenance free operation with identical operating characteristics. For flow rates from 70 GPM to 250 GPM.

THE FIRST LEAK DETECTOR TO MAKE A COMPLETE LINE TEST IN ONLY TWO SECONDS!

As early as 1959, Red Jacket developed and marketed a solution to the problem of leakage between storage tanks and dispensers of petroleum. Now, with the changing trend to self-serve installations, pumping delay can be a problem. Red Jacket responds with a new and improved leak detector that makes a complete line test in only two seconds.

Yet, the new Red Jacket Leak Detector is just as effective and reliable as past models. Years of research time and field experience are reflected in the new design. As with the previous Red Jacket design, the new unit provides foolproof, maintenance-free operation.

The new detector can be easily mounted on top of any current 4" Red Jacket Submersible Pump or adapts to older or other submersible pumps. **UL listed when used with an approved housing.**

The standard unit is designed for use with ⅓, ¾ and 1½ HP pumps with flows up to 70 GPM.

RED JACKET MEETS THE DEMANDS OF PETROLEUM MARKETERS AND SERVICE STATION OPERATORS.

Following are characteristics of the Red Jacket system which you demanded:

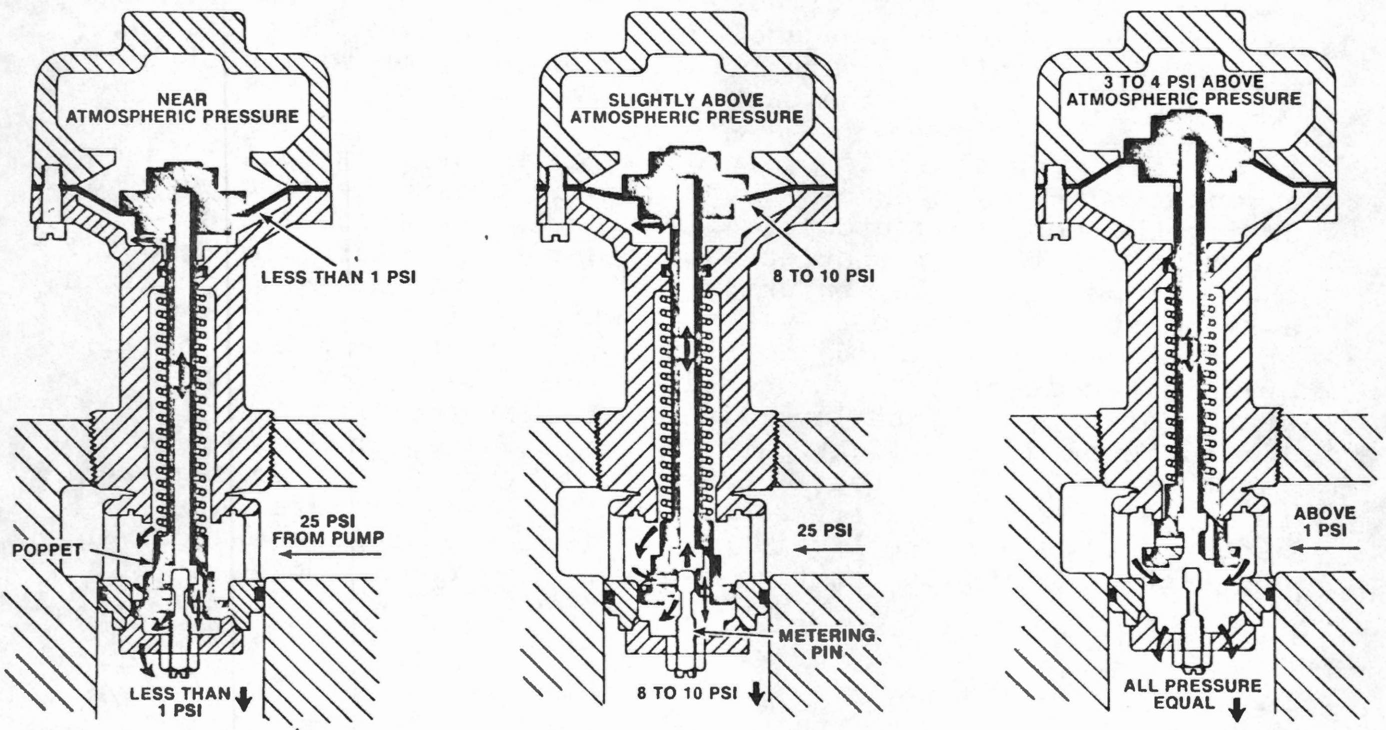
1. The Red Jacket leak signal is indicated only when a true leak is present, not just a pressure drop resulting from system resilience or thermal contraction.
2. The leak signal does not completely shut down operation of the system.
3. The signal will affect normal operations sufficiently to call for early investigation and remedial action.
4. Minor leaks are indicated, however, no service interruption occurs.
5. A Leak Detector can be installed in any position and is not sensitive to vibration.
6. New hexagonal shape makes the Two-Second Leak Detector easy to identify.

THE RED JACKET 3-STEP LEAK TEST

The Red Jacket leak detector is a pressure sensing, diaphragm operated valve designed to indicate a leak in the piping between the leak detector and dispenser.

When the submerged pump is turned on, a controlled amount of product (three gallons per hour) is metered through the leak detector into the piping system. If a leak is present which equals or exceeds this amount, as much product escapes from the system as is metered in through the leak detector. Under this condition pressure cannot build up in the piping system. When a nozzle is opened a poppet in the leak detector moves to a position which restricts the flow to approximately 3 GPM. This is the indication to the operator that a leak is present.

If there are no leaks, pressure rapidly builds in the system forcing the leak detector to open to the full-flow position. In a system with no leaks it takes only two seconds for a complete test. No further line testing takes place until the line pressure drops below 1 PSI.



1. **THE "TRIP" OR RELAXED POSITION.** Under normal operating conditions, it is assumed that the lines are filled with gasoline which is essentially non-compressible. When the system pressure is less than 1 PSI, the diaphragm and poppet are in their "down" or "tripped" position. The position of the valve "poppet" is such as to allow approximately 3 GPM flow into the delivery line, through a bypass opening in the leak detector valve poppet, when the submersible pump starts. Since the system is full, pressure builds instantly and the poppet moves to the leak sensing position, assuming there is no leak present.
2. **LEAK SENSING POSITION.** As the pressure builds to approximately 8 to 10 PSI (Instantly), the diaphragm has moved the "poppet" to such a position as to almost stop the flow into the piping through the leak detector valve poppet. In this position, all the flow must then travel around the metering pin which limits it to approximately 3 GPH rate. If a simultaneous loss from the system equals or exceeds this amount, the line pressure will not build beyond this point and the valve will remain in the leak sensing position with the main flow blocked. If there is an attempt to dispense while the valve is in this position, the line pressure will drop, the diaphragm will respond, and the poppet will return to position 1 where approximately 3 GPM will flow to the dispensers. Leaks smaller than 3 GPH will be indicated by the Leak Detector taking longer than two seconds to open completely. If there is no leakage in the system, the small flow around the metering pin increases the line pressure to 10 PSI in approximately two seconds at which point the diaphragm will snap the poppet to position 3. This all takes place in less time than it takes the dealer to reset the dispenser, walk to the car, remove the gas tank cap, insert and open the nozzle.
3. **NON-LEAK POSITION.** This position allows full flow. The poppet will remain in this position as long as the system pressure remains above 1 PSI. At less than 1 PSI the "poppet" will return to position 1.

RED JACKET® **PUMPS**

A Division of Wylain, Inc.

Form No. 5170

P.O. Box 3888, Davenport, Iowa 52808

TEST PROCEDURE FOR THE HTC LEAK DETECTOR

The HTC Leak Detector is an ultrasensitive device for measuring the changes in liquid level in an underground gasoline storage tank. Level changes as small as 0.0004" are readily measured with the device. Measurements are taken when the tank is inactive and contains between 65 and 82% of its volume (60-75% by height).

To shorten the test time, a procedure is included that reduces evaporation from the gasoline surface during the test. This is accomplished by spraying gasoline into the ullage thus saturating it with gasoline vapors. This is done prior to installing the test equipment in the tank.

In operation, a float is positioned in the storage tank in such a manner that any changes in the gasoline temperature occurring during the test are automatically cancelled. This allows testing of tanks that are not at a constant temperature throughout the test period. The measuring portion of the detector utilizes a light source/photocell system in which the light passes through a colored liquid (to the photocell). The amount of liquid in the light path changes in direct proportion to the change of the gasoline level in the tank. The change in the liquid level in the light path causes a change in the amount of light seen by the photocell which is converted to a voltage and recorded on a strip chart recorder. These charts are later used to calculate the liquid change (and thus volume change) in the tank relative to the time the test was conducted.

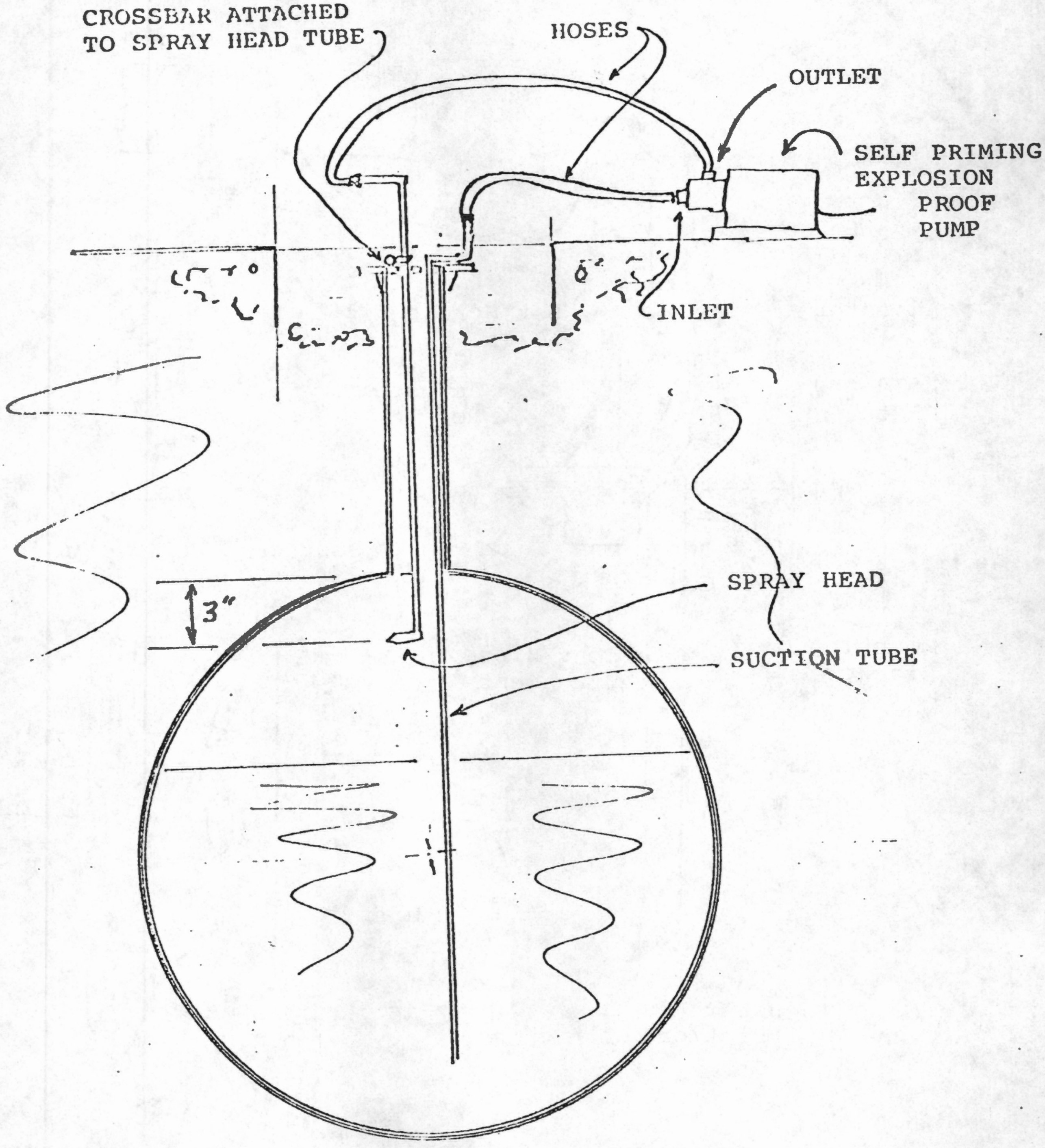

CROSSBAR ATTACHED
TO SPRAY HEAD TUBE
HOSES
OUTLET
SELF PRIMING
EXPLOSION
PROOF
PUMP
INLET
3"
SPRAY HEAD
SUCTION TUBE

FIGURE 2

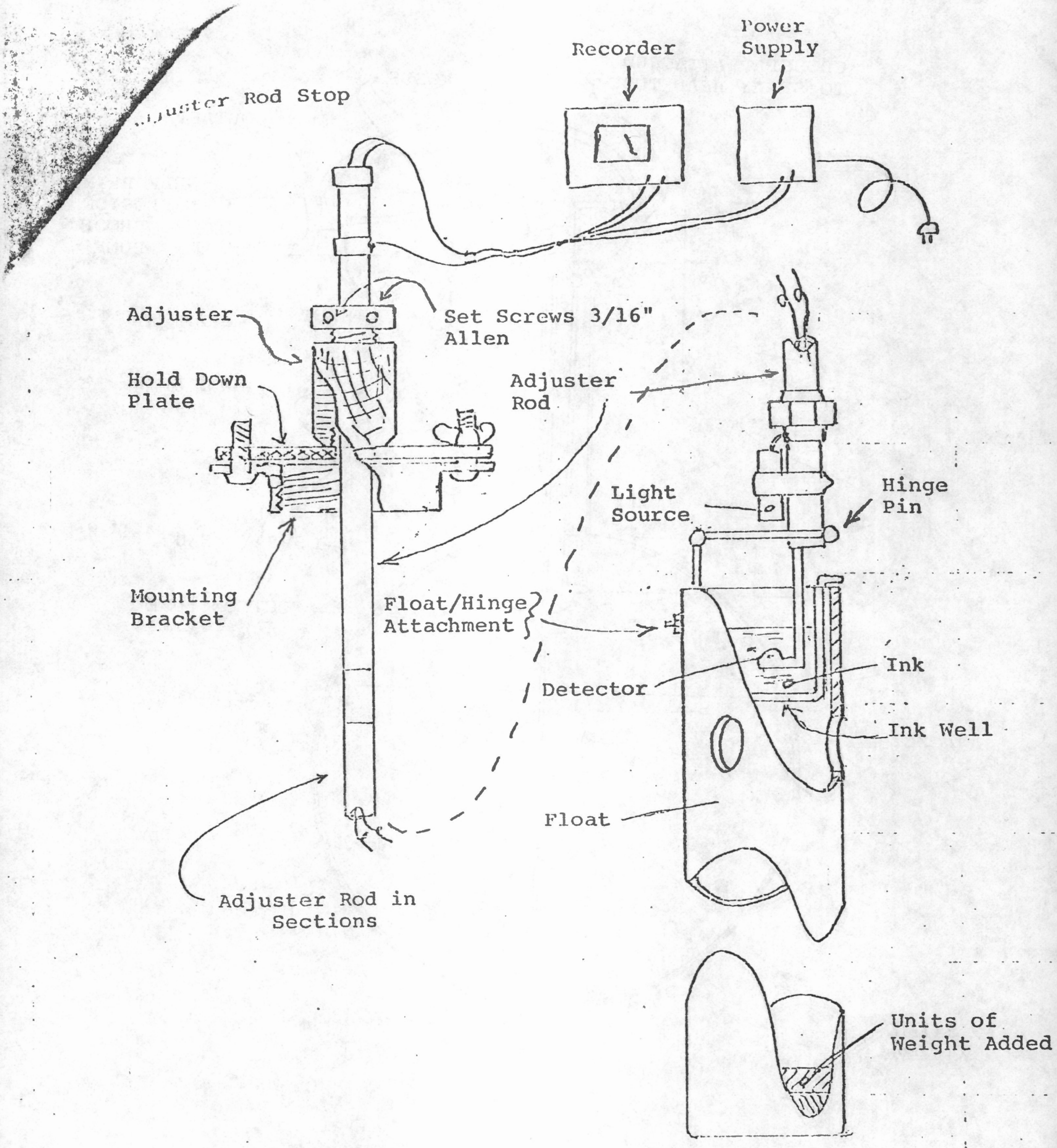


FIGURE 3: DETAILS OF ARCO LEAK DETECTOR

EMHART
ELECTRICAL/ELECTRONIC GROUP

POLLULERT SYSTEMS
MALLORY COMPONENTS GROUP

MALLORY

HUGH M. PETERS
Director, Pollulert™ Detection Systems

March 17, 1982

MAR 22 1982

Mr. Raymond J. Lesniak
Assemblyman
District 21 (Union-Middlesex)
60 Prince Street
Elizabeth, NJ 07202

Dear Assemblyman Lesniak,

The purpose of this letter and its various enclosures is to officially inform you of our product, the Pollulert detection system, which provides early warning in the event of leaks and spills of hydrocarbons and other liquid hazardous materials. Mallory has spent a number of years in the development of this product which has now been field tested for over three years. To our knowledge there does not exist a more efficient, low cost method of leak detection in the world market today.

I commend you and your Committee on Agriculture and Environment for addressing the problem of underground gasoline storage tank leak detection. As we have been intimately involved with this ever increasing problem, I should like to convey our findings as they may be useful to you and your Committee.

The State of New Jersey has recognized that many underground storage facilities have reached or surpassed their useful life and that some measure of protection against their inevitable demise is required. The problem however, is not just with old tanks but can relate as well to new installations which are subject to human error at the time of installation such as defective materials, improper installation, and lack of consideration to various hydrological influences which vary significantly depending upon the location of the installation.

At the time that Mallory undertook the feasibility of developing this product it was determined that industry and governments at all levels would eventually require a low cost, highly efficient early warning system. Mallory has designed to this criteria and priced its product so as not to force companies out of business. Our systems have been installed at a wide range of applications covering not only gas stations but other bulk storage facilities covering a customer base which is indeed many and varied. I am including a partial listing of our installations across the country.

The concept of "out of sight, out of mind" is no longer valid, as your committee has recognized, and the very fact that more than 65% of all underground tanks in the United States are more than 10 years old serves as witness to the fact that the potential for larger numbers of leaks is very real. In addition, various additives developed over the last few years to gasoline of all types have accelerated the rate of corrosion in a number of containment vessels.

Further, the problem is not just the tanks themselves but relates to valves fittings, transfer pipes, as well as pumps. It is our understanding that the petroleum industry has determined that the best method for determining product loss is by the strict adherence to accurate daily inventory control. It is not our intention to beride inventory control techniques, but out of necessity we must realize the limitations which are inherent with this approach. Firstly major oil companies have advocated strict inventory control for a number of years. The responsibility falls on the station operator and/or his employee which can lead to improper data gathering, laziness, and irregular accounting. Further many oil companies have built into their inventory control systems a plus or minus 2% factor which allows for expansion coefficients, theft, spillage, etc. A 1% miscalculation over the period of a year at a gas station that pumps over 100,000 gallons of product per month would result in a minimum of 12,000 gallons of lost product which could leak and therefore go undetected until it appears in municipal water supplies, underground aquifiers, or the like. A 1/8 inch hole in the tank would accumulate over 100,000 gallons of product in the course of the year. Further there is documented evidence of cases where strict inventory control techniques have been employed by use of a dipstick, but that the continued pressures created with this dipstick have eventually generated a hole in the bottom of the tank. Even required tank testing is not an answer to the problem as it is a one time test and leaks and spills can be created shortly after the test has been completed.

The short of it all is that there does not exist a fool-proof method to insure against leaks and spills in underground tanks. This is why we have developed our low cost, electronic monitoring system: to provide early warning in the event of such leaks and spills.

As you are probably aware, a number of municipalities in the northeast have adopted requirements for electronic monitoring of all underground stroage tanks. To our knowledge, the enforcement of these regulations has not caused any single business entity to cease operations. The typical gas station can be protected at a cost of approximately $6,000 or less. Several major oil companies have begun to realize the inevitability of legislation and are requiring the installation of monitoring wells at the time of new construction or at the time of tank replacement at their gas stations around the country. Installing monitoring wells at that time reduces this cost impact even further. Major oil companies are also dealing with the problem of the high cost of spill clean up and more importantly the liability created in the event of contamination of water supplies, etc. Such a circumstance has forced the insurance industry to deal with this inevitable high cost risk which is further justification of the need for continuous electronic monitoring. Accordingly, in many cases the installation of this type of equipment can lead to significant reductions in liability insurance premiums which serves to cost justify the installation.

I feel that the goals of your Committee are consistent with the design of our product. I believe your desire is to effect maximum protection at the lowest possible cost and to our knowledge there doesnot exist a more reliable, lower cost method in the world market today.

The development of this product has been made possible by the ever expanding capabilities of microprocessor technology. Accordingly our systems not only provide early warning capabilities, but can effect counter-measure actions automatically. Examples of this would be to generate an alarm at a remote location, activate telephone dialing systems, turn on or off recovery pumps, etc. These are standard features within our product, as described in the enclosed bulletin and do not add to the cost of the basic system. In total, devices such as this can provide for reduced costs to the user, can reduce insurance premium payments and, most importantly, provide a full measure of protection to the state of New Jersey without placing undue financial burden on industry. I trust that this information has been helpful and I stand ready to provide further inputs to you and your Committee at your convenience.

Very truly yours,

Hugh M. Peters

HMP:cm
Enclosure

cc: D. McClain
G. Cirangle

2/15/82

'Leaker' threat grows as oil, gas tanks age

Photo by Richard Raske

Workmen inspect the scene of a gasoline spill along the shore of Budd Lake in Mount Olive

By RICHARD S. REMINGTON

When the new proprietors of a Lake Hopatcong bar opened for business a few years ago, they decided to mark the occasion with an opening-night party for their neighborhood friends.

