

LEAK DETECTION FOR UNDERGROUND STORAGE TANKS

DURGIN / YOUNG
EDITORS



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Leak Detection for Underground Storage Tanks

Philip B. Durgin and Thomas M. Young, editors

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Foreword

This publication, *Leak Detection for Underground Storage Tanks*, contains papers presented at the symposium of the same name, held in New Orleans, LA on 29 Jan 1992. The symposium was sponsored by ASTM Committee E-50 on Environmental Assessment. Philip B. Durgin of Veeder-Root in Simsbury, CT and Thomas Young of Ann Arbor, MI presided as symposium co-chairmen and are editors of the resulting publication.

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Overview

The environmental decade of the 1980's brought with it a steady growth in the number and scope of environmental regulations. Much of the concern was directed at the contamination of groundwater supplies by organic chemicals. A newly-emerged, widespread concern was protection of groundwater supplies from underground storage tanks (UST) that leaked fuel. The public realized that the problem might be as close as their corner gas station or even the heating-oil tank buried in their backyard. The potential carcinogenic effects of gasoline components (particularly benzene), that partially dissolve in ground water, heightened the public's anxiety. As a result, there were demands for owners and operators of underground storage tanks to conduct leak tests, provide assurances that their subsurface tanks and pipelines were tight, and clean up sites that had become contaminated by fuels. EPA drafted regulations in response to these demands and they became effective in December 1988.

A considerable amount of research, discussion, and decision-making was devoted to leak detection issues in developing the federal UST regulations. These, together with newly-developed state regulations, have continued to generate strong interest in the private sector from owner/operators who are being regulated as well as from vendors of leak detection equipment and services. Representatives from these and other constituencies joined together to participate in an ASTM subcommittee dealing with leak detection for underground storage tanks. They formed task groups that dealt with leak detection methods outside as well as inside an underground storage tank. Together, they developed an ASTM guide and practice dealing with these issues.

The subject of UST leak detection is interdisciplinary and, as such, has attracted specialists from a variety of disciplines. These include environmental engineering, chemistry, electronics, groundwater geology, mechanical/electrical engineering, regulatory management, etc. Many of these workers have completed research and reported on it at conferences or in publications sponsored by their own particular specialty. However, until this ASTM conference there had been no conference that focused simply on UST leak detection.

A primary goal of the ASTM Symposium on Leak Detection for Underground Storage Tanks, held in New Orleans in January of 1992, was to bring together UST leak-detection specialists for participation in a forum that would generate a publication where readers could have important UST research under one cover. The papers provide a state-of-the-art review to many leak detection issues. In some cases, the papers report on research that was conducted two or three years ago but has never been adequately directed to the UST leak-detection audience. In other cases, the papers report on the latest UST research. Much of the leak detection research has been sponsored by the USEPA.

Although the amount of leak-detection research, conducted by industry and government, has expanded dramatically since the release of EPA's regulations, conclusive answers to some research questions remain elusive. The papers in this volume represent the most up-to-date review

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of this research and have been peer reviewed to insure that unsupported statements conflicting with the consensus of opinion among leak-detection experts were omitted. Nevertheless, legitimate differences of opinion about leak-detection methods persist in those areas lacking definitive research results. The editors have chosen to include such conflicting opinions so that readers may reach their own informed conclusions on these issues.

The phased-in approach of the UST regulations guarantee that owners and operators of UST systems will continue to need answers on how to deal with the regulations at least until 1998. Many simply will want to know the regulatory requirements and leak detection equipment on the market. However, for others this volume is intended to provide an objective, in-depth view of several UST issues. Regulators and vendors should also have an interest in this volume.

EPA developed the UST regulations with an eye towards allowing and promoting future improvements in leak-detection equipment and procedures. Conferences and volumes such as this help to communicate the issues and act as a catalyst for further development of UST leak-detection technology. The Symposium was divided into four sessions that were entitled I. Internal Monitoring, II. External