As the festivities were livening up, a series of strange events began that was to make the evening memorable for reasons other than the grand opening.

The bartenders, as they mixed drinks, started noticing gasoline, rather than water, coming out of the taps. When the patrons visited the bathrooms, they were startled to find toilets that flushed gasoline.

And, upstairs, where the proprietors lived, the wife of the bar owner was halfway through a shower when she was suddenly doused with gasoline.

Fortunately, the evening's bizarre events did not result in tragedy. However, they did demonstrate the consequences of a growing problem, not only in New Jersey, but across the nation.

The problem involves "leakers" — underground gasoline storage tanks which have spilled their contents into the surrounding soil and groundwater.

While such tanks are identified primarily with service stations, they can also be found beneath fire stations, stores and private homes. Their contents can include automobile gasoline or fuel oil.

"Leakers" have forced evacuations of apartment buildings when vapors from leaked gasoline created the threat of an explosion. Many private wells have been rendered useless when gasoline, which includes the cancer-causing agent benzene, have seeped into the water.

The most-publicized "leaker" occurred in 1978 in East Meadow, N.Y., when an estimated 30,000 gallons of gasoline traced to an Exxon station forced the evacuation of 25 homes. Exxon eventually bought 23 of the homes and paid for the living expenses of 27 displaced

(Please turn to Page 6)

'Leaker' threat grows as oil, gas tanks age

families.

In New Jersey, the Shell Oil Co. has spent more than $400,000 to remove ethers associated with gasoline from Rockaway Township's public wells. Shell, which has never claimed responsibility for the contamination, started financing the water purification project a year after 700 gallons of gasoline were reported missing from an interstate Shell station in the township.

In nearby Mt. Olive, work crews have labored to clean up a major gasoline spill into Budd Lake at a Town & Country service station on Route 46.

The two spills are among dozens reported daily to the state Department of Environmental Protection's (DEP) Division of Hazard Management. A sudden flurry of reports of gasoline tank leaks last week prompted Thomas Allen, chief of the DEP's Bureau of Emergency Response, to order that statistics be kept of the incidents.

As explained by environmental and oil industry officials, gasoline leaks usually result from corrosion of steel storage tanks which have an average life of 16 to 20 years. Many of the tanks were installed during a service station construction boom following World War II and are starting to fail in large numbers.

The steel tanks invariably are replaced with fiberglass models or fiberglass-lined steel models which are resistent to corrosion. A major producer of the new tanks, Owens-Corning Fiberglass Inc. of Toledo, has constructed a new plant on the West Coast and has retooled a Houston plant to meet the heavy demand from oil companies, said George Hammond, a corporation spokesman.

Hammond said virtually every major oil company has embarked on a major replacement program.

"The major oil companies have made the decision that, over the next few years, all of their older steel tanks will have the possibility of leaking," Hammond said. "The consequences today are quite severe.

"Most of them had concentrated on Long Island first. Now you'll see a lot more activity in New Jersey."

Hammond said approximately 800 to 1,000 new Owens-Corning storage tanks were installed last year in Nassau and Suffolk counties on Long Island. The tanks, which cost from $4,500 to $5,500, are warranted by the company for 30 years.

Hammond said tanks are being replaced first in areas with highly corrosive conditions. "In the less corrosive areas, they'll get them in the next five to 10 years," he said.

Long Island and Massachusetts have devised the most stringent regulations in the United States for storage tanks, he added.

Nassau County on Long Island set up a specific timetable for replacement of steel tanks and required that all replacement tanks be made of corrosion-resistant materials, said John Sorgel, the county's assistant fire marshall.

In addition, all new tanks must be registered with the county, Sorgel said.

"The control over it is getting much better," Sorgel said. "We have a pretty good idea how many tanks there are."

Donald Middleton, Long Island director of the New York Department of Environmental Conservation, said his office has the power to fine violators up to $10,000 a day, but rarely uses the authority. "Generally, we're after cleanup, rather than vengeance, if you will," he said.

Contacted last week, Middleton said his office was directing 78 separate gasoline recovery operations in the two Long Island counties.

In New Jersey, attempts made in the Legislature to require replacement of steel tanks did not progress far, according to DEP officials.

The DEP's authority to deal with "leakers" is embodied in the 1977 Spill Compensation and Control Act, which allows fines up to $25,000 a day, said Paul Giardana, director of the Division of Hazard Management.

Allen, who heads a staff of eight investigators in the DEP's Emergency Response Bureau, said "leakers" are among the most difficult of hazardous discharges to investigate.

"There are just so many uncertainties because they can't be seen with the eye," Allen said. "A report of missing gasoline often turns out to be an accounting error.

"When an oil company has reason to believe they have lost product (gasoline), their legal obligation begins to inform us," Allen said.

From that point, expensive tests must be performed to determine the source and extent of the leakage. Such tests range from drilling monitoring wells to conducting hydrological surveys and can cost thousands of dollars daily.

The question of who is to pick up such costs produces a different answer with almost every "leaker," Allen said.

"You'll approach an oil company and some will give you absolutely zero in trying to solve the problem," he said. "Others you can't thank enough.

"Sometimes I go to company 'x' and say, 'You're the only ones nearby and I think you're leaking product into wells.' They say, 'Fine, prove it.' That's when you talk time and money.

"Other times, you approach a service station and they'll say, 'We don't think it's us, but we'll be a good neighbor and conduct some tests'," Allen added.

"Overall, most are cooperative," he said. "Most are very, very reluctant to spend the money, but you have to understand their position.

"No one really wants to accept liability."

Exxon Corp. instituted a detection and prevention program in the early 1970s to minimize the occurrence of "leakers," said Jack McDonell, a corporate spokesman in Florham Park. As part of the detection program, inventory checks of the tanks in company-owned stations are required daily, he said.

McDonnell noted that on Long Island, Exxon has renovated many of the 23 homes it purchased after the 1978 East Meadow gasoline leak and has already placed four on the market. The owners of the other two homes moved back in after renovations were completed.

Mobil Corp. is in the final year of a four-year program of testing tanks and replacing those it finds deficient, said Greg LaBrache, a corporate spokesman.

"We determine what tanks to test using criteria on age, how long they've been in the ground and the corrosiveness of the area," he said. "If we find a leak, we replace it with a fiberglass tank."

In the meantime, LaBrache said, Mobil is working with the American Petroleum Institute in a study program to determine a threshold level for benzene. The study coincides with one being performed by the federal Environmental Protection Agency (EPA) which is to produce a recommended standard for the chemical this summer, said Richard Cahill, a spokesman in EPA's New York regional office.

The New Jersey Gasoline Retailers Association, which represents 3,000 of the state's 4,800 gasoline retailers, constantly urges its members to keep close inventory checks on their tanks to make sure they are not losing gasoline, said Jerry Ferrara, association director.

Ferrara said service station owners are becoming more receptive to the idea of maintaining close inventory checks because of the high cost of gasoline.

The DEP's Allen, however, was more critical of service station owners.

"I hate to say it, but from my experience, I can't visualize service station owners as true businessmen, such as the guy who runs the local grocery store," Allen said. "Many service stations don't stick (inventory) their tanks.

"There have been inventory audits when people have come in to look at the books and the books don't exist," he said.

Other problems confronted by the DEP include abandoned tanks beneath former gasoline stations, backyard gasoline tanks and fuel oil tanks at private homes, Allen added.

"Homeowners will call and say their well smells like fuel oil. After an investigation, we'll say, guess what, it's your tank. Or worse yet, it's your neighbor's tank."

Hammond said Owens-Corning anticipates heavy demand in the future for fiberglass fuel oil tanks.

2

Gasoline 'leakers' targeted

By RICHARD S. REMINGTON

Legislative remedies to prevent public health and safety hazards created by leaking gasoline storage tanks will be the subject of a March 4 public hearing scheduled by the Assembly Agriculture and Environment Committee.

Assemblyman Raymond Lesniak (D-Union), the committee chairman, said yesterday he is considering drafting legislation that would require replacement of steel tanks with corrosion-resistant fiberglass tanks.

Many oil companies are in the process of such replacement programs on a nationwide basis. Some have required their service station owners to closely inventory their gasoline supplies to detect faulty tanks, called "leakers."

Several incidents have been reported in New Jersey of forced evacuations of apartment buildings when gasoline vapors from "leakers" were detected in basement areas. Also, many wells have had to be closed when gasoline, which includes the carcinogen benzene, was discovered in the water.

In considering legislation to deal with "leakers," Lesniak said he will look at standards for the design and installation of the storage tanks. Also to be considered, he said, would be state requirements that close inventory records be kept of gasoline supplies in storage tanks.

The legislation would include authority by the state to impose fines, Lesniak said.

"We're in no position to draft anything now until we hear testimony from the industries and commercial establishments involved," Lesniak said. "We would not and could not do anything that would be impossible for them to implement."

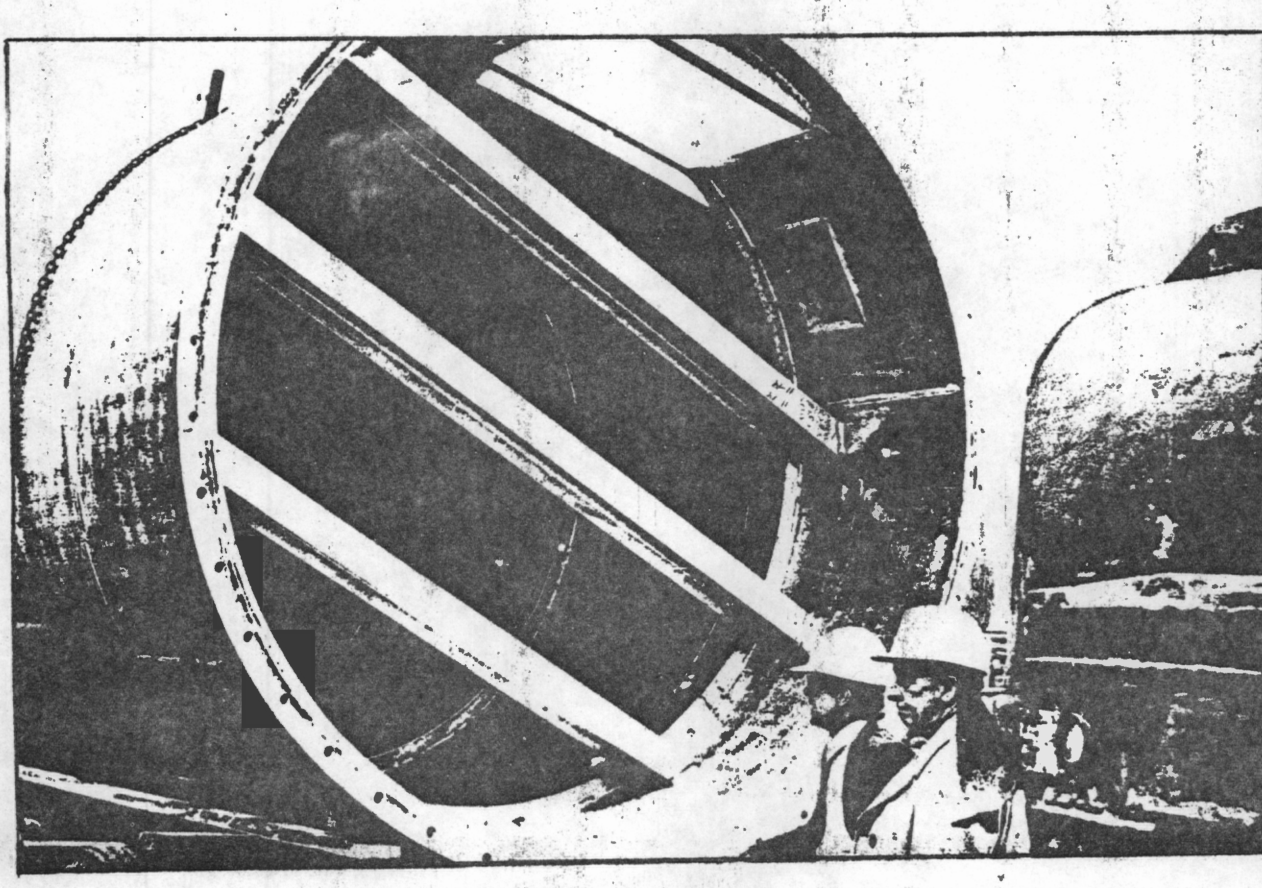
The purpose of any new state regulations would be to "avoid this particular type of contamination before it happens," he added. "If we leave it to the people involved (in private industry) to do it without government action, I don't believe it will be done as quickly as it should."

Lesniak said he believes violators who are found to be liable for a spill, but who take no action to clean up the contamination, should be subject to treble damages.

The assemblyman said he is reviewing an ordinance adopted by Nassau County on Long Island that established a specific timetable for the replacement of steel tanks with fiberglass tanks.

POLLUTION IN MUNICIPAL WATER:
A CONTINUING ODYSSEY

BY: WILLIAM E. BISHOP
MAYOR, TOWNSHIP OF ROCKAWAY



AT - "GROUNDWATER INFORMATION FORUM"
HELD - SEPTEMBER 25, 1981 - CHERRY HILL, N.J.
BY AMERICAN GROUNDWATER ASSOCIATION

POLLUTION IN MUNICIPAL WATER:
A CONTINUING ODYSSEY

BY: WILLIAM E. BISHOP
MAYOR, TOWNSHIP OF ROCKAWAY

AT - "GROUNDWATER INFORMATION FORUM"
HELD - SEPTEMBER 25, 1981 - CHERRY HILL, N.J.
BY AMERICAN GROUNDWATER ASSOCIATION

Some scant twelve hours into his first term of office, the Mayor of Rockaway Township was informed by his Director of Health that the township water system was poisoned. Specifically, the incidence of Trichloroethylene had been confirmed in amounts of two or three times that of the highest levels allowed by the New Jersey Department of Environmental Protection.

Frankly, the Mayor didn't, then, know the difference between Trichloroethylene and an advanced case of rickets. His director explained that Trichloroethylene was believed to be a carcinogen, was non-biodegradable and could travel in ground water for miles. It came from a source which was probably abundant, could continue in the water for years, if not decades and in any event rendered the supply, if untreated, unusable for potable purposes. When the director had finished, the Mayor, indeed, began to understand the difference between Trichloroethylene and rickets.

It occurs to me now, that the most immediately tragic fact about those revelations was that the Mayor of Rockaway Township - was me. At first blush this statement may seem self-pitying or at best, a bit maudlin around the edges. But, maybe the experiences of the Mayor really are the stuff of a Corpus Everyman. The Mayor was and is a user of that water supply, a taxpayer and with the veneer stripped away, a quite ordinary husband, father and homeowner with ordinary desiderata. Desiderata is the Portugese for those things most fervently wished for, most intensely desired and most intimately needed.

But, lets pause a bit here, and set a base of reference.

Rockaway Township is a comparatively large municipality in north central New Jersey, about forty five square miles in size. Shaped somewhat like a lazy football with bumps, it is located on the map of New Jersey, in a northeast - southwesterly direction. It has, more than a fair share of mountains, lakes, streams, forests and tilled fields. It is intersected in the south by Interstate - 80 and U.S. 46, bordered on the west by U.S. 15 and on the north by Route 23. Its area is served internally by about 114 miles of streets and roads.

Its population is about twenty thousand and two-thirds of the people live in the south-western half of its area. Rockaway Township is a largely middle class society. Its residents, for the most part, are employed elsewhere. One lake community houses about 48 percent of all residents, with the remaining divided among eight to ten identifiable, fairly closely knit, but different, communities. Thus, overall homogeneity is almost nonexistent.

Politicllly, its voters are about three to two, Democratic. They traditionally produce a rather high voter registration and turnout, and maintain an extensive quantity and quality of political awareness and involvement.

The Township's government is classified as Faulkner - Style "F". This is a full, three branch form with clear and distinct separation of powers. Although placed in the strong - Mayor group of Faulkner forms, its legislative body, a Council of nine members, commands a very respectable amount of power through its budget appropriation prerogatives. It is a partisan form, and the party affiliation of the Council opposes that of the Mayor by a two to one ratio. Rockaway's operating budget is about seven million dollars exclusive of the school budget, but including its water utility. Its revenue is raised from 5,828 residential properties and some 62 commercial enterprises of varying sizes.

Locale of the continent's oldest magnitite iron mine site, Rockaway Township emerges from a history of mining and agriculture. Its existing commercial interests use about Three percent of its land area and contribute about 32 percent of its total general tax revenue.

The provision of potable water for the Township is accomplished in four basic ways.

First and most extensive is the Rockaway Township Water Company itself. Serving about three thousand customers, 11,000 people, it derives its water from three municipal wells. These wells are located on a plain, the altitude of which is among the Township's lowest, and are situated in a straight line approximately 80 feet apart. Their depths range from about 150 feet to 163 feet and reach almost to bedrock in the aquifer. This aquifer, named the Beaver Brook Aquifer, is extremely productive. It is very large, fairly well defined, serves at least six municipalities and is of near textbook formation throughout most of its definition. As it passes, running roughly athwart the line of Township wells, its normal movement is towards the south at a probable rate of four to five inches per day. The wells, numbered 7,4 and 6 from northeast to southwest, can pump 990, 500 and 650 gpm respectively. Demand runs from about 1 million gpd in winter to 1.5 million gpd during summer peak use. The system serves roughly three stages in altitude from five storage tanks and develops 110 psi at the well head. It has a booster station at the middle stage.

The second method, really an adjunct of the first, is a pumping station which draws, in normal times, some 250 to 300 thousand gpd into the system from neighboring Rockaway Borough. This station lies about a mile from the well field.

The third and most confused method of distribution is accomplished by the simple extension of the Dover municipal system and the Rockaway Borough municipal system to serve users located within the political boundries of Rockaway Township.

Finally, the remainder of the residential and commercial users are served by individual private wells.

Against this background, then, consider the onslaught.

During the waning days of 1979, the Director of Health, in a supremely confident wish to demonstrate that Rockaway Township's water, save for iron, was pure and pristine, subjected it to a gas chromatography test. Some disturbing unknowns showed, and to allay his dawning suspicions, he further subjected samples to mass spectrometry. The resultant readouts rendered a death blow to his supreme confidence. A few days later, Trichlorethylene was confirmed at 280 parts per billion.

Our first reaction was to try to determine just what TCE is. Who manufactured it? Why? In what products might it be found? Where? Who stored it? How? What were its properties? Could it be neutralized? Could it be separated from the water? How? Under what circumstances? At what cost? What were its effects on the human organism? What effects, short-term? What effects long-term? In what quantities was it harmful? Lethal? What did it do to the healthy person? To the less than healthy? We attempted to find answers to these questions and many more. Parenthetically, I sometimes feel that the first thing we should have done was to stop and take a short course on the use of initials. TCE, PCE, MTBE, DIPE, CHC, GAC, PUC, DEP, ACTD, EPA, EMO, DLGS and later CBS, NBC and ABC, to mention just a few.

One thing, though, became swiftly and disconcertingly clear. Too many authorities had no answers or conflicting answers to too many very critical questions. For instance, to the question "What is the very top number, in parts per billion, allowed for safe potable water"? the answer came from EPA, "Probably 100, but maybe 35 and we're looking at 5." DEP informed us that we could use a working 100, but to keep a close eye on EPA. We found that by going down the row of books on the subject at a good library, we could arrive at just about any conclusion which felt comfortable to us at the time. It was like playing in a ball game with timid umpires in which the rules changed during the second inning, the third frame and the fourth quarter.

To further exacerbate an already almost impossible situation, in October of 1980, two more volatile organics became manifest in our system. They were first listed as "unknowns' and were later confirmed as Methyl tertiary butyl ether and Di isopropyl ether at counts of 70 ppb cumulatively. But these two offenders brought an added dimension. TCE might be killing us in ways that were tasteless, odorless and colorless; but the ethers tasted and smelled lethel. Now the entire public became aware, and reacted. For the administration, the myriad of questions commenced all over again.

We found that although studies were scant and no one, superagencies or otherwise, had many sure answers; the ethers in and of themselves were probably not hazardous at those counts. Interestingly enough, the silhouette of their effects on the central nervous system were almost identical to that of good bourbon. Indeed, our Water Operator suggested we institute a rate surcharge, asking where else could a man get a free high with his morning shower.

The most ominous unanswered question, though, was what were the health effects which might derive from the combination of the two ethers with Trichloroethylene.

The oracles tell us that the gods visit tragedy on us mere mortals in groups of three. The third visitation of our tragic trilogy occurred when Rockaway Borough was struck by their own special bolt of lightning. In December of 1980, Rockaway Borough Officials informed us that tests had confirmed Tetrachloroethylene in their supply in unacceptable amounts. We ceased pumping from that source forthwith.

The knowledge of the advent of pollutants, however, was only the beginning of the whole problem. More accurately, it was the first of a continuing series of problems.

Very early on, we were faced with the need to make a very painful, precedent setting decision. We had to decide whether or not to be totally open and forthcoming with our residents. It was not a decision which could be stalled. Deferment itself was a kind of secrecy.

Make no mistake, there were good and sound reasons for secrecy. The first was, very simply, panic. On the heels of all the media rumblings of Three Mile Island, Agent Orange and acid rain, all in somebody else's front yard, what would the reaction be to the disclosure of three pollutants in our own? Second was our concern with levels of real estate sales in an already tough, buyer's market and with impairment of the ability to attract new commercial, industrial and housing ratables. Finally, we were warned by our financial wizards, that although our rating was excellent, the sales of our bonds could be very adversely affected. Anyway, we were advised, no water company, public or private, historically trumpets its troubles to the winds. The old politicos sagely whispered that it was foolish to reveal serious problems until and unless we could furnish cheap easy solutions.

We knew that because of the two-to-one stack of legislative officials vs. the Mayor, certain members of the Council could be depended upon to oppose, just for the sake of opposition. Instinctively, we felt that in something this big and long-lived, there had to be sometime, somewhere in the process, at least a certain amount of trust in leadership. If that trust was as fragile as the media led us to believe, then irresponsible and unfounded opposition could produce chaos.

Contrary to all this was the almost overpowering right and need of the public to know. The assumption that we could act as some vague, nebulous, surrogate conscience was at worst, malevolent and at best, sophistry.

To this point, I have listed our problems as though they occurred in a rapid fire manner. Of course they did not and as the first appeared we took steps to meet it. As each new problem struck, we expanded or modified our efforts as best we could.

Before dealing with solutions, however, let's consider available resources, particularly as they obtained at the outset.

Although we were and are a small town, we were blessed with extraordinary department staffs. Due to a long and complicated set of events and circumstances our department heads including Health, Engineering, Public Works, Finance, Administration and Emergency Management were all very superior in credentials and experience and were quite simply bereft of mediocrity. Serving each of these men was a staff which was a reflection in quality of himself. Clearly, then, although we might have suffered at times for lack of numbers, excellence abounded. In truth it would require hours to relate just a portion of some of the astounding things they achieved. It was and is this excellence which largely explains Rockaway's success in the tribulations which followed.

From a financial standpoint our resources in the fourth year of cap budgetry were limited.

Perhaps it would help at this point to explain the use of the term, "cap budgetry." Very simply it means that, by state mandate, no municipality may increase its operating expenditures over that of the preceding year by more than approximately five percent. This is New Jersey's "me too" answer to California's Proposition 13. The first year or so it could be managed. But, by the fourth year, and with double digit inflation, municipal budgetry had become a constant juggling act. Whatever solutions were to be effected, had to be squeezed into cap constrictions.

I would be remiss in failing to recognize that, although we did not realize it then, another very valid resource was our responsible, concerned private citizens. We could not have managed without them.

From this base of resources, then, we began in early '80 to address our problems.

One thing we did right and from the beginning. That was to resist the siren song of litigation. It's an old rule. If a public official seeks instant regard and voter attention he need only threaten, long and loudly, to sue the perceived enemies of his constituency. The bigger the enemy, the more heroic the rhetoric appears.

The hard facts of life are that good attorneys are expensive, experts are exorbitant and the courts, slow as they are, tend not to share automatically the official's necessarily subjective view of the issue. Further, unless a plume is traced to a polluter, there is seldom a real case to be made. We found early that the fine art of plume-tracing is new, often inexact and can run into hundreds of thousands of dollars. Certainly the steps we took were completely documented and done with the kind of attention to detail that would give them the weight of evidence, should litigation finally become necessary. But litigation as a concept had to be considered a last option.

We consciously made another decision, both right and early. Rockaway Township did not sit with arms folded waiting for the super agencies, whether in Morristown, Trenton or Washington to come extricate us from our predicament. EPA had its own problems, much greater in scope than ours and as in many government agencies, they were seriously short of detachable personnel. DEP was engaged in its own third world war. New Jersey was just swinging into its worst drought in fifteen years and maybe in the century, and almost the entire brunt of fighting that battle fell on DEP. The County Board of Chosen Freeholders was prepared, neither by design nor nature to be of any real, substantive assistance.

This is not to say that these agencies were useless; especially in the case of DEP, but they took so long, so very long.

Regarding TCE, our first counter attack in January 198C was made on two fronts. We commenced looking for a second water ource and immediately began a library/field study of all substances used, past and present, by all the industries surrounding our well field. That's right, our well field sits plop in the middle of our largest industrial zone and only twelve hundred feet from that of our sister town, Denville. (Oh! the marvels of midcentury planning!)

At this point we determined that the swiftest probable method of relief was to pipe water from the nearest technically feasible point of the distribution system of next-door Dover. Dover, alone of our neighbors, could produce water far in excess of their own greatest conceivable needs. Dover's water commission was overjoyed. They liked the idea of added income, and began their part of the necessary engineering studies.

Dover's governing body, however, said no. Time doesn't permit going through their reasons for refusal. Suffice it to say that the kindest explanation possible would have to include the word "bizarre".

Of course, we could always develop a second well field. Although we retained Gerhety and Miller to commence a full geohydrological exploration, we knew we couldn't wait for that exhaustive process to be completed. Frankly, I myself made some optimistic noises about willow forks and water diviners, but no one seemed to be listening.

Even as we warred with Dover, and watched our experts gear up for exploration, we didn't wait. Our Health Director and Water Operator discovered that by pumping from only well number 7 into our system and pumping from number 6 onto the ground, the counts of TCE in our system dropped to a technical zero. As we proved to a skeptical DEP, by aborting with 6 we were intercepting the plume and keeping 7 clean. The abundance of our aquifer permitted full capacity pumping without serious draw down.

True, we were pumping TCE laden water into Beaver Brook. Beaver Brook empties into the Rockaway River, Rockaway River into the Boonton Reservoir and Boonton Reservoir into the taps of Jersey City. Epually true, EPA, DEP and PUC were all very unhappy therewith. But since we were pumping at high pressure into a splash board, thus rendering the counts to zero some eighty feet downstream, we were tacitly allowed to continue.

With the breathing spell afforded us by this practice of interception, we looked carefully at our remaining options.

These were aeration, air stripping and filtration.

Aeration was rejected when we learned that the only comparable systerm we could find had at least three drawbacks. First, it required a great deal of space. Obviously the space needed was simply not available near our well field and at a reasonable dollar amount. Second, it required redevelopment of head (pressure) to transport water to the system's upper levels. Finally, the act of transference of TCE to another part of our environment, rather than true disposal, raised a nagging question of morality. We were already guilty of this with interception.

Air stripping involved all the other drawbacks contained in aeration, except space, and it was even less proven.

Filtration remained as the only feasible alternative. As late as June, the Feds had strongly suggested granular activated carbon. (Federal Register, Vol. 45, No. 127. Dated 6/30/80) Armed with an ever growing list of criteria, we considered an extensive collection of filtration combinations, agents, processes and vendors.

Some of that criteria, I believe, merits mention. To be safe, we set for ourselves a target level of less than five ppb TCE. We wanted to try a pilot project before committing to a system which might have to serve for decades. We were very concerned with how the used filter agent would be disposed of. By definition in the Federal cradle-to-grave laws, we were passers, if not producers, of a controlled dangerous waste substance.

A very thorough job of research by our Health and Engineering staffs produced the choice of carbon as the most suitable agent. It indicated Calgon of Pittsburgh as the vendor most suited to supply our unique needs. We then contacted that vendor and began negotiations for the installation of a portable pilot vehicle.

Here, we collided with a recalcitrant Council. They were dubious. They questioned the gravity of our situation. After all nobody tasted, smelled or saw beasties in the water. There was no great outcry from citizens. Nobody was suing us, or had died - yet.

They sagely counselled patience and more debate. (Again the word bizarre aches to get in at this point) It is unworthy, though, to omit the fact that a minority honestly wanted to move ahead.

Despite this, we proceeded with arrangements for a pilot project.

Meanwhile our library/field study of substances used by industries was going well. We discovered that a manufacturer named Keuffel and Esser had stored TCE in underground facilities in the past. Although they no longer did so, had emptied and cleaned those tanks and strongly protested their innocence, we felt we had at last found the source.

Finding a source and proving it, we discovered, are two different entities. The cost of tracing a pollutant plume from our wells to their abandoned tank was variously estimated at from fifty to one hundred and fifty thousand dollars - maybe. Nothing short of a sufficient number of evidentiary quality test wells would prove anything. We were at a point of "put up or shut up".

We did neither. Instead, we sat down and quietly, reasonably, negotiated. These negotiations resulted in the following bargain. K&E would finance the test wells if we would agree not to publicly implicate K&E until the plume either led to them or went elsewhere. If the pollution was proven theirs, we would wait until they had begun to right their wrong before we named them. If not, we would lend any help we could to extol their good citizenship and recognize their contribution. It may not seem to be much of a bargain for K&E, but for a company which intended to remain in our Township - what price innocence? Some weeks and a few test wells later it became obvious that the plume traced away from K&E and toward the Denville-Rockaway Township border. "Though innocent, you've gone this far", we suggested, "take it to the line." They did. We were grateful.

In all conscience, I must pause here and state flatly that had not Keuffel and Esser honestly desired to be honorable and morally responsible, none of this could have succeeded. We are indeed profoundly grateful.

The plume ended at the Township line. Having no jurisdiction outside Rockaway Township, we couldn't proceed officially. Nonetheless , by initiatives which will remain unarticulated at this point, we learned that the polluter could be identified as an industrial concern which had formerly used great amounts of TCE. That potential source lies about 1200 feet in a southeasterly direction from the well field. DEP has now assumed the plumetracing chores requisite thereto.

This set of circumstances obtained until late September 1980, at which point our Water Project Officer began checking reports of a peculiar taste and odor in Township water.

On the morning of October 9th, the presence of the first of two ethers was confirmed in well number 7, with the second ether following closely behind. That afternoon we declared a civil emergency and called the Council into emergency session for 8 o'clock the following evening.

During that session we brought the Council up to date on the latest developments and recommended that they immediately bond the necessary monies to purchase and put on line, two Granular Activated Carbon devices complete with the required plumbing, metering, pad, housing and carbon agent. At 8:46 p.m. that evening they passed that emergency bond unanimously and 18 minutes later we placed the order to Calgon.

In a period of thirty-five hours and four minutes we had declared a civil emergency, obtained official definition and sanction from the state, written all legal paper, specified two very complicated devices, convened the legislative body, obtained the desired ordinances and ordered our GAC's from the vendor.

I have come to believe that if philosophy could somehow be preached with an accompanying inglorious taste and odor, everybody would get religion.

For a period of 27 days thereafter we suggested, by an all-utility mailing, that users employ prudence in drinking the water.

During that 27 day period Rockaway Township personnel prepared the ground; designed, set and erected the piers; installed the required plumbing; received, set and connected the GAC's; purged the water system and informed the public that the water was safe to drink. When I state that Township personnel did those things, I mean it quite literally.

It was a sight to behold. Mild-mannered engineering assistants became roaring, cursing, rigging bosses. Draftsmen became pier designers and water operating assistants, concrete experts. Road workers became transportation engineers. Water operators became geohydrologists, sanitarians, scientists and everybody was a lawyer. The Mayor marveled and prayed a great deal.

Central to that success story was the superb job done by the vendor. Their response, in giving advice, expertise, physical help in the provision and installation of the GAC's and emplacement of carbon exceeded our highest expectations.

Now we had drinkable water again. We stopped aborting from well 6 and began looking for the source of the ethers.

A few weeks later we found that a petroleum interest located some 1100 feet southwest of the wells had experienced an underground spill months earlier. Among the constituents of that spill were, among other things, Di isopropyl ether and Methyl tertiary butyl ether.

For talking purposes, I refer hereinafter to this suspected polluter as XYZ Inc.

We contacted officials of XYZ Inc. and commenced face to face negotiations. Our approach was much the same as with K&E but with this difference. Since XYZ is a massive, international firm, and since taste and odor control requires more frequent changes of carbon, we bargained with arguments more performance oriented that moral.

"The plain fact" we said, "is that Rockaway Township is cleaning up, with the surest method we can find, your spill." We submitted that we should be paid for that very costly service rendered. More specifically, we stated that if XYZ agreed , we wanted payment for the following. We wanted XYZ to pay the difference between $290.00 and the actual production cost of each million gallons of potable, aesthetically acceptable water produced by Rockaway Township from October 9, 1980 until such time as costs return to $290.00. (Periodically adjusted for inflation) Immediately, though, we wanted XYZ to pay for all carbon changes until such time as.....

Some 12 test wells, three carbon loads, a proposed GAC booster device and many many dollars later - all financed by XYZ - we are on the verge of striking a permanent bargain. When that occurs, we will no longer refer to them as XYZ.

It is incumbant upon me, I believe, to deal briefly with the very able assistance volunteered us by many of our private citizens. When the initial shock wore off, many ordinary residents came forward with, at times, extraordinary help. There were many, but six people especially merit individual comment.

One man, a chemistry expert for a central New Jersey firm, all but took up residence with us during the most trying, decision making times. At several points, for example, he did a swifter surer job of diagnosis than some of the best labs in North Jersey. He has been and remains a better consultant than we could buy anywhere. Why better? Because in addition to expertise, he brings deep concern.

One woman, a homemaker and mother, became enraged at the cavalier manner in which a national TV network was handling our story. She took on the giant. She waged a campaign which resulted in two programs which were nearer to the heart of truth. Appearing on one, she urged others to be open, aware and dedicated, then proceeded to follow her own advice.

The office staff of our largest community's Property Owner's Association volunteered long hours in the preparation and promulgation of water user notices. They did so with no recompense.

We have attempted to keep our people informed. We have held 16 community meetings, attended by as few as 12 and as many as 500 residents, at clubs, churches, schools and wherever a few would gather together to listen and share. There have been over one hundred articles handling one aspect or another of our story in our three local newspapers and in the Newark Star-Ledger, the Bergen Evening Record, the Wall Street Journal, McCalls Magazine and many trade and technical periodicals. In addition, we have sent, at least six all-user mailings. We have spent upwards of $25,000. in testing and promulgation of results. All three national TV networks have treated the Township's water odyssey.

Well, that's our story to date. It continues. Always there will be detracters and exploiters. But always there will be doers and builders. The end is not yet.

There remains here, perhaps only a few brief comments growing from our experience.

If I were asked to write a primer for the treatment of ground water pollution of municipal wells, the first principals would include these.

1. Be totally open and forthright with the public.
2. Listen to everybody, among the dross of complaint are the diamonds of wisdom and help.
3. Allow your employees to rise to the challenge.
4. Negotiate, the world is not completely peopled by villains.
5. Work with your experts and vendors, don't just watch.
6. Don't rush to blame; rush to solve.
7. Test, test, test and test.

I mentioned earlier that perhaps the Mayor's experiences might be applied to Everyman. Maybe his fears, his hopes, his needs, to one degree or another, are those of every person who turns on a tap.

I respectfully submit that all of us - experts, engineers, environmentalists, teachers, public servants - know always that the best of that which we do is nothing unless we do it for all who wish, desire, need, for each of us is - Everyman.

LOCAL LAW NO. 22-1979

A Local Law amending Article 10 of Chapter 18 (Fire Prevention Code) of the Unified Code of Ordinances, regarding underground motor fuel storage tanks

Be it enacted by the Board of Trustees of the Village of Mamaroneck as follows:

1. Section 10.32 of Division III (Service Stations) of Article 10 (Flammable and Combustible Liquids) of Chapter 18 (Fire Prevention Code) of the Unified Code of Ordinances is hereby amended to read as follows:

Section 10.32. Construction Installation, Testing and Maintenance.

a. No permit for the installation, relocation or replacement of tanks, their auxiliaries, piping and pumps shall be issued until an application is first filed with and approved by the Building Inspector and referred to the Board of Fire Inspectors, giving the following information:

(1) Name and address of applicant;

(2) Location (proposed installation);

(3) Maximum quantity of flammable liquids to be stored.

(4) Dimensions of storage tanks;

(5) Gauge of glass armor coating used in tank construction;

(6) Name and address of concern making installation;

(7) Certificate of insurance indicating policy numbers and expiration dates of public liability insurance and property damage in the minimum amounts of $1,000,000 and $500,000 respectively;

(8) A survey showing clearly thereon: (i) location of building or buildings on the land where tanks are located; (ii) location of each tank; and (iii) size of fill and vent pipes and where they terminate.

Such permit must state the name of permittee, capacity of tank and location of premises where it is installed. The permit must be on public display on the premises at all times.

The permit is subject to inspection at any time by the Fire Inspector or Building Inspector and may be modified, suspended or revoked at any time.

b. Class I liquids shall not be stored or handled within a building having a basement or pit into which flammable vapors may travel, unless such area is provided with ventilation designed to prevent the accumulation of flammable vapors therein.

c. Construction, installation, location requirements, spacing and venting of underground motor fuel storage tanks shall be in accordance with the Code Manual of the State Building Construction Code and National Fire Protection Association #30, as same may be, from time to time, amended.

d. Underground motor fuel storage tanks:

(1) shall not be constructed under or inside any building or other structure, and

(2) shall have the uppermost part thereof at least two (2) feet beneath ground, and

(3) shall be covered by a reinforced concrete slab of minimum thickness of six (6) inches;

(4) shall be glass armor internally coated, whenever repaired, with a minimum of .200-inch thickness and approved by the Fire Inspector and Building Inspector of the Village of Mamaroneck;

(5) if repaired, newly installed, or reactivated after not being used for a continuous period of more than two (2) months, must be provided with a constant monitoring electronic leak detecting system that gives visual and audible warning signals, and same must be approved by the Fire Inspector and Building Inspector of the Village of Mamaroneck;

(6) shall comply with 2, 3 and 5 immediately above whenever storage capacity is increased;

(7) shall be immediately drained and filled with water or sand, or other material approved by the Building Inspector, whenever the use of the tank ceases for a continuous period of more than two (2) months;

(8) shall be tested and maintained as follows:

(i) all new and existing tanks and accessory piping must be tested by a minimum air or hydrostatic pressure of eight (8) pounds per square inch. Such pressure must be maintained for a period of at least thirty (30) minutes. During that time if the test is by air pressure, the entire exterior surface and all joints must be coated with a solution of soap and water or other material suitable for the purpose, to detect leaks. Hydrostatic pressure, if used, must be gauged in the top of the tank. The tank piping must be inspected for the presence of liquid indicating leaks. Any leakage detected by any of the methods described must be accepted as evidence of failure to maintain the requirements of the specifications. Under no circumstances must bottled gases under pressure be used.

(ii) all monitored leak detection systems shall be tested annually and proof of such testing must be submitted to the Building Inspector and Fire Inspector immediately after such testing.

e. Except as otherwise herein provided, above-ground motor fuel storage tanks are prohibited.

f. All changes in motor fuel storage shall be approved by the Building Department and Fire Inspector of the Village of Mamaroneck.

2. A new Division IV is hereby added to Article 10 (Flammable and Combustible Liquids) of Chapter 18 (Fire Prevention Code) of the Unified Code of Ordinances and shall read as follows:

DIVISION IV

UNDERGROUND MOTOR FUEL STORAGE TANKS, AS PERMITTED ACCESSORY USES TO PRINCIPAL PERMITTED M-1 DISTRICT USES.

Section 10.41. Scope.

This division shall apply to all storage of motor fuels where same is a permitted accessory use to a qualifying permitted principal use in an M-1 District as indicated in the Zoning Ordinance of the Village of Mamaroneck.

Section 10.42.

Sections 422 and 423.7 of the Zoning Ordinance of the Village of Mamaroneck shall be applicable herein.

Section 10.43. Construction, Installation, Testing and Maintenance.

a. Section 10.32, except subparagraph "e" thereof, shall be applicable to the construction, installation, testing and maintenance of all underground storage tanks governed by Division IV.

b. Above-ground motor fuel storage tanks are prohibited.

Section 10.44. Miscellaneous.

Sections 10.34, 10.35, 10.37, 10.38, 10.39 and 10.40 shall be applicable to all business establishments governed by Division IV, and the words "automotive service stations" and "service station" shall be deemed appropriately amended to govern the particular business establishment subject to this Division.

3. This Local Law shall become effective immediately upon filing in the office of the Secretary of State.

Became effective October 25, 1979

(4)

VILLAGE OF SCARSDALE

WESTCHESTER COUNTY, NEW YORK

FIRE DEPARTMENT

RAYMOND J. WHITE
FIRE CHIEF

LOWELL J. TOOLEY
VILLAGE MANAGER

TO WHOM IT MAY CONCERN:

The Scarsdale Village Board, at its regular meeting held on November 8, 1977, adopted Local Law No. 6 Fire Prevention Code.

I have attached the sections of the code which pertain to your operation.

Some of the changes which take effect as a result of this new fire code directly affect your operation and should be immediately complied with.

Sincerely,

Raymond J. White

Raymond J. White
Fire Chief

RJW:lmp
Attach.

ARTICLE 13

PUBLIC GARAGES AND GASOLINE AND

OIL STORAGE OR FILLING STATIONS

13-13-1: SCOPE

The provisions of this article apply to the use, storage, and handling of motor vehicles fuels and lubricants, and to the materials and procedures associated with the repair and service of motor vehicles.

13-13-2: PERMIT REQUIRED

A public garage and/or gasoline and oil storage or filling station may not be established without a permit from the Fire Chief.

13-13-3: STORAGE AND HANDLING OF FLAMMABLE LIQUIDS

13-13-3.1

Except as otherwise provided for in this section, Class I and Class II flammable liquids must be stored in underground tanks. Class III liquids may be stored in containers or underground tanks or in special enclosures.

13-13-3.2 Constant Monitoring Electronic Leak Detecting Systems

All motor fuel storage tank installations must be provided with a constant monitoring electronic leak detecting system that gives visual and audible warning signals, and is approved by the Fire Chief. All motor fuel storage tanks installed prior to the enactment of this chapter must be in compliance with this section within twelve months of the date of such enactment.

13-13-3.3

Whenever there is reason to believe that flammable liquid tanks or lines are leaking, the owners thereof shall advise the Scarsdale Fire Department. Upon the request of the Fire Chief, the owner or operator of the facility shall have such suspect tank or lines tested for tightness. All costs for such testing shall be born by either the owner, operator or supplier.

Reason for giving notice of possible flammable liquid leakage shall include, but not be limited to, warning signals provided by leak detecting devices, discovery of inventory losses in excess of metered sales or use, the presence of liquid seepage in the reasonable vicinity of the tanks or lines, or persistent odors in adjacent premises.

13-13-3.8

Dispensing is prohibited of Class I, II or III flammable liquids into containers larger than six gallon capacity, or into any portable container which is not approved by the Fire Chief.

The following warning is to be conspicuously posted, in letters at least one inch high, on each dispenser island:

WARNING

"IT IS UNLAWFUL TO DISPENSE GASOLINE INTO ANY PORTABLE CONTAINER NOT APPROVED BY THE FIRE CHIEF."

13-13-4 DISPENSING SYSTEMS

13-13-4.1

Class I and II flammable liquids must be transferred from underground tanks by fixed pumps so designed and equipped as to allow control of the flow and to prevent leakage or accidental discharge. Supplemental means must be provided outside the dispensing device, whereby the source of power may be readily disconnected in the event of fire or other accident. Dispensing devices for Class I or Class II flammable liquids must be of approved pressure or gravity type from drums, barrels, and similar containers. Gear pumps or similar positive displacement devices taking suction through the top of the container must be used. Class I and Class II flammable liquids must not be dispensed by a device that operates through pressure within a storage tank, unless the tank has been approved as a pressure vessel for the use to which it is put. Air or gas pressure may not be used for this purpose.

13-13-4.2

The dispensing of Class I flammable liquids into the fuel tank of a vehicle or into a container must be under the control of a competent attendant. The use is prohibited of any device, except one approved by the Fire Chief which permits the dispensing of Class I flammable liquids. A competent attendant must be in the immediate vicinity of the vehicle being filled by such an approved nozzle.

The City of New York

FIRE DEPARTMENT

DIVISION OF FIRE PREVENTION
Room 1128, Municipal Building
Brooklyn, New York 11201

August 11, 1976

TO: All Inspectors, Examiners & Supervisors

FROM: Milton Fishkin Chief Inspector

SUBJECT: Gasoline Tank Installation Fittings

Local Law #38 of 1976 amending C19-50.0-i Administrative Code was approved by the Mayor on July 22, 1976, effective immediately, and reads as follows:

"A LOCAL LAW to amend the administrative code of the city of New York, in relation to the storage of liquids used as motor fuels.

Be it enacted by the Council as follows:

Section 1. Subdivision i of section C19-59.0 of title C of the Administrative code of the city of New York is hereby amended to read as follows:

i. Piping, generally. - Each storage tank shall be provided with a filling pipe, a drawing-off pipe and a vent pipe; provided that tanks installed as part of a hydraulic storage system shall not be required to have a vent pipe. All pipes and fittings shall be of galvanized steel, designed to withstand a hydrostatic pressure test of at least one hundred pounds to the square inch. All screw joints shall be made with a piping compound, approved by the board of standards and appeals. In lieu of galvanized steel fittings, galvanized malleable iron fittings, with one hundred and fifty pound p.s.i. rating, may be used on any system that is provided with a leak detection system satisfactory to the fire commissioner such as probe holes, leak detection cables or other devices installed around the perimeter of the tank installation, designed for monitoring and that will be subjected to a hydraulic pressure test with water or product at ten p.s.i. in the presence of a fire department representative, every ten years. Brass trimmed specialty valves and brass control valves may be used in underground service lines and portions of suction lines within pump housing.

§2. This local law shall take effect immediately."

New installations have the option of either using galvanized steel piping with galvanized steel fittings, or galvanized steel piping with malleable iron fittings and with a leak detection system.

Piping changes or alterations on existing installations must conform with the new law, except that for repairs, installation may be restored to conditions permitted by the Code prior to Local Law 38 of 1976, i.e.:

Installations Prior to December 29, 1969 - Galvanized wrought iron pipe with malleable iron fittings

Installations from 12-29-69 to 7-22-76 - Galvanized steel pipe with galvanized steel fittings

By order of,

Milton Fishkin
Chief Inspector
Division of Fire Prevention

MF/rs

CC: All Licensed Installers for Underground Storage Systems of Gasoline, inflammable liquids and/or Diesel Fuel Oil for Motor Vehicle use

NOTICE TO ALL SERVICE STATIONS, GARAGES AND OTHER OPERATORS OF UNDERGROUND GASOLINE STORAGE TANK INSTALLATIONS

+ + + + + + + + + + + + + + + + +

ON MARCH 4, 1980, THE TOWN BOARD OF THE TOWN OF EASTCHESTER ADOPTED THE FOLLOWING NEW ARTICLE TO THE FIRE PREVENTION CODE AS FOLLOWS:

ARTICLE 33. Public Garages and Gasoline and Oil Storage or filling Stations

Section 33.1 Scope - The provisions of this article apply to the use, storage, and handling of motor vehicle fuels and lubricants, and to the materials and procedures associated with the repair and service of motor vehicles.

Section 33.2 Constant Monitoring Electronic Leak Detecting Systems,

All motor fuel storage tank installations must be provided with a constant monitoring electronic leak detecting system that gives visual and audible warning signals, and is approved by the Fire Chief. All motor fuel storage tanks installed prior to the enactment of this Fire Prevention Code must be in compliance with this section within twelve (12) months of the date of such enactment.

LEGAL NOTICE

PLEASE TAKE NOTICE that the Board of Trustees of the Village of Larchmont, New York, at its meeting on August 12, 1974, after Public Hearing, approved the adoption of the following amendment to the Zoning Ordinance of the Village of Larchmont, otherwise to be known as Local Law No. 3 of 1974, as follows:

"Schedule Controlling Buildings and Land
Retail Business (RB) - Column 4, Paragraph 2

All gasoline and other fuel pumps shall be 20 feet or more from any street curb, all motor fuel tanks shall be underground. Not more than 12,000 gallons of motor fuel shall be stored at any time and motor fuel storage must comply with all of the following, and a Certificate must be obtained from the Village Engineer that the following conditions have been met:

a. Maximum tank size shall be 4,000 gallons;

b. Tank shall be glass-armor coated with minimum .200" thickness and approved by a Licensed Professional Engineer and the Building Department of the Village of Larchmont;

c. Each tank shall be mounted with leak-detection system with a visual indicator and installation approved by a Licensed Professional Engineer or the Building Department of the Village of Larchmont;

d. Whenever storage is increased, existing motor fuel tanks shall be equipped with glass armor and leak-detection system as indicated in paragraph (b) and (c);

e. All changes in motor fuel storage shall be approved by the Building Department and the Fire Department of the Village of Larchmont.

f. Testing and Maintenance -

1. New tanks and accessory piping shall be air-tested and all screw joints visually tested with soap suds under five pounds air pressure for 1/2 hour after installation and witnessed by a Licensed Professional Engineer.

2. After ten years from the date of issuance of the original approval, each tank and accessory piping shall be retested as per item (f) 1, less testing subsurface screw joints. Glass-armor guarantee must be renewed. The renewal guarantee shall be submitted to the Fire Department prior to the issuance of a Fire Permit, as required under Article 17 of the Fire Prevention Code.

3. Before issuance of annual Certificate by Fire Department, the monitored leak-detection system shall be tested and proof of such testing must be submitted to the Fire Department."

This amendment shall take effect immediately.

BY ORDER OF THE BOARD OF TRUSTEES
OF THE VILLAGE OF LARCHMONT, N Y
Barbara Wood, Village Clerk

Dated: Larchmont, N.Y.
August 13, 1974

4 Crestmont Drive
Dover, New Jersey 07801
January 26, 1982

Sgt. Robert Reder
Court House
Morristown, New Jersey 07960

Dear Sgt. Reder:

This letter is in reference to my proposal, which we have previously discussed in telephone conversations, concerning the use of the K-9 unit to detect the origin of chemicals polluting the Rockaway Township water supply. The chemicals of interest are listed below, along with the higher concentrations in which they have been found. These chemicals have appeared in wells #6, #7, and in the Lake Denmark and Lake Telemark areas.

Chemical	Concentration, parts per billion (micrograms per liter)
Methylene Chloride	1455
1,1,1 - Trichloroethane	3154
Trichloroethylene (TCE)	333

The dogs would be searching waterways and wooded areas.

If successful, this method might have widespread application. Rockaway Boro has water contamination problems similar to ours, as do other towns. The K-9 unit might aid hazardous waste cleanups by detecting buried, leaking contaminants. In a recent conversation with David Longstreet, Assistant to the Director, Division of Hazard Management, NJDEP, I was told that many dump sites are not known. Mr. Longstreet suggested writing a proposal to the NJDEP Office of Science and Research or to the new DEP commissioner, and he said that grants might be available. Also, the Environmental Action Committee of the Sierra Club is sponsoring a "Hunt the Dump" campaign to locate unsafe waste disposal sites. The dogs could also help in the enforcement of recent legislation limiting the use of chemical degreasers by detecting them if they have been illegally used.

Last but not least, the use of dogs would be far more economical than costly chemical analysis.

Thank you in advance for your attention to this proposal. I look forward to hearing from you soon.

Sincerely,

Nancy Stoldt
Rockaway Twp. Environmental
Commission

Meet Your Environmental Commission

The Environmental Commission consists of 7 members, all appointed by the Mayor. We're volunteers who are very interested in having a healthful, attractive, and well planned environment in Rockaway Township. Many of us hold one or more college degrees - our education gives us the background for our tasks.

The Environmental Commission studies all requests for construction in the Twp. and makes sure the environment is not adversely affected. We review site plans and Environmental Impact Statements. The E.I.S. tells what effect the construction of a building or development will have on the air, water, wildlife, traffic, noise level, etc. in the area in which it is located. We try to make sure that our natural resources are not abused, that our water supply is not contaminated, and that our streams and lakes are kept clean. A site tour will be arranged if we think it necessary. We also attend educational conferences and sponsor worthwhile projects in the community. We have given presentations at the recent landfill hearings and members have served on the Water Filter Committee and the Gypsy Moth Task Force. Currently we are sponsoring a school environmental slogan and poster contest, and are trying to start a newspaper recycling program. Ideas and comments from our residents are welcome - there is an E.C. mailbox in the Municipal Building. Our meetings are usually held on the first Wednesday of each month at 8 p.m.

Commissioners: Charles Lenchitz, Gary Schraft, Nancy Stoldt, Dr. Stephen H. Stoldt, Dr. Carl Shellenberger, Carl Miller.

Associate Members: Dr. Fred Gaeta, Dr. James Hilbert, Charles Ryan

Save Our Resources and Landfills: Recycle

Separating your garbage is very beneficial to the environment. Some of it can be made into compost. Hamm's Sanitation is now collecting newspapers for recycling. All newspapers should be bundled and placed on the curb on regular collection days. Glass and aluminum cans should also be separated since they can be melted down and reused. The township will be establishing recycling centers in the near future to take these materials. All used oil must be taken to the nearest automobile service station and should never be placed in the garbage. Municipalities which recycle will be eligible for financial grants from the state. If everyone recycles, there also will be less need for landfills in the future.

ASSEMBLY, No. 280

STATE OF NEW JERSEY

PRE-FILED FOR INTRODUCTION IN THE 1982 SESSION

By Assemblymen LESNIAK and BENNETT

A SUPPLEMENT to the "Safe Drinking Water Act," approved September 17, 1977 (P. L. 1977, c. 224, C. 58:12A-1 et seq.).

BE IT ENACTED *by the Senate and General Assembly of the State of New Jersey:*

1. As used in this act:

a. Hazardous contaminants" means selected toxic and carcinogenic compounds previously identified by the Department of Environmental Protection or by any agency of the Federal Government as potential hazards to human health and the environment. These substances may be divided into subgroups, as follows:

(1) Purgeable organics, including Methylene Chloride, Methyl-Chloride, Methyl Bromide, Chloroform, Bromoform, 1, 1, 2-Trichlorethylene, 1, 1, 2, 2-Tetrachloroethane, Dibromochloromethane, Trifluoromethane, 1, 1, 2-Trichloroethane, Carbon Tetrachloride, 1, 2-Dibromoethane, 1, 2-Dichloroethane, 1, 1, 1-Trichloroethane, Vinyl Chloride, 1, 1, 2, 2-Tetrachloroethylene, o, m, p-Dichlorobenzene, Trichlorobenzene, Diiodomethane;

(2) Pesticides and related compounds, and Polychlorinated Biphenyls (PCBs), including but not necessarily limited to Heptachlor, Methoxychlor, Toxaphene, DDT and associated compounds, alpha-BHC, beta-BHC, gamma-BHC, and delta-BHC, Endrin, Lindane, Aldrin, Dieldrin, Heptachlor Epoxide, Mirex;

(3) Metals, including but not necessarily limited to Arsenic and compounds, Beryllium and compounds, Cadmium and compounds, Chromium and compounds, Copper and compounds, Lead and compounds, Mercury, Nickel and compounds, Selenium and compounds, Zinc and compounds;

(4) Base/neutral extractable organic compounds and acid extractable organic compounds.

b. "Aggressivity index" means a calculated number representing the capacity of water to corrode piping;

c. "Water supply system" means a system, whether privately or publicly owned, comprising structures which, operating alone or with other structures, result in the derivation, conveyance, transmission, or distribution of water for potable or domestic purposes, and which serves 1,000 or more customers.

2. The owner or operator of each water supply system in this State shall undertake the periodic testing of the water provided to customers by the system in order to determine the presence of hazardous contaminants, and the nitrite/nitrate content and the agressivity index of that water. The tests shall be conducted in accordance with standards and procedures established by the department pursuant to section 3 of this act. The tests for purgeable organics, enumerated in subsection a. (1) of section 1, and for determining the aggressivity index shall be conducted within 6 months of the effective date of this act and at least semi-annually thereafter. All other tests required by this act shall be conducted within 6 months of the effective date of this act and at least annually thereafter. The superintendent or operator of each water supply system shall retain for public inspection all test results and maintenance records of all systems under his charge.

3. Within 30 days of the effective date of this act, the department shall establish, by regulation, standards and procedures for the testing of water for hazardous contaminants, nitrite/nitrate content, and aggressivity index required by this act.

4. a. Any person who fails to comply with the provisions of this act shall be liable to a penalty of $1,000.00 to be adjudged, collected, and enforced pursuant to the provisions of "the penalty enforcement law" (N. J. S. 2A:58-1 et seq.). If the violation is of a continuing nature, each day during which it continues shall constitute an additional, separate and distinct offense.

b. The penalties provided in subsection a. of this section shall be in addition to the penalties provided in section 10 of P. L. 1977, c. 224 (C. 58:12A-10).

5. This act shall take effect immediately.

STATEMENT

The potable water supplies of this State are being threatened by the leaching of hazardous substances at more than four hundred dump sites, by the widespread application of chemical fertilizers and insecticides to farmlands, and from countless other industrial disposal practices.

Accordingly, this bill requires the water purveyors who serve at least 1,000 customers to undertake the periodic testing of their water supplies in order to determine the presence of certain hazardous contaminants and other potentially dangerous circumstances. The tests are to be conducted in accordance with standards and procedures adopted by the Department of Environmental Protection, and the results are to be made available to the public upon request.

STATEMENT OF DR. JAMES M. KUSZAJ
ON BEHALF OF THE
CHEMICAL MANUFACTURERS ASSOCIATION

BEFORE THE

ENVIRONMENTAL PROTECTION AGENCY

ON GROUND WATER

JANUARY 30, 1981

CMA TESTIMONY ON THE EPA NATIONAL GROUND WATER PROTECTION STRATEGY

Good afternoon Mr. Chairman and Members of the Hearing Panel. My name is Dr. James M. Kuszaj. I am Manager of Regulatory Activities for Special Projects, at the Dow Chemical Company. Today I am appearing on behalf of the Chemical Manufacturers Association (CMA) and its Ground Water Management Task Group of which I am chairman.

CMA is a nonprofit trade association having 188 United States company members representing more than 90% of the production capacity of basic industrial chemicals within this country.

When EPA announced over a year ago that it would be developing a comprehensive national ground water strategy, CMA and its member companies recognized the importance of addressing ground water policy issues in a systematic way. Consequently, in March of 1980 a Ground Water Management Task Group composed of representatives of several member companies was formed within CMA. Members of this group participated actively in the EPA Ground Water Workshops in June 1980, and have maintained close contact with the Agency's activities on this issue.

At an early date, the CMA Ground Water Management Task Group decided it should formulate its own ground water policy independent of the ongoing federal effort. Due to our participation in EPA's activities, it is not surprising that in most respects there is close agreement between the resulting CMA policy and the proposed National Ground Water Strategy recently published by EPA. A copy of CMA's policy with some explanatory materials is attached to our written testimony for your consideration.

I believe the best use of our time today would be to compare and contrast the CMA policy with the EPA proposed Strategy. During this session I believe we will answer most, if not all, of the nine questions posed by EPA at the beginning of the Strategy document. However, detailed written answers to each of the nine questions are also being submitted for the record.

CMA recognizes that ground water is an important natural resource which contributes significantly to the environmental and economic well being of our nation. We also recognize the potential for chemical and biologically contaminated ground water to adversely affect human health and damage the environment. In our opinion, a scientifically well-balanced national ground water policy which establishes reasonable goals and suggests management strategies and technical options and proper federal/state roles and relationships is a vital foundation for a collective national effort to protect public health and the environment.

The CMA's Ground Water Policy fully embodies these four objectives. First, the goal of any national ground water policy should be to protect human health and the environment and to responsibly maintain the multiple uses of the resource. Second, a recommended management approach to achieve this goal is to identify use classes and develop a comprehensive data base on ground water contaminants and sources of ground water pollution. The states then should use this data base to assign and classify ground waters when a present or projected need for the resource is identified. Third, technical approaches to achieving this multiple use management must be flexible and provide a variety of options that can be tailored to the individual needs of each ground water according to its use classification. Alternative technical options should be allowed when it can be demonstrated that the assigned use classification will not be impaired. Finally, the states should retain the authority to implement a ground water management program under a national ground water policy because the sole right to allocate waters has traditionally been a state right.

The CMA policy accounts for certain hydrogeologic facts. Among these are that not all ground waters are of the same value. Nature as well as past societal activities clearly have had an impact on our ground waters. Therefore, we must begin with a recognition of ground waters as they exist. Further, we also must recognize that ground water quality cannot be separated from ground water quantity considerations. Finally, in many instances, ground waters and surface waters are connected and such actions affecting one also will affect the other.

Historically, states have exercised the sole right to allocate waters within their jurisdiction. Therefore the states should retain the authority in a national ground water policy.

The federal role should be to provide information and guidance which the states would use in assigning classes to ground water and determining the management options and technical requirements needed to maintain the assigned uses for each ground water supply.

Turning to the EPA proposed strategy, areas of agreement and disagreement with the CMA policy have emerged.

First, there are important differences in the goal statements. EPA proposes a strategy that apparently would not only protect public health and significant ecological resources but also would require the protection and enhancement of ground water quality independent of health or environmental effects. We believe that protection and enhancement of ground water quality for its own sake should not be a part of the goal of a national ground water policy. Rather, the goal should be protection of human health and the environment and management of the resources for multiple uses. In appropriate circumstances, management will include both quality protection and quality enhancement objectives. By elevating "protection and enhancement" to coequal positions with multiple use, EPA imposes an inflexible approach involving not only an automatic nondegradation standard but also restriction in use classifications to "drinking water or better" use classes. We can realize the full potential of our ground water resources only through a multiple-use approach.

Classification of ground water is an effective approach to implementing a multiple-use ground water management strategy. Application of such use classes at the state level is indeed essential not only because of the interrelationship between ground water quality and ground water quantity but also in order to balance state and local concerns regarding hydrogeologic factors. Appropriate considerations for selecting use classes include present and projected future use, quality, yield, vulnerability (geologic setting) and socioeconomic and political values of the particular ground water.

Once a good data base is available there should be no significant technical impediments to implementing the use-based classification system.

However, CMA is very concerned about a national policy which arbitrarily elevates any one particular use class to a paramount position. This should be avoided. Currently, the

EPA strategy document presumes that all ground water which is of drinking water quality or better must be classified as such. Applying this presumption imposes significant socioeconomic and political impediments to any ground water management system. This would effectively preclude any state management efforts to identify and assign nondrinking water use classes to ground waters that are not already used for nondrinking water purposes. What the strategy fails to acknowledge is that not all ground water is of drinking water quality or better and not all ground water supplies will be needed as drinking water sources.

A national ground water policy must assure full flexibility to the states to make their own multiple use management decisions based on their assessment of present and projected future needs. Further, if a drinking water quality presumption is automatically equated with public health protection the possibility exists that "imminent hazard" provisions in federal, state and local laws would be punitively invoked where no actual threat to the public health or the environment exists. We urge EPA to remove the drinking water source presumption from the proposed national ground water policy.

As a final note we would recommend that the federal government clearly recognize its limited role in shaping and implementing any national ground water policy. Management decisions concerning ground water are best made at the state level with financial and technical assistance and guidance from the federal level. Implementation of a policy should be at the option of each state and according to its judgement concerning timing and content. The federal government should refrain from using such vehicles as State/EPA agreements to compel any state to adopt and implement a ground water policy contrary to state wishes. CMA does encourage states and EPA to cooperatively arrive at consensus definitions of a family of use classes and technical approaches from which individual states' policies may be drafted.

In closing I draw your attention to the goals and objectives of environmental policy. The decade of the seventies began with a congressional declaration of the environmental goal in the National Environmental Policy Act. The goal was to achieve a balanced and harmonious protection of the public health and the environment while fostering our continued productivity and economic well-being. Now in the decade of the eighties we would do well to remember the objective in formulating a ground water policy based on multiple-use management of valuable resources.

Thank you, Mr. Chairman and members of the hearing panel for this opportunity to testify today. I will be happy to answer any questions that you have concerning my testimony, our written answers to your stated questions, or the CMA position on a national ground water policy we have submitted to you.

QUESTION 1

Is the policy goal based upon "present and projected future uses . . . " a sound and workable goal? Conversely, should alternative goals be selected, such as nondegradation for some or all ground waters? What would be the practical implication of such approaches?

* * * *

- A ground water policy goal based on present and projected future uses is a sound and workable approach.

Ground water is a valuable natural resource which contributes to the environmental and economic well-being of all segments of society. A "use-based" goal provides a flexible management framework that recognizes the necessity of accommodating the varied demands placed upon this valuable resource. The identification of present and projected uses of ground water supplies enables management decisions concerning the development and conservation of ground water resources to be made in a manner that reflects societal demands upon the resource.

Because of the varying societal demands upon ground water, decisions on the appropriate "use" of any particular ground water resource will, by necessity, involve a delicate balancing of physical, social, and political factors.

- Physical Factors

The quality of certain ground water resources has changed through historical use. For example, in older industrialized, irrigated and cultivated areas, and in regions where septic tanks have long been in place, documented cases of contamination are readily available. Moreover, even without human impact, certain ground waters are unsuitable for human consumption, industrial or agricultural uses because of naturally high levels of conventional pollutants material. Ground water policy must recognize the fact that past usage and natural processes have changed the characteristics of certain portions of the ground water resource. Management of ground water by "use" should consider the resource as it presently exists.

- Social Factors

Chemically and biologically contaminated ground water has the potential to adversely affect human health and damage the environment. Human health and the environment must be adequately protected while allowing a variety of societal interests to function. If only one use class of ground water was arbitrarily recognized without assessment of health and environmental impacts, other beneficial ground water dependent interests would unjustifiably be compromised.

- <u>Political Factors</u>

Politically, a ground water policy has the potential to usurp the traditional and well-developed state water rights. The Agency has attempted to define state and federal roles to avoid a conflict with the states. Yet, the policy suggests that through a series of steps involving:

1. Water quality standards;
2. Planning criteria; and
3. State/EPA Agreements (SEAs)

the Agency may infringe on the traditional rights and prerogatives of state governments. The management of ground water by "use" must start from an acceptance of the state's traditional role as manager of its own water resources.

A goal based on present and projected use will require thoughtful balancing of each of these competing physical, social, and political factors. Ultimately, however, the resulting management decisions will protect ground water supplies which are critical to human or ecological functions.

- <u>The use of the term "protect" in the proposed goal statement, severely limits the management options and choices.</u>

The proposed management strategy implicitly accepts the concept of "multiple users". EPA defines the word "protect" as "to embody a protective presumption". In effect, this "protective presumption", limits the seven use categories proposed in the management approach to exclusively one use -- drinking water. Drinking water is certainly an important use of the ground water resource. However, it is not the <u>only</u> possible use. The "management" of ground water recognizes the <u>multiple</u> use of the resource. The term "manage" includes "protection" where appropriate, but it also includes a host of other techniques allowing a flexible approach to solving complex technical and social ground water issues. The protection concept per se is too narrow a goal.

- <u>The word "enhance" is inappropriate in the proposed goal statement.</u>

Enhancement of ground water is a management technique which may or may not be appropriate depending upon the use classifications of the resource. The decision to "enhance" a ground water supply will undoubtedly be based on uses and conditions peculiar to that resource and "will deal with those contamination problems which already exist and those which occur accidentally in the future". Enhancement of ground water resources should not be considered part of a national goal which intends to delineate use classes ranging from drinking water to waste disposal. As the Agency itself has stated, the enhancement concept is merely a "supplement" to the strategy. It should properly be discussed by the Agency in the management approach section of the proposed strategy, not in the goal statement.

Even if included as a management technique, however, enhancement has no basis in a national policy that may guide interpretation and implementation of many laws relating to ground water. Enhancement for its own sake is not authorized generally under environmental statutes. In such statutes, the implementing agency's authority is carefully and clearly limited to protection of public health and the environment. Actions to enhance ground water quality should be authorized and limited by specific statutes consistent with their individual scope and Congressional intent.

- The proposed three-tiered control system proposed by the Agency exemplifies the pitfalls of including "protection" and "enhancement" in the goal statement.

The three-tiered system including federal specifications of requirements for each of the three levels is contrary to former President Carter's federal water policy message delivered to Congress on June 6, 1978. The former President stated: " . . . the federal government (should not) preempt the primary responsibilities of the states for water management and allocation," and also that the "federal water policy cannot attempt to prescribe water use patterns for the country."

Mandated federal requirements, bans and restrictions on certain facilities, industries, and developments, suggested by the ground water policy constitute a prescription for water use patterns and preemption of states' water rights. This is not consistent with the federal water policy stated by President Carter. EPA's proper role is to guide, encourage, and support the states in ground water policy development and implementation. The policy is the framework by which statutes are interpreted and regulations are administered. The policy should not in any way be a mechanism for expanding the statutory authority.

- A goal of blanket nondegradation would be a simplistic solution to a technical and socially complex issue and would not achieve multiple use objectives.

Contrasting nondegradation with the use-based system, serious problems with a nondegradation scheme are obvious. First, nondegradation is inconsistent with naturally occurring physical processes. The inconsistency is most easily seen by considering ground water systems that are hydraulically connected to surface waters. Consider, for example, the problem of salt water intrusion. If a nondegradation standard was applied to coastal ground waters, induced infiltration from hydraulically connected brackish surface streams could contaminate the ground water and violate the nondegradation concept. Thus, even natural processes could result in violations of the standard.

The main problem with a nondegradation system is that a blanket nondegradation system is an unworkable concept consistently rejected as a rational basis for environment regulation. All societal activity generates materials which may find their way into the ground water. The question is how to manage the ground water which may be impacted. Congress has consistently recognized that zero-discharge is an impractical goal. Consequently, Congress has sought to control, not prohibit, discharges under existing federal statutes. Such environmental statutes are largely technology-based and severely limit the use of "no-discharge" concepts. For example, the Resource Conservation and Recovery Act does not "prohibit" disposal, but requires promulgation of performance standards as may be necessary to protect human health and the environment.

Congress' most recent consideration of the nondegradation standard involves the Superfund legislation enacted in December 1980. When originally introduced, the Senate bill expressly contained a no-discharge approach. It was extensively changed in Committee, however, to eliminate the approach and specifically account for federally-permitted releases.

The Agency, like Congress, should recognize that it is the proper <u>management</u> of discharges that is critical to environmental protection efforts.

QUESTION 2

Are state strategies a useful vehicle for helping to improve state efforts toward ground water protection? For focusing EPA and other federal assistance on state and local concerns?

* * * *

- State strategies are useful vehicles for improving state efforts toward ground water protection.

The development of ground water protection strategies by states must be a central element of any national ground water strategy. The preparation of state strategies would encourage state and local authorities to address ground water issues in a systematic and critical manner. Moreover, the use of state strategies would acknowledge and continue the state's historical role as the primary authority over issues affecting both the use and the quality of ground water.

- <u>The phased-in development of state strategies is a necessary requirement to the program.</u>

An important factor determining the succcess of a national ground water protection strategy will be an appropriately phased-in development of state strategies. The three-phase approach suggested by the Agency appears to be a realistic method of developing state strategies.

The first phase calls for the formulation and the issuance of federal guidance in developing state strategies with the full participation of state and other interested groups. Al-though no time frame for developing such guidance is specified, it can be expected that it might take as long as 12 to 24 months.

The second phase would tailor the particular criteria to a particular state. The strategies would be prepared with appro-priate participation by affected local governments, the public, business, and special interest groups. A requirement in this area would be the normal mechanism, i.e., proposal, public hearing, comment period, and then a final strategy. Again, this area is expected to take an additional 12 to 24 months to be developed.

The third phase involves the use of State/EPA agreements, (SEAs). The use of the State/EPA agreements could be a valuable mechanism in establishing the initial framework for state ground water strategies. However, no state should be required to develop a comprehensive ground water protection program as part of any State/EPA agreement.

Instead of using a State/EPA agreement, the Agency should review the state strategy and suggest areas for possible voluntary improvement. The state should be encouraged to comprehensively address problems such as highway de-icing, underground storage tanks, agricultural practices, and other local events affecting ground water.

- State strategies are useful because they help consolidate state efforts and management activities

Ground water data may currently exist in a variety of state water resource departments, e.g., water programs, solid waste department, public health department and various local or community programs. A state strategy would encourage the state to consolidate the data under the direction of one lead state agency.

- State strategies are useful because they will encourage informed ground water management policy decision.

Once any underlying policy regarding ground water is developed by the state, the application of such a policy to decisions regarding state regulations, classification of ground water, development of new activities, etc., will be based on a consistent set of criteria. Decisions regarding future activities will be based on an informed policy which has had the benefit of public participation.

- <u>Federal and state activities can be coordinated to assist state strategies development</u>.

A wealth of data exists in the governmental agencies, (e.g., U.S. Geological Survey, U.S. Coast Guard, adjacent state ground water programs) that the state can use to develop an adequate data base for classifying ground water. If federal activity presents new data on ground water (priority sources of contamination, etc.) the state can consider incorporating the information in the state strategy.

States, however, should not be required to initiate the extensive ground water impact analysis that EPA prescribes on p. VII-6 of the Proposed Ground Water Protection Strategy. These "full assessments" impact analyses are both impractical and unnecessary. A reasonable and scientifically-based classification system can and has been developed (e.g. the State of Connecticut) without the burdensome requirements set

QUESTION 3

Is ground water classification an effective and useful approach to setting priorities on the protection of significant ground waters? To identifying appropriate areas for siting new hazardous waste disposal facilities and other facilities with the potential for seriously affecting ground water quality?

* * * *

- The ground water classification concept is a technically feasible approach to setting priorities on the protection of "significant" ground waters.

The concept, if implemented properly, should help differentiate the high priority ground water areas while making ground water of lower priority available for other uses.

EPA has proposed a classification system which appears to possess signficant flexibility. The system will be based on present or projected future uses and will include considerations of quality, yield, vulnerability (geologic setting) and value (socioeconomic and political). The state agency charged with implementing the classification will have considerable flexibility because they can weigh each consideration according to their own concerns and desires. For instance, one state might place more emphasis than another on aquifer yield when classifying ground water. This could conceivably result in the two states adopting different use categories for ground waters with similar or even identical characteristics. Obviously, each state will emphasize the considerations most important to that particular state or region. The resultant ground water classification should reflect the ground water priorities of that state or region fairly accurately. Ground water quantity questions are intimately connected to questions of ground water quality. Any regulated program impact on ground water quality must be consistent with existing state ground water quantity management programs. Almost without exception state ground water quantity programs are based on use classification. Accordingly, ground water quality programs must also be based on use classifications if they are to be effective.

While generally agreeing with the ground water classification concept, CMA is concerned about the arbitrary nature of the "value" consideration. The other considerations are numerical in nature and lend themselves to some sort of mathematical matrix that should result in a logical, scientifically-based classification. The value consideration, however, is quite subjective and could obviate any matrix. If an unwarranted high value is attached to all ground waters within a state, the resultant classification might include only one use category and only one level of protection. This is clearly contradictory to the proposed EPA goal that "recognizes that all ground water is not of the same value". The socioeconomic value and even political value of ground water should be important considerations but should not automaticlally overshadow all other considerations.

- The ground water classification concept is a sound, scientifically-based approach to identifying appropriate areas for siting new hazardous waste disposal facilities and other facilities with the potential for seriously affecting ground water quality.

The concept will provide the implementing state agency with the flexibility to address vulnerability as a single consideration, thereby differentiating those areas characterized by geologic settings amenable to waste disposal activities.

All ground waters within a state that are judged to have minimum vulnerability may be potential candidates initially for purposes other than drinking water. This means, of course, that the geologic factors associated with the candidate ground water must be such that the potential for contamination is low and that the potential for transport of contaminants to ground water with higher classifications is also low. Properly weighted consideration of the other factors (quality, yield, and value) should further reduce the candidates for nondrinking water uses.

While ground water classification may be an effective tool allowing waste disposal in suitable areas while protecting drinking water in others, there may be problems in classifying ground water regulated by other existing laws. For instance, Subtitle D of RCRA prohibits the open dumping of solid waste. Discharges from a solid waste disposal facility cannot cause the underlying ground water quality to exceed the MCL's for the primary drinking water standards without violating the federal prohibition against open dumping. The states should have the sole authority to classify ground water and set criteria for compliance with the various use classes. However, it is important to recognize that this authority could conceivably result in a lesser use class and compliance criteria for ground water underlying solid waste disposal facilities. CMA does not support EPA's self-proclaimed override authority with regard to state ground water if it strips states of their right to classify all ground waters according to their own needs. A ground water classification system will be most effective when the various federal programs, to the maximum extent possible are consistent with the state classification.

QUESTION 4

What are the technical impediments to carrying out a classification system? Are there social, economic or political impediments? What steps should be taken at the federal, state or local levels to overcome such impediments?

* * * *

- Where a scientifically valid data base is available, there are no major technical impediments to carrying out a classification system.

The data base should consist of information such as fate and transport of contaminants, sources of contamination and resource definition. Much of this information is already available at various federal and state agencies. When the monitoring requirements of existing laws like RCRA and SDWA become effective, even more site-specific data will be generated. EPA has proposed to make these and other technical resources available to the state officials charged with implementing the classification system. We endorse the use of this ever-expanding data base in carrying out the classification system.

The proposed strategy proposes to minimize "logistical" problems associated with the classification system by working with the states to develop a common system. Such a common classification system should enable the continuation of a ground water classification system across state lines if desired with no major differences in use classes of levels of protection. However, the proposal to coordinate the various state classification systems should be implemented with caution since such coordination, in the extreme, can result in an inflexible system. Interstate agreements and compacts may be a more effective way of dealing with "logistical" problems.

- There will be certain social, economic or political impediments to the classification of a state's ground waters. Most of these impediments will be more dependent upon current uses of ground water and will usually be quite site specific.

Any policy which intends to classify all ground water, which could conceivably be of drinking water quality or better, will find several barriers at the state and/or local level(s). Ground water which is suitable for drinking water may be needed by a state for another use. If the state is confident that other adequate drinking water supplies exist for present and projected needs, the state prerogative should be to use ground water supplies for other purposes. The "presumption of drinking water" in the proposed strategy is based on the assumption that ground water must be classified whether or not there is a need to use the resource. Good management of a natural resource accommodates a variety of users and beneficiaries. The arbitrary classification of ground water as drinking water, before any need has been identified, is inappropriate.

Lack of such funding can prohibit the states from hiring adequate additional staff, providing ample public participation in classifying or reclassifying ground water resources, and enforcing their entire classification system (permitting, compliance, etc.). Lack of planning and implementation funds are also significant impediments to ground water classification in many states. Each state would be able to more quickly get its classification system in place if the Agency provided at least minimum financial assistance through the Clean Water Act's section 208 program.

State/EPA agreements (SEAs), however, are not appropriate funding mechanisms because such agreements may infringe upon traditional rights of the states to allocate waters within their jurisdiction. SEAs must be limited to authority specifically granted to EPA by federal statute. EPA must cease using these agreements as a means to coerce states into carrying out policies and programs that Congress has not included in existing laws.

Political impediments to classification could occur either within state governmental agencies or between state and local authorities. Most interagency controversies as to which department has the prime responsibility for the classification program could be eliminated by encouraging state strategies which specify the lead agency and the relationship between that Agency and all other interested agencies. Disagreement between state and local governments would be greatly reduced if adequate public participation programs encouraged full local participation in developing a state strategy. Such concepts as ground water advisory commissions, state-wide classifications boards, and negotiation/mediation techniques would help solve areas of disagreement early in the process.

QUESTION 5

What criteria might be devised to ensure appropriate participation of local authorities in the formulation of state ground water protection strategies and in classifying ground waters?

*   *   *   *

- All interested or affected segments of society should be given an adequate opportunity to participate in the formulation of the state strategy.

The development of individualized state ground water protection strategies is one of the key elements of the proposed national ground water strategy. Each state strategy will establish a unique framework for all future planning, implementation, and enforcement activities at the state and local level. Consequently, it is important that local governments, the general public, business and other interested segments of society all be encouraged to participate in the formulation of the state strategy. The proposed national strategy should not over-emphasize the participation of local authorities to the exclusion or detriment of other segments of society.

● <u>The key to achieving such broad-based participation in state decision making is to ensure that interested and affected segments of the public have the opportunity to receive accurate, understandable, pertinent, and timely information sufficiently in advance to impact decision making.</u>

The biggest obstacle to effective public participation in governmental activities has been a lack of full public awareness of those activities. Identification, notification and education of interested and affected segments of society at an early stage of regulatory development will help maximize appropriate participation. Governmental authorities, however, should not expect or attempt to force the same level of public interest and involvement in all aspects of a program. Encouragement, not coercion, is the appropriate governmental approach to public participation.

Suggested criteria to encourage public participation in the formulation of state ground water protection strategies and state classification of ground water include the following:

Make more extensive use of existing federal public participation procedures and regulations to the extent that the state ground water management programs carry an existing EPA program. EPA's Office of Water and Waste Management has already promulgated regulations encouraging public participation in rulemaking activities under the Resource Conservation and Recovery Act, the Safe Drinking Water Act, and the Clean Water Act (40 CFR Part 25). Similarly, the public participation requirements for the NPDES Permit Program, the RCRA Hazardous Waste Program, the Dredge and Fill Permit Program, and the Underground Injection Control Program were promulgated on May 19, 1980. These two sets of regulations set forth requirements for public information, public notification, public consultation, advisory groups, and responsiveness summaries. To the extent mandated by federal law, full use of these existing public participation procedures should insure participation by all parties who want to participate. EPA could specify that the federal public participation policy be incorporated in guidance, program . grant regulations and delegations of authority to the state to administer existing federal programs. A new federal participation policy exclusive to the ground water program, however, is unnecessary.

For state ground water management activities that go beyond those mandated by existing federal law, the states should be encouraged to establish a policy of full public participation in the formulation of ground water strategy and classification. This could be done by using existing state and local organizations designed to review decisions of community-wide impact. Such organizations might include planning commissions, advisory boards, and area-wide water planning agencies. To the extent that the states have poor informationsharing processes or none at all, the federal government could encourage improved public participation by making financial assistance available. Ultimately, however, the states must be allowed to adopt the level of public involvement appropriate for that state's own needs.

- <u>State, not local, government should retain primary responsibility for the formulation of the state's ground water protection strategy and classification</u>.

The proper role of local authorities in the formulation of a state strategy is to participate in, and influence decision making at the state level. Area-wide management efforts will be necessary to effectively deal with ground water problems that may encompass a number of local communities. State governments are generally the only organizations within a state that have the time, necessary manpower, and financial ability to review area-wide conditions and to conduct the scientific activities needed to develop an effective ground water strategy that recognizes all competing demands on the resource.

QUESTION 6

Is the proposed system for developing national criteria for ground water classification appropriate for state implementation? Are the associated federal, state and local responsibilities applicable and useful or should alternative approaches be considered?

* * * *

- The identification of a family of potential use classes for ground water is an appropriate tool to assist states in assigning appropriate use classifications to their ground water resources.

Use classes should not be considered mandatory national criteria for ground water classification. Rather the identified use classes should be but one part of the comprehensive, informational base that forms the nucleus of informed state decision making. The actual assignment of a particular use classification to a specific ground water resource within a state should result only after considering identified potential use classes together with scientific data, societal needs, intended uses, and the actual quality and quantity of the resource as it exists.

- <u>Active participation of the states in identifying a common family of potential use classes is essential.</u>

Any system of use classes must be flexible enough for individual states to select use classes reflecting national concerns yet tailored and responsive to specific state needs. For example, the quantity and quality of ground water are inextricably linked. The proposed national strategy minimizes quantity considerations. A state's implementation of a classification system, however, may well need to deal with both quantity and quality issues within the state. The development of a classification must reflect not ignore legitimate state concerns.

- <u>A strong state role in the classification process will not result in major economic dislocations or "pollution havens".</u>

Specific program requirements under various federal statutes directed toward control of specific potential sources of ground water pollution will exist concurrently with state ground water classifications. Existing specific federally-mandated programs such as RCRA will effectively discourage actions creating state pollution havens.

- <u>The proper federal role in any classification system must be cooperation with and encouragement of the states</u>.

Providing national goals, scientific information, and technical and financial support is a proper supportive role for the federal government. Funds for planning and development of state ground water strategies and programs under existing authorities should continue where they presently exist, and additional funds should be made available if possible. The traditional responsibilities of the states for management of their ground water resources should be recognized and supported. The state role should be to choose and to implement appropriate use classes using information provided by the federal government. Provision for local public participation at all phases of the classification process must be insured. This public participation process will allow for debate and consideration of issues impacting local governments, concerned citizens, and other interested parties.

QUESTION 7

Is there any basis for concern that the proposed Ground Water Protection Strategy (or any part of it) would preclude or hamper EPA or the states from acting under their "imminent hazard" statutes to protect the public health or to deal with significant environmental threats?

* * * *

- The proposed strategy will not preclude or hamper actions under "imminent hazard" statutes to protect the public health or deal with significant environmental threats under a reasonable construction of such statutes.

Three federal statutes that contain "imminent hazard" provisions that are applicable to ground water contamination are the Safe Drinking Water Act, the Resource Conservation and Recovery Act, and the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (Superfund). Although the Clean Water Act also authorizes certain emergency response actions on certain pollution to resources within the Act's purview, applicability of this Act to ground water is questionable at present.

The proposed goal for the national ground water strategy focuses on the multiple use concept. The goal also emphasizes as an "overriding concern" the assurance of ground water quality levels necessary for the protection of the public health and significant ecological systems. The federal imminent hazard statutes relating to ground water also provide for protection of the public health and the environment. With such a similar focus on public health and the environment there should be no major inherent conflict between the proposed strategy and existing statutes. Consistent and reasonable interpretations, however, of the "imminent hazard" language of these acts will insure actions that reflect the overall goal of ground water management.

A potential conflict between the strategy and existing statutes could arise if the present drinking water source presumption contained in the proposed strategy were automatically translated by enforcement officials into a public health protection presumption. The potential for this conflict is most likely under RCRA (as recently amended) and Superfund with respect to the "may present an imminent and substantial endangerment" language. When combined with the drinking water source presumption, the "may present provisions could be punitively invoked where there is no actual threat to the public health or the environment. The drinking water source presumption should therefore be removed from the proposed strategy.

- <u>Implementation of the proper national ground water strategy should lead to a situation where action under imminent hazard statutes will rarely be necessary.</u>

One of the key reasons for adopting a national ground water strategy should be to avoid situations where imminent hazard authority would have to be used. Implementation of a ground water classification system based on multiple use and application of appropriate technical requirements to ground waters by use class should adequately protect human health and the environment from any hazard. Of course, in implementing a classification system, it will be necessary to protect existing ground water uses, provide alternative sources where necessary, or compensate the vested user where condemnation of existing rights is required.

- <u>Imminent hazard authorities should be construed to the maximum extent possible in a manner that is consistent with the national ground water strategy</u>.

The various imminent hazard authorizations must be reasonably interpreted in a manner consistent with the national ground water policy to avoid situations where use of such authorizations could undercut the national strategy. These imminent hazard provisions generally authorize the government or the courts to order a halt in the activity causing the hazard to the public health and the environment. They also go on to authorize orders compelling "such other action as may be necessary" to abate the hazard. This authority obviously can be interpreted in many different ways by administrative agencies. The potential also exists for a court or an agency to order an action that would be inconsistent with the technical requirements and use class assigned by a state to the particular ground water. This conflict can easily be avoided by requiring interpretation of the "such other action as necessary" phrasing in various statutes in a way that is consistent with the national ground water strategy.

QUESTION 8

Should EPA seek new federal legislation to implement this strategy (or selected parts of it) immediately or should we await additional experience as outlined in the proposed strategy?

* * * *

- EPA should not seek new federal legislation to implement this strategy (or selected parts of it) immediately.

CMA agrees that the immediate challenges are those of coordination, follow-through and implementation of existing federal and state programs. As implementation of programs, such as the Resource Conservation and Recovery Act (RCRA), Underground Injection Control Program (UIC) and the recently passed Superfund legislation, are undertaken, true and accurate assessment of the condition and vulnerability of this nation's ground water resources will be developed. The need for legislation or significant new programs can more realistically be addressed at that time.

QUESTION 9

Are there areas of ground water protection into which the Federal government should not intrude itself? What would be the impact of leaving these areas exclusively to state and local control?

* * * *

- The Federal government should not take any action with respect to ground water policy which would infringe upon state water rights and water quality laws. National ground water policy must therefore be developed by consensus among the states and be implemented through state actions.

While the proposed EPA strategy document emphasizes flexibility and refers in many areas to cooperation with states, there are several critical aspects of the document which raise substantial concern and potential conflict with existing state law. The three points of most concern from the proposed strategy document are: (1) The inclusion in the goal statement of protection and enhancement of ground water quality for its own sake, (2) The assumption that all ground water suitable for drinking water must be presumed to have a "projected future use" as a drinking water supply and be protected to levels consistent with that use, and (3) An overriding power reserved in EPA to impose programs or take such actions in unspecified situations where the "problems affecting ground water are so serious, complex or ubiquitous that national action is warranted."

Taken together, the ground water quality protection and enhancement goal and the drinking water use presumption could result in an overriding nondegradation policy which in many instances might amount to a nonuse policy. Coupled with an EPA power to override state decisions and actions, a national ground water policy which includes these principles will violate many state water rights laws both as to existing and future rights, and infringe on state ground water quality laws.

As to water rights, this will be particularly true in several western states where the right to obtain water, either from surface waters or ground waters, by initiating a water right and to use that water for beneficial uses is a constitutionally protected property right. Thus policies and actions affecting ground water are not simply a matter of management decisions by government but also must protect the property rights vested in each states' citizens by its constitution. In many states the proposed EPA strategy could impair the use and market value of existing ground water rights and the right to initiate and use ground waters in the future.

In the water quality area the attached legal memorandum indicates that virtually all of the states presently have water pollution control statutes which extend to ground water. Many of these states also have specific statutory authority to develop classification systems and criteria to protect ground water quality. Often there are state and local controls adopted to meet special local circumstances. Inadequacy in state action is not as much the result of lack of authority but rather the result of "staffing and budgetary limitations", as EPA recognizes in the Strategy document. See p. III-14.

The attached memoranda from Davis, Graham and Stubbs describe in detail the potential impacts of EPA's proposed ground water protection strategy upon state water rights and water rights laws.

DAVIS, GRAHAM & STUBBS

January 22, 1981

MEMORANDUM

TO: Chemical Manufacturers Association

RE: EPA Proposed Ground Water Protection Strategy

You have asked us to comment upon certain aspects of the Ground Water Protection Strategy proposed by the U. S. Environmental Protection Agency in November of 1980 (the "EPA strategy"). This Memorandum deals primarily with the following question propounded in the EPA's strategy paper:

> 9. Are there areas of ground water protection into which the Federal government should not intrude itself? What would be the impact of leaving these areas exclusively to state and local control?

More specifically, this Memorandum addresses the advisability of leaving additional programs to protect ground water quality to state and local control in light of the impacts of the proposed EPA strategy upon (1) water rights and state water rights law, (2) state ground water protection laws, and (3) the interrelationships between those bodies of state law.

We focus upon Colorado as a case study for the water rights issue because Colorado has a highly developed body of water rights law, which has influenced its development of water quality law. Although some specific features of water rights law are peculiar to Colorado, many other states have comparable provisions. More importantly, the principles underlying the interrelationship between water rights law and water quality law are broadly applicable. Therefore, we believe that a comparison between the Colorado approach and the proposed EPA strategy illustrates fundamental and significant differences.

I. Description of Proposed EPA Strategy

A. Goals

The proposed goal of the EPA strategy is laudable:

> To assess, protect and enhance the quality of ground waters to the levels necessary for current and projected future uses, and for the protection of the public health and significant ecological systems. EPA strategy paper, p. VI-1.

The goal is described by the EPA strategy paper as providing "flexibility to accommodate state and local conditions affecting ground water" and permitting explicit decisions as to whether particular aquifers should be preserved for drinking water purposes or allowed to be used for industrial, agricultural or other purposes. Both of these characteristics are desirable. Apparently, in proposing a goal keyed to future as well as to present uses, the EPA rejected the alternative possible goal of non-degradation of all ground waters.

However, the means proposed to implement the goal seriously undercut the benefits set out to be achieved and bring the EPA dangerously close to a non-degradation and even non-use standard.

B. Implementation

The EPA proposes to implement its strategy by encouraging the states to develop ground water classification systems. Ostensibly, this arrangement would permit the states considerable flexibility in classifying ground waters for different uses. However, the EPA proposes that the Federal government would: develop the set of ground water classes into which the states must assign individual ground waters, develop criteria for the classification categories, take the lead in developing consistent approaches from state to state, override state program decisions in some unspecified instances and take direct action in other unspecified situations where the "problems affecting ground water are so serious, complex or ubiquitous that national action is warranted". EPA strategy paper, p. VII-10. The tool which the EPA proposes to use to "encourage" the states to adopt and implement classification procedures which are acceptable to the EPA is financial: funding of the classification process under State/EPA Agreements.

The classification process which the EPA envisions would:

> begin with the assumption that all ground water now suitable for drinking water (whether or not it is currently being used for drinking waters) must be presumed to have a "projected future use" as a drinking water supply and should be protected to levels consistent with that use. EPA strategy paper, p. VII-6.

If a state seeks to classify a particular aquifer for some other purpose, the EPA contemplates that it may do so only in rare circumstances and that it will impose stringent control requirements on the types of use (energy production, agriculture, industrial use, etc.) which then would be permitted.

Once an aquifer has been classified, the EPA apparently contemplates that the purposes of that classification will be effected by siting controls, prohibition or limitation of certain types of industrial development, including energy facilities, and mandatory best management practices for activities such as agriculture. Technology-based or effluent standards also may be imposed. The EPA strategy paper defers detailed discussion of these technical approaches and recognizes that a great deal is unknown as to how these approaches actually would work.

C. <u>Recognition of Ground Water Uses</u>

The EPA strategy paper recognizes, in its articulation of assumptions, that any strategy for protecting ground water quality must complement existing programs concerned with ground water use.

> The quantity and quality of ground water are so inextricably linked that any efforts to protect or enhance quality will have to be coordinated with the activities of the states and other Federal agencies in managing the quantity of ground water use. Ground-water management efforts must also be coordinated with surface water quality management programs. EPA strategy paper, p. V-1.

That is true and important, although the EPA also should have recognized that questions of ground water rights and use are not solely the province of government management programs. These are also matters of private right, constitutionally protected as property. Unfortunately, however, the EPA strategy does not comport even with its limited acknowledgement of the need to recognize ground water uses.

D. Practical Problems

Combining the presumption that all aquifers of drinking water quality would be preserved for that purpose with the anticipated strict control requirements for uses overlying or utilizing an aquifer where some other activity is permitted, the proposed EPA strategy looks a great deal like the non-degradation standard which the EPA says that it has chosen not to adopt. The situation is exacerbated in the western states, where the water supply is the shortest and a non-degradation policy may mean strict limitations on the future use of the ground water resource, by at least three additional factors:

1. Until an aquifer is classified, the EPA strategy assumes that: "all ground water currently of drinking water quality will be presumed to be a drinking water source and provided protection to insure that its utility for this purpose is not impaired". EPA strategy paper, p. V-1.

2. It is not contemplated that the individual states will have complete programs fully implemented until 1990.

3. Relative scarcity of water is a special consideration, in the view of the EPA, for classifying an aquifer restrictively, for drinking water purposes only; this, despite the facts that in states like Colorado agricultural use is now and is anticipated to be the predominate use of ground water and that future energy and other industrial developments frequently must look to ground water to obtain a reliable supply.

II. Effects upon Rights Obtained under State Water Law

A. Ground water use

Ground water is used extensively in Colorado for domestic, municipal, industrial and agricultural purposes. One factor which compels agricultural, energy and other industrial water users in the west to rely upon ground water is the seasonal variation in surface flows. Flows may be high during the annual run-off, but at other times of the year be so low that the supply is insufficient for existing users, let alone new users. Colorado's surface flows are over-appropriated much of the year. This means that to enjoy a reliable physical supply, a water user must look to an aquifer where the physical supply is more constant. Frequently this is the best--or only feasible--means of assuring a reliable water supply. Sometimes a water user may have the alternative of purchasing a water right with a very senior priority, but then his use will be limited to the historic season of use actually enjoyed by that senior right, which typically was only the irrigation season. He may have the option of constructing storage facilities and impounding flows during the seasonal run-off to dampen out the variation in flow, but this option is not easily implemented. Cf. President's Water Policy Message: Detailed Background (June 6, 1978); Memorandum from the President, July 12, 1978, re: Improvements in the Planning and Evaluation of Federal Water Resource Programs and Projects. An aquifer on the other hand provides both a reservoir facility and a ready source of storage water, available without dam construction.

B. The nature of a water right

In Colorado, both the right to initiate a water right, whether related to ground water or surface water, and the right to use it are constitutionally protected. Colorado Constitution, Article XVI, Sections 5 and 6. A water right supplied by ground water is just as fully a property right, entitled to exercise and protection in accordance with its priority of appropriation, as is a right supplied by surface diversion. Our Supreme Court has endorsed the use of ground water in order to maximize, i.e. increase, the beneficial use of water, subject to protecting the water rights of others. Fellhauer v. People, 167 Colo. 320, 447 P.2d 986 (1968), Cache La Poudre Water Users Assn v. Glacier View Meadows, 191 Colo. 53, 550 P.2d 288 (1976). Mining of an aquifer, provided that this is done over a reasonable period of years, is recognized as necessary and proper. Fundingsland v. Colorado Groundwater Commission, 171 Colo. 487, 468 P.2d 835 (1970). In short, the right to use ground water in Colorado is both indispensable to the State's well being and protected as a property right by state law.

C. The interrelationship of water rights and water quality

Despite the importance assigned to water use, water users are not entitled by their appropriative rights to generate waste into water they appropriate and return to the stream waste products which will detrimentally affect the beneficial uses to which other users have put, or can put, the water resource. The Humphreys Tunnel and Mining Company v. Frank, 46 Colo. 524, 531-532 (1909) (mine and mill wastes); Mack v. Town of Craig, 68 Colo. 337, 341-342 (1920) (municipal sewage); Wilmore v. Chain O'Mines, Inc., 96 Colo. 319, 325, 44 P.2d 1024 (1934) (mine and mill wastes); The Farmers Irrigation Company v. The Game and Fish Commission of the

State of Colorado, 149 Colo. 318, 323-324, 369 P.2d 557 (1962) (fish hatchery wastes); The Suffolk Gold Mining & Milling Company v. The San Miguel Consolidated Mining & Milling Company, 9 Colo. App. 407, 418 (1897 (mine and mill wastes).

Thus, the Colorado common law recognizes a right of action for damages and injunction by water users against each other to enforce that degree of water purity requisite to their beneficial uses. The priority doctrine has no application to these circumstances--the question is not who was first but whether a water use is impaired by pollution caused by another. As a corollary to this principle, a water rights holder does not acquire the right to receive and utilize pollutant constituents being carried by the stream, even though a particular constituent in the water may enhance the productivity or economic benefit of the waters' application. A-B Cattle Company v. United States, ____ Colo. ___, 589 P.2d 57 (1979).

The Colorado common law of water quality protection for beneficial use does not recognize a right in water users to curtail or prevent water withdrawal which may have a concentrating effect upon naturally occurring or man caused pollution in the stream, impairing beneficial uses. Stated differently, there is no right to in-stream appropriations for pollutant dilution purposes. All waters in and tributary to surface waters are available for appropriation, subject to the quantitative rights of seniors. This is the essence of the Colorado appropriation doctrine. Metropolitan Suburban Water Users Association v. Colorado River Water Conservation District, 148 Colo. 173, 187-188, 365 P.2d 273 (1961).

The common law of water quality protection in Colorado forwards the maximum utilization of the water resource for beneficial uses. It cannot be read to restrict or condition the right to appropriate volumes of water from the stream, but only to provide relief against the generation and introduction of waste products which diminish the incentive and usefulness of appropriations by others.

In Colorado, water quality law complements rather than detracts from water quantity law. The common law developed by the courts of Colorado provides the background for understanding and interpreting Colorado statutory enactments on water quality. The common law has not been supplanted; the Legislature provided for cumulative remedies. C.R.S. 1973, 25-8-612. The long history of a constitutionally based water rights system, and concomitant water quality protection, was the background against which the Colorado General Assembly acted.

Water pollution control law in this State was codified in the "Colorado Water Pollution Control Act of 1966". The basic thrust of that Act was to establish a State water pollution control commission which had authority to establish water quality standards to conform with the then existing Federal Water Pollution Control Act, including the federal Water Quality Control Act of 1965. 1966 Colo. Sess. Laws, Ch. 44, p. 205, Section 8(1). With respect to limitation of the Commission's regulatory powers in regard to water rights, the 1966 Act provided as follows:

> In administering this Act, including adoption and promulgation of standards of quality, the Commission shall not require any present or future appropriator of water to divert, cease diverting, exchange, cease exchanging, store, cease storing, or release any water, for the purpose of controlling pollution in the waters of the state.

1966 Colo. Sess. Laws. Ch. 44, p. 206, Section 8(2).

In 1973 the Legislature adopted the Colorado Water Quality Control Act, C.R.S. 1973, 25-8-101 et. seq. and provided an even more sweeping section regarding its intent to respect the water rights law and administration in the State:

> Nothing in this article shall supersede the provisions of Articles 80 to 93 of Title 37, C.R.S. 1973.

C.R.S. 1973, 25-8-506(1). The statutory sections referred to deal with the entire range of the water rights system, from appropriation of water, through storage and exchange of water, the right to convey water through natural streams and lakes, and the right to build ditches, canals and reservoirs. Thus, the Legislature replaced the 1966 language with an even more comprehensive declaration which prohibits the Commission from displacing the water rights system by water quality regulation.

This approach is consistent with the federal authority under which the EPA operates. According to the terms of the Wallop amendment, federal water quality regulation was never meant, and is not now meant, to impair these State law systems or rights acquired under these State law systems. The Conference report to the Clean Water Act enunciates clearly the federal policy to respect State water rights systems and the rights to quantities of water obtained under such systems:

> The conference substitute amends section 101 of the Act to add a new subsection declaring it the policy of Congress that the authority of each State to allocate quantities of water within its jurisdiction should not be superseded, abrogated or otherwise impaired by the Act. It is further the policy of Congress that nothing in this Act should be construed to supersede or abrogate rights to quantities of water that have been established by any State. Federal agencies are to cooperate with State and local agencies to develop solutions to prevent, reduce and eliminate pollution in concert with programs for managing water resources. . . .
>
> This provision is intended to clarify existing law to assure its effective implementation. It is not intended to change existing law.

Conference Committee, Report No. 95-830, p. 236, Vol. 3, Leg. Hist. of 1977 Clean Water Act.

D. Procedures to initiate a water right

In order to initiate a ground water right in Colorado, the water user must first obtain a permit from the State Engineer or, if he is located within a designated ground water basin, from the Ground Water Commission. The

Ground Water Commission may deny a permit on the basis of "unreasonable deterioration of water quality", but only if the proposed use will impair uses under existing water rights "beyond reasonable economic limits of withdrawal or use". 1973 C.R.S. 37-90-107(5). With regard to permits outside of designated basins, the State Engineer is directed to (and does) impose conditions upon drilling, casing, and equipping wells to prevent pollution. Typically these include conditions that the well bore be cased and sealed so as to prevent the intermingling of waters from different aquifers. 1973 C.R.S. 37-90-137(2). Thus, quality is already a consideration in the initiating of a ground water right, but the standard is one that encourages reasonable use of the ground water and protection of other uses, rather than non-degradation.

E. <u>Practical impacts of the EPA strategy</u>

The EPA strategy, if adopted and implemented, would frustrate the drilling of new wells and the use of ground water for anything other than drinking water purposes. Any withdrawal for an agricultural or industrial use overlying a shallow aquifer can be said to contribute in some way, albeit small, to the degradation of water quality in that aquifer. Some would argue that the removal of water from an aquifer, for any purpose, even for use elsewhere, degrades the aquifer water quality by leaving less water in place to bear the existing pollutant load.

By extension, since diversions of ground water which is tributary to a surface stream eventually diminish ground water contributions to surface flows, ground water use, per se, could be seen as degrading surface water quality. Under the proposed EPA strategy, an applicant for a well permit in Colorado would first have to demonstrate the quality of water present in the aquifer, particularly if that aquifer had not yet been classified, and then would have to bear a very heavy burden of proof in order to use the water for purposes which would impair the potential use of that aquifer for drinking water purposes, even if the aquifer did not then serve as a source of drinking water. The test for obtaining the permit to initiate the water right would not simply be that the applicant protect other existing uses, but that he avoid degrading the aquifer to an extent that would impair its use for drinking water supply. The practical effect would be to deny the constitutionally-protected right to appropriate ground water and to deprive the citizens of Colorado of a badly needed source of water supply.

The EPA strategy could become a tool for barring needed industrial development which utilizes ground water. For example, oil shale, coal and other minerals frequently are found in or below water-bearing strata. The energy companies must dewater that mining zone in order to operate.

Existing water rights also would be subject to impairment. Today, a farmer chooses how to irrigate--flood, sprinkler, drip, etc.--based upon economic and farming considerations. Under the "best management practices" contemplated by the EPA strategy he might be required to farm so as to minimize percolation of return flows into the underlying aquifer, despite what the logic of farming may dictate. This, in turn, affects the return flow reaching the next water user and hence his water supply.

The transferability of water rights would be impaired as a practical matter. Today, a water user or the purchaser of a water right may change the nature of use of that water, subject only to the requirement that other users are not injured. Non-injury includes the protection of a usable quality of supply. Under the proposed EPA strategy, however, an industrial user, real estate developer or other water user who purchased and sought to use a surface water right to replace stream depletions caused by his wells would find an additional limitation upon the change of use. He would be required not only to preserve the quantity and quality needed by other water users, but to preserve the quality, *per se*, of the water in the aquifer providing his supply.

III. Conclusion

Many states require permits to initiate ground water rights and apply a standard of non-injury to other water users. (See, *e.g.*, Utah, Wyoming, Kansas, Idaho.) Many states permit the change of use of existing water rights, subject only to non-injury to other water users. (See, e.g., California, Oregon, New Mexico.) The effects of the proposed EPA strategy upon state water law systems and the rights created under those systems are not discussed in the EPA strategy paper, and perhaps were not foreseen. These effects dictate that the EPA re-examine the ground water quality issues in light of the fact that "the quantity and quality of ground water are so inextricably linked. . . ." EPA strategy paper, p. V-1. What is required is deference to particularized state law approaches which take this interrelationship into account.

Memorandum

United States Environmental Protection Agency - Proposed Ground Water Strategy

State Authorities To Protect Ground Water Quality

On November 24, 1980, the Environmental Protection Agency ("EPA") announced its proposed Ground Water Strategy [See 45 Fed. Reg. 77514 (November 24, 1980)]. This "strategy" paper is founded on the premise that existing state authority to protect ground water quality is either non-existent or inadequate. Accordingly, EPA proposes to develop ground water classifications and minimum national requirements for selected high priority problems. (45 Fed. Reg. at 77516). In soliciting public comment on its strategy, EPA inquired:

> "Are there areas of ground water protection into which the Federal government should not intrude itself? What would be the impact of leaving these areas exclusively to State and local control?"

(Id. at 77514). In an earlier memorandum (January 22, 1981) we responded to EPA's inquiry with respect to the impact of the proposed strategy on state water rights law. The present memorandum addresses the related question of existing state authorities to protect ground water quality. Unlike the Federal government, which has no jurisdicition over ground water under the Federal Water Pollution Control Act [Exxon Corp. v. Train, 554 F.2d 1310 (5th Cir. 1977)], virtually all of the states presently have water pollution control statutes which extend to ground water. Many of these states also have specific statutory authority to develop classification systems and criteria to protect ground water quality. These existing state authorities demonstrate both that the question of ground water quality control is being addressed at the state level and that, in many cases, there are state and local controls adapted to meet special local circumstances.

Moreover, EPA's "strategy" paper itself indicates that: "State staffing and budgetary limitations will, for the most part, determine the ultimate form and organization of ground water protection efforts. It appears that no state has the resources or funding it needs." Thus, even by EPA's reckoning, it is inadequate funding -- and not inadequate authority -- which hampers developing state ground water control programs. Since funding can be provided without extensive Federal control over program elements, and since peculiar local factors may affect a particular state's ground water strategy, it seems highly inappropriate for the Federal government to intrude on state ground water control authorities. The Federal government should allow the states to develop their own ground water programs.

Many states have existing, explicit authority to protect ground water and to establish ground water criteria or standards. The following is a brief description of several examples:

<u>ALASKA</u>: Under Alaska law, the State has pollution control authority over "bodies of surface or underground water." ALASKA STAT. §44-46.03.900(22) (1979). Moreover, Alaska's water quality standards include classification of the State's ground water. <u>See</u> 1 State Water Laws - Envir. Rep. (BNA) at 706: 1012.

<u>COLORADO</u>: The Colorado definition of "state waters" includes "any and all surface and subsurface waters which are contained in or flow in or through . . ." the state. COLO. REV. STAT. §25-8-103(16) (1973).

The Colorado Water Quality Commission has the authority to promulgate water quality standards for state waters which describe water characteristics or the extent of specifically identified pollutants. Standards may be promulgated for use in connection with any one or more of the classes of state waters authorized pursuant to Section 25-8-203. The Commission is required to promulgate control regulations to describe prohibitions, standards, concentration, and effluent limitations, or the extent of specifically identified pollutants. COLO. REV. STAT. §25-8-204 (1973). One of the considerations in promulgating control regulations is the need for safety precautions that should be taken to protect water quality, including requirements to protect <u>subsurface waters</u> in connection with mining, and the drilling and operation of wells. COLO. REV. STAT §25-8-205 (1973).

<u>DELAWARE</u>: The Delaware law expressly prohibits unpermitted activities "in any way which may cause or contribute

to discharge of a pollutant into any surface or ground water." DEL. CODE ANN. tit. 7, §60-6003 (1979).

FLORIDA: Florida law defines "waters" to include "all other waters . . . surface or underground." FLA. STAT. §403.031(3) (1979). Moreover, the State Department of Environmental Regulation is expressly directed to take "general control and supervision over underground water. . . ." FLA. STAT. §403.062 (1979). Florida's regulations establish separate ground water effluent limitations (§17-6.20) and ground water quality criteria (§17-3.071; §17-3.151). See 1 State Water Laws - Envir. Rep. (BNA) at 746:0608,746:1009, 746:1014 (1979).

ILLINOIS: The State statute defines "waters" to include "surface and underground" waters. ILL. ENVIR. PROTECTION ACT, tit. I, §3(0) (1979). Moreover, the State's governing regulations require that underground waters meet the detailed water quality criteria for Public and Food Processing Water Supply. Ill. Pollution Control Bd. Regulations §§204, 207; 1 State Water Laws - Envir. Rep. (BNA) at 766:0507, 766:0510 (1979).

INDIANA: The Indiana statute defines "water" to include "underground water." IND. CODE §13-1-13-16 (1979). In addition, the State regulations establish water quality criteria for underground water. Indiana Administrative Code tit. 330, §§6, 7; 1 State Water Laws - Envir. Rep. (BNA) at 771:1002, 771:1004 (1979).

MAINE: The Maine Statute defines such terms as: aquifer, aquifer recharge area, and ground water, in addition to its general definition of "Waters of the State" which includes "any and all surface and sub-surface waters which are contained within, flow through, or under or border upon this State or any portion thereof. . . ." ME. REV. STAT. tit. 38, §361-A(1980). In addition, the statute provides that the Maine Board of Environmental Protection "shall have two standards for classification of ground water". ME. REV. STAT. tit. 38, §363-B(1980). The highest classification is called "GW-A" and must be of such a quality that it can be used for public water supplies. (Id.). GW-B is the second highest classification and "shall be suitable for usages other than public water supplies." (Id.).

NEW MEXICO: In New Mexico, the definition of waters of the State include surface or subsurface waters. N.M. STAT. ANN. §75-39-2(G)(1977). The State Water Quality Control Commission has the authority to adopt comprehensive water quality programs, water standards, and regulations. In adopting standards, the Commission is to consider a number of factors including the public interest and the social and economic value of the source of the contaminant, practicability of decreasing the contaminant, successive uses, and flexibility of treating the contaminant before a successive use is made. The Commission also has the authority to classify waters and sources of contaminants as will facilitate the assignment of administrative responsibilities to various agencies implementing the State Water Quality Act.

The New Mexico Statute specifically protects State property rights in water and disavows any intent to modify existing water rights. N.M. STAT. ANN. §75-39-11(A)(1977).

Regulations promulgated by the Commission for discharge onto or below the surface of the ground are intended to protect ground water which has an existing concentration of 10,000 mg/l or less TDS (total dissolved solids) for present and potential future use as domestic and agricultural water supply and to protect those segments of surface waters which are gaining because of ground water inflow. The regulation allows degradation of ground water up to the limit of the standards if the concentration of the pollutant is less than the standard, and will have existing concentrations equal the level of maximum degradation if greater than the standard. New Mexico Water Quality Control Commission Regulations, Pt. 3-101; 2 State Water Laws - Envir. Rep. (BNA) at 856:0505 (1977). New Mexico has also promulgated numerical standards for ground water which has a TDS concentration of 10,000 mg/l or less. Id. at Pt. 3-103.

NEW YORK: The definition of New York waters includes surface or underground water. N.Y. [Envir. Conserv.] Law §17-0105(2).

The New York Department of Environmental Conservation has the authority to classify waters so that appropriate quality standards can be applied. When adopting classifications and standards the Department is to consider: (1) The size, depth, surface area, volume, direction, rate of flow, and temperature; (2) the character of the district bordering the waters and its suitability for particular uses in an attempt to encourage the most appropriate use for residential, agricultural, industrial or recreational purposes; (3) uses which have been, are being, or may be made of the water; (4) the extent of present defilement. The Department has the authority to assign standards of quality and purity for each classification necessary for the public use or benefit contemplated by such classification. Id. at §17-0301.

Part 703 of the New York Water Classifications and Quality Standards of the Code of Rules and Regulations of the State of New York, Chapter X, specifically establishes ground water classifications and quality standards. See 2 State Water Laws - Envir. Rep. (BNA) at 861:1007 (1979).

In addition to these particular states, virtually all other states now have statutory jurisdiction over ground water as part of their overall authority over the Waters of the State. See, e.g., ALA CODE tit. 22, §22-1(b)(3) (1979); ARIZ. REV. STAT. ANN. §36-1851.16 (1979); ARK. STAT. ANN. §82-1902(9)(a)(1980); CAL. WATER CODE §13050(e)(1980); CONN. GEN. STAT. ANN. §25-54(b) (1980); GA. STAT. ANN. §17-5-3(d)(1978); HAW. REV. STAT. §342-31(6)(1979); IDAHO CODE §39-103(9)(1980); IOWA CODE §455 B.30(9)(1979); KAN. STAT. §65-161 (1975); KY. REV. STAT. §224.005(28) (1980); LA. REV. STAT. ANN. §30-1093(5)(1980); MD. PUB. HEALTH CODE ANN. §43-387(1980); MASS. GEN. LAWS ANN. ch. 21, §26A(1980); MICH. COMP. LAWS §323.11(b)(1980); MINN. STAT. ANN. §9-115.01(9)(1980); MISS. CODE ANN. §49-17-5(f)(1979); MO. ANN. STAT §12-204.016(15)(1980); MONT. REV. CODES ANN. §75-5-103(9)(1980); NEB. REV. STAT. §81-1502(21)(1980);NEV. REV.

STAT. §445.191 (1980); N.H. REV. STAT. ANN. §149: 1 (VIII)(1979), N.J. STAT. ANN. §58:10-23.11b(u)(1980); N.C. GEN. STAT. §143-213(20)(1980); N.D. CENT. CODE §61-28-02(6) (1977); OHIO REV. CODE ANN. §6111.01(H)(1978); OKLA. STAT. tit. 63 §1-901(a)(1980); OR. REV. STAT. §468.700(8)(1980); PA. CONS. STAT.§1 (1979) (2 State Water Laws - Envir. Rep. (BNA) at 891: 0102); S.C. CODE §48-1-10(2)(1980);S.D. COMPLIED LAWS ANN. §34A-2-2(6)(1978); TENN. CODE ANN. §70-326(cc)(1978); TEX. WATER CODE ANN. tit. 2, §26.001(5)(1979); UTAH CODE ANN. §73-14-2(f)(1980); VA. CODE §62.1-44.3(4)(1979); WASH. REV. CODE §90.48.020(1979); W. VA. CODE §20-5A-2(e)(1979); WIS. STAT. ANN. §144.01(19)(1980); WYO. STAT. §35-11-103(c)(vi)(1978).

Moreover, some states have special ground water protections apparently intended to serve special local concerns. For example, North Carolina's Statute enumerates specific factors for establishing ground water criteria [N.C. GEN. STAT. §143-214.1(d)(5)(1980)] and the State of Texas provides special statutory protections for one of its principal aquifers (the Edwards Aquifer)[TEX. WATER CODE ANN. tit. 2 §26.046 (2 State Water Laws - Envir. Rep. (BNA) at 921.0113)].

* * *

With adequate, non-interfering Federal funding, the States are perfectly able to proceed with their own sound strategies to protect their ground water. EPA's "strategy" document laments that absent Federal interference, "ground water standards may be very different from state to state, with each state emphasizing the parameters and levels needed to ensure its own protection." EPA November, 1980 Draft at p. III-14. In view of important state interests in preserving water rights and addressing special ground water protection problems, we respectfully submit that our Federal system needs, and indeed compels, such independent state authority over its own ground water.

Respectfully submitted,

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constant after passage of the soil-column reaction front. The desorption of aromatic amines that resulted during the flush peak of soil organic acids indicated hydrophobic interactions of amines with the organic-matter component of soil.

Soil has both desirable and undesirable properties as a sorbent for organic solutes in retort wastewater. It is an effective adsorbent for organic solutes if less than 1 void volume of retort water is applied, but greater than 1 void volume will cause migration of most of the organic solutes coupled with the extraction of soil organic matter. Rainfall leaching following retort-water application also will probably enhance organic-solute migration and extraction. Therefore, soil is a useful absorbent for retort water only for small spills (1 void volume) whereby retained organic solutes will likely be degraded by additional chemical and biological processes after retort-water evaporation.

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Comparison of Groundwater and Surface Water for Patterns and Levels of Contamination by Toxic Substances

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■ The scientific literature indicates that, except for isolated exceptions, groundwater will be relatively uncontaminated with toxic substances when compared with surface water. Using data on the concentrations of 56 toxic substances in samples of both groundwater and surface water from New Jersey, we test this relationship. The results indicate that in New Jersey groundwater has the same patterns of contamination by toxic substances and is at least as contaminated as surface water.

Contamination of public drinking-water supplies by toxic substances poses a serious problem in the United States. The numerous reports of toxic and carcinogenic substances contamination of groundwater in recent years have been widely accepted as isolated examples. The effort to protect potable water supplies from toxic substances contamination has focused on surface-water sources. It has simply been assumed that groundwater is relatively uncontaminated with toxic substances when compared to surface water. Using data from New Jersey, this paper tests that assumption.

Knowledge of chemical and geohydrologic processes leads us to believe that groundwater should be less contaminated with toxic substances than surface water. Groundwater contamination is not usually direct. In most cases the pollution must pass through a layer of soil. Attenuation of contaminants flowing in the unsaturated zone is generally greater than below the water table because there is more potential for aerobic degradation, adsorption, complexing, and ion exchange of organics and inorganics. Even after a contaminant has reached the water table, many physical–chemical processes may operate to purify fluid wastes. These include dilution, buffering of pH, precipitation by reaction of water with indigenous waters or solids, precipitation due to hydrolysis, removal due to oxidation or reduction, mechanical filtration, volatilization and loss as a gas, biological assimilation or degradation, radioactive decay, membrane filtration, and sorption (*1*).

There is a body of research which indicates that these processes are effective at removing toxic substances before they reach groundwater supplies. Terrierre et al. (*2*) found that less than 0.1% of DDT applied to orchards reached groundwater. Thompson et al. (*3*) found that less than 2% of dieldrin was leached through soil after 1 yr of precipitation. Reese and Beck (*4*) found that after 20 yrs forest soil in Mississippi retained 34–50% of the DDT originally found. On the basis of the organochlorine insecticides which have been studied most extensively, many have concluded that leaching of pesticides from soils into groundwater does not appear to be important (*5–15*). Richard et al. (*16*), in a study in Iowa, found that well systems, adjacent to the alluvial plain of a river in which pesticides were found, showed little or no biocide contamination. These results indicate that soil is effective at protecting groundwater from chlorinated hydrocarbons and other toxic substances.

If the soil is polluted by toxic substances to such a degree that its adsorptive retention power is exceeded, the most diverse materials can be released to the water and can be detected in the groundwater (*17*). The great emphasis on controlling surface-water pollution and air pollution, and the mandated end to ocean dumping, have produced a manifold increase in surface and subsurface disposal of toxic water products. The Clean Water Act Amendments of 1977 clearly encourage the use of innovative technology for waste-water treatment which often entails surface or subsurface application of waste water (*18*). The Environmental Protection Agency (EPA) estimates that 2.4×10^8 ton of industrial wastes end up in land disposal sites each year (*19*). Surface impoundments receive some 1.7×10^{12} gal of liquid waste products per year (*20*). The Resource Conservation and Recovery Act (RCRA) will improve the handling and disposal of these toxic waste products when it is fully implemented (*21*). These policies and the economics of toxic waste products create pressures for land disposal of toxic substances, and that represents a threat to our groundwater resources.

A lack of clear responsibilities and effective legal mechanism is a serious obstacle to the control of toxic substances contamination of groundwater. The protection of groundwater supplies from toxic contaminants is the responsibility of the states, but few states have the necessary authority and most do not recognize the problem (22). Existing federal authority over groundwater protection is so weak that new federal legislation is widely believed to be a prerequisite for an effective groundwater protection program (23).

Experimental Section

This paper examines toxic substances contamination of groundwater in New Jersey. It attempts to determine how extensive a problem it is and how the concentrations of toxics in groundwater compare to the concentrations of toxics in surface water. The data include samples of groundwater collected from over 1000 different wells throughout New Jersey, and samples of surface water collected from over 600 different

Table I. Descriptive Information on the Toxics in Groundwater and Surface Water from New Jersey during 1977–1979 [a]

	groundwater (surface water)					
	no. sampled	no. detected	mode	median	90th percentile	highest
fluoroform	949 (431)	29 (33)	0 (0)	0 (0)	0 (0)	3.5 (2178.2)
methyl chloride	1058 (605)	3 (24)	0 (0)	0 (0)	0 (0)	6.0 (222.4)
vinyl chloride	1060 (606)	4 (21)	0 (0)	0 (0)	0 (0)	9.5 (566.0)
methylene chloride	1047 (605)	246 (275)	0 (0)	0 (0)	90.0[b] (90.0[b])	1900.0 (743.3)
chloroform	1073 (606)	690 (390)	0 (0.8[b])	0.8[b] (0.8[b])	1.5 (1.6)	438.3 (2461.8)
1,2-dichloroethane	1066 (606)	104 (71)	0 (0)	0 (0)	0 (1.1)	36.5 (304.9)
1,1,1-trichloroethane	1071 (606)	835 (478)	2.0[b] (2.0[b])	2.0[b] (2.0[b])	6.1 (2.8)	607.8 (1016.8)
carbon tetrachloride	1073 (606)	691 (412)	0 (0)	0.1[b] (0.1[b])	0.5 (0.4)	263.9 (20.6)
1,1,2-trichloroethylene	669 (462)	388 (261)	0 (0)	0.3[b] (0.3[b])	2.8 (0.6)	635.1 (32.6)
dichlorobromoethane	543 (431)	186 (186)	0 (0)	0 (0)	0.1[b] (0.1[b])	43.0 (10.0)
1,1,2-trichloroethane	1069 (603)	72 (53)	0 (0)	0 (0)	0 (0)	31.1. (18.7)
dibromochloromethane	1070 (606)	148 (108)	0 (0)	0 (0)	0.1[b] (0.1[b])	2.4 (8.2)
1,2-dibromoethane	421 (175)	34 (11)	0 (0)	0 (0)	0 (0)	48.8 (0.2)
1,1,2,2-tetrachloroethylene	421 (174)	179 (154)	0 (0)	0 (0.1[b])	0.9 (1.1)	90.6 (4.5)
bromoform	1072 (604)	235 (197)	0 (0)	0 (0)	1.0[b] (1.0[b])	34.3 (3.7)
1,1,2,2-tetrachloroethane	1072 (608)	64 (67)	0 (0)	0 (0)	0 (0.1)	2.7 (3.0)
diiodomethane	1071 (608)	64 (11)	0 (0)	0 (0)	0 (0)	2.0 (3.2)
total dichlorobenzene	1090 (615)	37 (44)	0 (0)	0 (0)	0 (0)	8031.9 (241.5)
m-dichlorobenzene	685 (463)	13 (19)	0 (0)	0 (0)	0 (0)	236.8 (241.5)
p-dichlorobenzene	685 (463)	19 (26)	0 (0)	0 (0)	0 (0)	995.1 (30.5)
o-dichlorobenzene	685 (463)	20 (15)	0 (0)	0 (0)	0 (0)	6800.0 (8.2)
aroclor 1242	662 (612)	70 (46)	0 (0)	0 (0)	0.1[b] (0)	3.4 (117.3)
aroclor 1248	668 (612)	42 (83)	0 (0)	0 (0)	0 (0)	5.4 (109.1)
aroclor 1254	1040 (612)	30 (88)	0 (0)	0 (0)	0 (0.1)	0.4 (127.0)
gem-dichloroethylene	378 (305)	168 (197)	0 (0)	0 (10.0[b])	18.5 (36.2)	17288.3 (2071.5)
dibromomethane	377 (282)	45 (79)	0 (0)	0 (0)	0.1[b] (0.1[b])	44.9 (358.6)
trans-dichloroethylene	378 (273)	191 (172)	0 (0)	0.1[b] (10.0[b])	43.0 (158.8)	818.6 (1307.5)
bromodichloroethane	142 (31)	25 (2)	0 (0)	0 (0)	0.1[b] (0.0)	1.7 (4.7)
BHC-alpha	1076 (604)	169 (236)	0 (0)	0 (0)	0.1[b] (0.1[b])	0.8 (0.1[c])
lindane	1076 (604)	222 (204).	0 (0)	0 (0)	0.1[b] (0.1[b])	0.9 (0.8)
BHC-beta	991 (604)	493 (363)	0 (0)	0 (0.1[c])	0.1[b] (0.2)	8.7 (3.1)
heptachlor	1075 (604)	228 (129)	0 (0)	0 (0)	0.1[b] (0.1[c])	1.0 (5.9)
aldrin	1076 (604)	280 (142)	0 (0)	0 (0)	0.1[b] (0.1[b])	1.2 (0.6)
heptachlor epoxide	1076 (604)	280 (240)	0 (0)	0 (0)	0.1[b] (0.1[b])	0.6 (0.5)
chlordane	1076 (603)	433 (340)	0 (0)	0 (0.1[b])	0.1[b] (0.1[c])	0.4 (0.8)
o,p'-DDE	1076 (603)	209 (266)	0 (0)	0 (0)	0.1[b] (0.1[b])	1.0 (0.1[c])
dieldrin	1076 (604)	179 (237)	0 (0)	0 (0)	0.1[b] (0.1[b])	0.9 (0.1[c])
endrin	1076 (604)	114 (83)	0 (0)	0 (0)	0.1[b] (0.1[b])	0.2 (0.1)
o,p'-DDT	1076 (604)	102 (109)	0 (0)	0 (0)	0 (0.1[b])	0.5 (0.1)
p,p'-DDD	1076 (604)	103 (164)	0 (0)	0 (0)	0 (0.1[b])	0.4 (0.1[c])
p,p'-DDT	1074 (604)	85 (104)	0 (0)	0 (0)	0 (0.1[b])	0.9 (0.1[c])
arsenic	1064 (591)	1061 (591)	1.0 (1.0)	1.0 (1.0)	3.0 (3.0)	1160.0 (392.0)
beryllium	1064 (591)	1064 (591)	1.0 (1.0)	1.0 (1.0)	1.0 (1.0)	84.0 (1.0)
cadmium	1063 (591)	1063 (591)	1.0 (1.0)	1.0 (1.0)	1.0 (1.0)	405.0 (6.0)
copper	1063 (590)	1061 (590)	1.0 (1.0)	5.0 (3.0)	64.0 (9.0)	2783.0 (261.0)
chromium	1063 (591)	1062 (590)	1.0 (1.0)	1.0 (1.0)	5.0 (6.0)	360.0 (216.0)
nickel	1062 (591)	1061 (591)	2.0 (2.0)	3.0 (3.0)	11.0 (10.0)	600.0 (45.0)
lead	1061 (590)	1058 (590)	1.0 (2.0)	1.0 (4.0)	8.0 (17.0)	572.0 (86.0)
selenium	1062 (590)	1062 (590)	2.0 (1.0)	2.0 (2.0)	2.0 (2.0)	8.0 (7.0)
zinc	1063 (589)	1063 (589)	5.0 (2.5)	15.0 (16.0)	150.0 (46.0)	36500.0 (1510.0)

[a] Concentrations in ppb. [b] Minimum reportable concentration (trace). [c] Above trace, but less than reported.

sites throughout New Jersey (*24*, *25*). The sample locations were chosen to produce a representative sample of the groundwater and surface water of the state. Samples of both groundwater and surface water were collected from every county, from urban, suburban, and rural areas, and from areas of every land use common in the state. The sample locations were selected to include approximately the same number of sites in rural or undeveloped areas as those in heavily developed areas including industrial areas and some in the vicinity of landfills. Both the groundwater and surface-water samples were characterized as water used for potable supply and those not used for potable supply. Some analyses were performed on only those samples of groundwater and surface water used for potable supply. Both data sets are basically single grab samples with some duplicates, replicates, resamples, and seasonal and time-series sampling. Both data sets were analyzed for 56 toxic substances: 27 light chlorinated hydrocarbons, 20 heavy chlorinated hydrocarbons, and nine heavy metals (see Table I).

The method used to compare the levels of toxics in groundwater and surface water consists of three distinct analyses: (1) comparison of the maximum concentration of each toxic substance in the groundwater data with the maximum concentration of that substance in the surface-water data; (2) comparison of the probability of detecting each toxic substance in the groundwater data with the probability of detecting each toxic substance in the surface-water data; (3) comparison of the nonparametric average concentration of each toxic substance in those samples with detectable concentrations in groundwater samples with those in surface-water samples.

Results and Discussion

Information on the 50 toxic substances which were detectable in at least 5% of the samples in both the groundwater and surface-water data sets is presented in Table I. The number of samples collected and the number of samples with detectable concentrations exhibit considerable variation among the toxic substances and between the groundwater and surface-water data sets. For most of the toxic substances, a greater number of samples were taken from groundwater than from surface water.

The mode, the median, and the range of concentrations provide some indication of the severely right-skewed frequency distributions of almost all of the toxic substances in both the groundwater and the surface-water data sets. The measures of central tendency are remarkably consistent between the two data sets. The fact that most of the toxic substances in both the groundwater and the surface-water data sets have similar skewed distributions and measures of central tendency indicates that the levels of contamination of these toxic substances in the groundwater and surface water of New Jersey are very similar. The high degree of skewness indicates that parametric statistical procedures will not be appropriate for comparing the concentrations of toxic substances in the two data sets.

The maximum concentrations reveal considerable variation between groundwater and surface water. For 32 of the toxics (64%) the highest concentration was found in groundwater, and for 18 toxics (36%) the highest concentration was in surface water. Since groundwater flows nonturbulently and experiences limited dilution, this result is not surprising, but it may represent a significant threat to some people consuming water from groundwater sources.

The probability of detecting each toxic in New Jersey groundwater and surface water is presented in Table II. These a posteriori probabilities are based on the limits of detection used in the analysis of the groundwater and surface-water samples collected in New Jersey (*26*, *27*). The chi-square test was used to determine whether the probability of detecting each toxic in groundwater was different from the probability of detecting each toxic in surface water at the 0.05 significance level. There is substantial variation in the probabilities of detection among the 50 toxic substances and between groundwater and surface water. For the organics the variation is much greater between toxics than between the same toxic in groundwater and surface water. All of the heavy metals were

Table II. Probabilities of Detecting Toxics in New Jersey Groundwater and Surface Water

	probability detectable in groundwater	probability detectable in surface water	significantly different at 0.05 level
fluoroform	0.03	0.08	yes
methyl chloride	0.01[a]	0.04	yes
vinyl chloride	0.01[a]	0.03	yes
methylene chloride	0.23	0.45	yes
chloroform	0.64	0.64	no
1,2-dichloroethane	0.10	0.12	no
1,1,1-trichloroethane	0.78	0.79	no
carbon tetrachloride	0.64	0.68	no
1,1,2-trichloroethylene	0.58	0.56	no
dichlorobromoethane	0.34	0.43	yes
1,1,2-trichloroethane	0.07	0.09	no
dibromochloromethane	0.14	0.18	yes
1,2-dibromoethane	0.08	0.06	no
1,1,2,2-tetrachloroethylene	0.43	0.88	yes
bromoform	0.22	0.3[illegible]	[illegible]
1,1,2,2-tetrachloroethane	0.06	0.11	y[illegible]
diiodomethane	0.06	0.02	yes
total dichlorobenzene	0.03	0.07	yes
m-dichlorobenzene	0.02	0.04	yes
p-dichlorobenzene	0.03	0.06	yes
o-dichlorobenzene	0.03	0.03	no
aroclor 1242	0.11	0.08	no
aroclor 1248	0.06	0.14	yes
aroclor 1254	0.03	0.14	yes
gem-dichloroethylene	0.44	0.65	yes
Dibromomethane	0.12	0.28	yes
trans-dichloroethylene	0.51	0.63	yes
bromodichloroethane	0.18	0.06	no
BHC-alpha	0.16	0.39	yes
lindane	0.21	0.34	yes
BHC-beta	0.50	0.60	yes
heptachlor	0.21	0.21	no
aldrin	0.26	0.24	no
heptachlor epoxide	0.26	0.40	yes
chlordane	0.40	0.56	yes
o,p'-DDE	0.19	0.44	yes
dieldrin	0.17	0.39	yes
endrin	0.11	0.14	no
o,p'-DDT	0.09	0.18	yes
p,p'-DDD	0.10	0.27	yes
p,p'-DDT	0.08	0.17	yes
arsenic	1	1	no
beryllium	1	1	no
cadmium	1	1	no
copper	1	1	no
chromium	1	1	no
nickel	1	1	no
lead	1	1	no
selenium	1	1	no
zinc	1	1	no

[a] Probability is less than 0.01.

detected in almost all samples of both groundwater and surface water.

The results of comparing the probabilities of detection of toxics indicate that the toxics included in this research are more likely to be detected in surface water than in groundwater but that, for almost half the toxics in the analysis, there was no significant difference between the probability of detection in groundwater and surface water. For 27 of the toxics (54%), the probability of detection is greater in surface water, while only diiodomethane (2%) had a greater probability of detection in groundwater. There were 22 toxics (44%) which had no significant difference in the probability of detection in groundwater or surface water.

The third and final method of comparing the levels of toxics contamination in the groundwater and surface water of New Jersey compares only those samples with detectable concentrations of the toxic substance being tested. The first method compared the maximum concentrations. The second method compared the probabilities of detection. The third method compares the central tendency of only those samples with detectable levels of toxics. The analysis uses the nonparametric Mann–Whitney test to determine whether the average concentration of each toxic in those groundwater samples known to be contaminated with that toxic is less than, not significantly different from, or greater than the average concentration in those contaminated surface water samples.

The results of comparing only samples with detectable concentrations reveal that there is no significant difference in the average concentration for the majority of toxics but that the average concentration is greater in a larger number of toxics in groundwater than in surface water (Table III). For 26 toxics (52%) there is no significant difference between the average detectable concentration in groundwater and surface water. There are 13 toxics (26%) which have greater average detectable concentration in groundwater than in surface water. There are 11 toxics (22%) which have greater average detectable concentrations in surface water than in groundwater. At the 0.05 significance level there is no difference in the average concentration for 26 toxics and a greater average concentration in groundwater samples for 13 toxics. The total, 39 toxics, is 78% of the toxic substances included in this analysis which have an average concentration at least as great in groundwater as in surface water.

The set of three analyses used to compare toxic substances in all groundwater and surface-water samples from New Jersey was repeated for different subsets of the data. The subsets of the data include all New Jersey water samples from sources used for drinking-water supply, all New Jersey water samples from sources used for non-drinking-water supply, southern New Jersey water samples, and northern New Jersey water samples; see Figure 1 (*28*). The subset of data including only water samples from sources used for drinking-water supply was chosen because of the direct threat to human health caused by toxics in drinking water and because samples collected near sewerage outfalls or landfills might be thought to bias the larger data sets. By repeating the set of three analyses on a subset of data including only samples from water-supply sources, we decrease the possibility that the results are the product of nonrepresentative samples too greatly influenced by a few heavily contaminated samples. Where the analyses of samples from water-supply sources examine the best water in New Jersey, the subset of samples from sources not used for potable supply provides the opportunity to repeat the analyses for samples from the lowest-quality water in the state.

Subsets of samples from southern and northern New Jersey were used to repeat the set of analyses because these subsets divide the state into units with distinctive physiography and land use. Southern New Jersey is entirely within the Coastal Plain physiographic province. It is a relatively flat landscape of unconsolidated sands, clays, and gravels. The land area is largely agricultural and substantially less densely populated and industrialized than northern New Jersey. A large portion of southern New Jersey is occupied by the Pine Barrens. Northern New Jersey is composed of the Piedmont, Appalachian Highlands, and Ridge and Valley physiographic prov-

Table III. Mann–Whitney Test of Detectable Groundwater Samples vs. Detectable Surface-Water Samples

	data set greater at significance level 0.05 [a]	two-tailed probability
fluoroform	ND	0.47
methyl chloride	ND	0.42
vinyl chloride	ND	0.12
methylene chloride	ND	0.06
chloroform	ND	0.32
1,2-dichloroethane	surface	0.002
1,1,1-trichloroethane	ground	0.0001 [b]
carbon tetrachloride	ground	0.009
1,1,2-trichloroethylene	ground	0.0001 [b]
dichlorobromoethane	ND	0.31
1,1,2-trichloroethane	ND	0.49
dibromochloromethane	ND	0.50
1,2-dibromoethane	ND	0.15
1,1,2,2,-tetrachloroethane	ND	0.20
bromoform	ND	0.27
1,1,2,2-tetrachloroethane	ND	0.18
diiodomethane	surface	0.04
total dichlorobenzene	ND	0.26
m-dichlorobenzene	ND	0.38
p-dichlorobenzene	ground	0.046
o-dichlorobenzene	ND	0.22
aroclor 1242	surface	0.0001
aroclor 1248	surface	0.0001
aroclor 1254	ND	0.44
gem-dichloroethylene	ND	0.77
dibromomethane	ND	0.22
trans-dichloroethylene	ND	0.75
bromodichloroethane	ND	0.25
BHC-alpha	ND	0.10
lindane	ND	0.78
BHC-beta	surface	0.0001 [b]
heptachlor	surface	0.0001 [b]
aldrin	ND	0.45
heptachlor epoxide	ND	0.22
chlordane	surface	0.018
o,p'-DDE	ground	0.049
dieldrin	ground	0.007
endrin	ground	0.001
o,p'-DDT	ground	0.0001
p,p'-DDD	ground	0.0001 [b]
p,p'-DDT	ground	0.0003
arsenic	surface	0.0001 [b]
beryllium	ND	0.06
cadmium	ground	0.009
copper	ground	0.0001 [b]
chromium	surface	0.02
nickel	surface	0.04
lead	surface	0.0001 [b]
selenium	ground	0.0001
zinc	ND	0.39

[a] ND = no difference. [b] Probability is less than 0.0001

inces and is both densely populated and heavily industrialized. Repeating the set of three analyses on these subsets of data provides additional information on the relative levels of toxics contamination of groundwater and surface water. In addition to decreasing the probability that previous results were the product of a few bad data points, these subsets provide significant contrasts in geology, soils, and patterns of human settlement.

The results of analyzing all subsets of the New Jersey data and the total data set are summarized in Table IV. The complete results of the analyses of the subsets of the data are available in a previously published work of mine (28). The results of repeating the analyses comparing toxics in groundwater and surface water on the subsets of the New Jersey data reveal a remarkable consistency. This consistency over distinctly different subsets of the data provides considerable support for the finding that in New Jersey groundwater is at least as contaminated with toxic substances as surface water. Approximately two-thirds of the toxics for which data are available have their maximum concentration in groundwater. In both of the other two tests used to compare the levels of toxics in groundwater and surface water, the major finding is that there is no statistically significant difference between the probability of detection or the average detectable concentration for most of the toxics studied. While the literature supports the view that concentrations of toxics would be expected to be higher in samples of surface water, the analysis of groundwater and surface-water samples from New Jersey reveals that the concentrations of the overwhelming majority of toxic substances either are not significantly different in groundwater and surface water or are greater in groundwater.

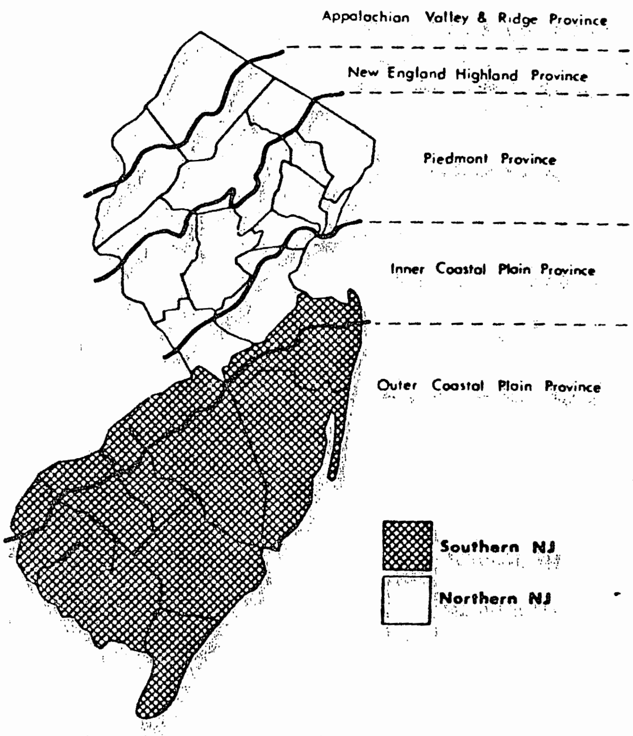

Figure 1. Northern and southern New Jersey regions.

An additional analysis compared the patterns of toxic substances contamination in groundwater with the patterns of toxic substances contamination in surface water by using the New Jersey data. These patterns of contamination are groups of toxic substances which factor analysis found to be usually present in the same water samples. The intent is to determine whether the patterns of toxic substances contamination found in samples of groundwater are different from or similar to the patterns of contamination found in samples of surface water. First, factor analysis is used to identify the sets of toxic substances which covary to form identifiable patterns of contamination. The second step is a comparison of these patterns of contamination in groundwater with those in surface water.

The results of factor analyzing the groundwater and surface-water data sets are presented in Tables V and VI and described more completely in ref 28. Factor 1 in both the groundwater and surface-water analyses is a pesticide factor. It is the strongest pattern of contamination identified, explaining 49.2% of the variation in the groundwater data and 48.5% of the variation in the surface water. This pattern of contamination is a set of toxic substances which are found to covary in both the groundwater and surface-water data. Many samples have elevated concentrations of this entire set of pesticides, which are identified as factor 1, while other samples may have nondetectable concentrations of the entire set of pesticides.

The light-chlorinated-hydrocarbon (LCH) factor is factor 2 in the groundwater data and explains 23.9% of the variance in the data, while it is factor 3 in the surface-water data and explains 13.6% of the variation in the data.

A heavy-metals factor is factor 3 in the groundwater analysis and explains 17.8% of the variation. The heavy-metals factor is factor 2 in the surface-water analysis and explains 30.1% of the variation in the data.

Factor 4 in the results of both the groundwater and surface-water analyses is a BHC-beta-related factor. It is the least important pattern of contamination in both analyses, explaining 9.1% of the variation in the groundwater results and 7.9% of the variation in the surface-water results.

A quantitative measurement of the similarity of the prin-

Table IV. Summary of Comparisons of Toxics Concentrations in the Groundwater and Surface Water of New Jersey

	percentage toxics max concn found in		percentage toxics with probability of detection			percentage toxics with average detectable concn		
	surface water greater	groundwater greater	surface water greater	no difference	groundwater greater	surface water greater	no difference	groundwater greater
all New Jersey samples	36	64	54	44	2	22	52	26
all New Jersey potable-water samples	22	78	33	63	4	18	47	35
all New Jersey nonpotable-water samples	40	60	31	59	10	12	67	21
southern New Jersey samples	33	67	29	69	2	20	53	27
northern New Jersey samples	29	71	38	58	8	8	67	25

Table V. Rotated Factor Matrix for Toxics in New Jersey Groundwater [a,b]

variables	pesticide (1)	LCH (2)	heavy metals (3)	BHC-beta (4)	communalities (h^2)
	factors				
methylene chloride					0.10
chloroform		0.59			0.43
1,1,1-trichloroethane		0.46			0.24
carbon tetrachloride		0.45			0.21
1,1,2-trichloroethylene		0.65			0.47
dibromochloromethane					0.07
1,1,2,2-tetrachloroethylene		0.75			0.58
BHC-alpha	0.45				0.26
lindane	0.52				0.46
BHC-beta				0.67	0.55
heptachlor	0.44				0.24
heptachlor epoxide	0.57				0.37
chlordane	0.59				0.41
o,p'-DDE	0.69				0.49
dieldrin	0.69				0.48
endrin	0.78				0.64
o,p'-DDT	0.75				0.58
p,p'-DDD	0.77				0.63
arsenic					0.18
copper			0.72		0.52
chromium					0.12
lead			0.81		0.68
zinc			0.47		0.23
eigenvalues	4.39	2.13	1.59	0.81	
percent variation	49.20	23.90	17.80	9.10	

[a] Varimax rotation. The squared multiple correlation coefficients were used as communality estimates. $N = 692$. [b] Only factor loadings greater than 0.40 are presented.

Table VI. Rotated Factor Matrix for Toxics in New Jersey Surface Water [a,b]

variables	pesticide (1)	LCH (2)	heavy metals (3)	BHC-beta (4)	communalities (h^2)
	factors				
methylene chloride				0.71	0.63
chloroform			0.46		0.40
1,1,1-trichloroethane			0.51		0.33
carbon tetrachloride			0.46		0.25
1,1,2-trichloroethylene					0.23
dibromochloromethane			0.50		0.31
1,1,2,2-tetrachloroethylene			0.70		0.54
BHC-alpha				0.47	0.29
lindane	0.50				0.25
BHC-beta				0.57	0.54
heptachlor					0.19
heptachlor epoxide	0.41				0.26
chlordane	0.63				0.52
o,p'-DDE	0.70				0.54
dieldrin	0.74				0.61
endrin	0.66				0.46
o,p'-DDT	0.67				0.47
p,p'-DDD	0.68				0.52
arsenic		0.43			0.22
copper		0.67			0.48
chromium		0.51			0.34
lead		0.79			0.64
zinc		0.52			0.28
eigenvalues	4.50	2.79	1.26	0.74	
percent variation	48.50	30.10	13.60	7.90	

[a] Varimax rotation. The squared multiple correlation coefficients were used as communality estimates. $N = 320$. [b] Only factor loadings greater than 0.40 are sented.

Table VII. Groundwater–Surface Water Comparison of Cosine Values among Factor Structures [a]

	groundwater			
	pesticide F_1	LCH F_2	heavy metal F_3	BHC F_4
surface water				
pesticide F^1	0.99	0.02	−0.01	0.14
heavy metal F^2	−0.03	0.35	0.92	0.15
LCH F^3	0.00	0.93	−0.32	−0.20
BHC F^4	−0.14	0.13	−0.21	0.96

[a] F = factor.

cipal patterns of toxics contamination in the groundwater data with the principal patterns of toxics contamination in the surface-water data was calculated. The factor loading matrices which were obtained from the orthogonal factor analysis of the groundwater data and the surface-water data were rotated to attain the maximum overlap between the corresponding test vectors in the groundwater matrix and the surface-water matrix (*29*, *30*). The degree of rotation required is expressed as the cosine of the angle between the factor axes and may be interpreted as correlations between the factors.

The results of comparing the patterns of toxics contamination in the groundwater data with the patterns of toxics contamination in the surface-water data are presented in Table VII. The first set of three analyses was designed to compare the levels of toxic substances contamination of groundwater and surface water. This analysis tests to see whether the combinations and concentrations of toxic substances in samples have the same patterns of occurrence in groundwater and surface water.

The pesticide factor, factor 1, is found to be extremely correlated between the groundwater data and the surface-water data with a cosine among these factor axes of 0.99. This informs us that the pattern of toxics contamination that we have identified as the pesticide factor is almost identical in the groundwater and surface water of New Jersey. The light-chlorinated-hydrocarbon factor has a cosine among the factor axes of 0.93, indicating a high correlation between this pattern of contamination in the groundwater data and in the surface-water data. The heavy-metals factor has a cosine among the factor axes of 0.92, which indicates that this pattern of toxics contamination is highly correlated between the groundwater and surface-water data. The BHC-beta factor, factor 4, has a cosine among the factor axes of 0.96, indicating a high correlation between this minor pattern of toxics contamination in both the groundwater data and the surface-water data.

Conclusions

On the basis of the data collected in New Jersey, we can conclude that groundwater is at least as contaminated with carcinogenic and toxic substances as surface water. The patterns of contamination are found to be very similar in the groundwater and the surface water of New Jersey.

While the long-term health impacts of low-level exposure to carcinogenic and toxic substances in water supplies is presently unknown, public policy should give at least equal emphasis to the control of toxic substances in groundwater as is given to the control of toxic substances in surface water.

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The Association of New Jersey Environmental Commissions is a private, non-profit, membership service organization. As such our primary charter is to provide education, information and advice to municipal environmental commissioners, other environmental organizations and the public at large.

As part of this activity we were awarded a U.S. Environmental Protection Agency grant to make information from the federal computerized chemical database network available to the public without governmental or industrial interpretation. This networking system is called the Chemical Substances Information Network (CSIN) and we have brought the Committee copies of our brochure announcing this service.

In providing this and all our other services we receive inquiries from a large variety of sources. It is of interest that a large percentage of these calls relate to concerns over the pollution of drinking water supplies. To say that the public is concerned and that the problem of contamination of New Jersey's groundwater supplies is very real is an understatement. The public is concerned and rightly so.

The questions we receive on a daily basis reflect that concern. Local Boards of Health and Planning Boards and governing bodies are at a loss to offer proper protection from future problems, much less find the money to finance remedial programs.

I would like to give you some examples of recent calls for information on the CSIN databases to show you of the range of public concerns. Clearly the largest percentage of calls deal with contaminants found in drinking water supplies. The effects of pesticides used to control the Gypsy Moth are next in public concern. The questions on water supply contamination involved chemicals including trichloroethylene, benzene, gasoline, and heavy metals including lead, nickel, and mercury.

In Europe monitoring of water from private and public sources is done on a more frequent basis and the use of high technology activated carbon filters helps to assure a safe, thoroughly treated water supply. In addition, aquifer recharge areas and watershed areas are protected from toxic spills and from pollution from urbanization. We in New Jersey must protect our surface and groundwater systems and count the costs of such protection on the plus side instead of as a loss of rateable or cost to industry. The research upon which we must base our decisions is insufficient to prove that even the minimums used for establishing existing safe drinking water standards will be safe over the long term and over numerous generations. The ultimate costs of destroying our water supplies will be reflected in the GNP's of the future and must be considered in determining our course of action today.

We have a problem for which adequate research, closer monitoring, land use controls, improved technology, and respect for natural systems can offer us some answers.

Thank you for the opportunity for testifying today.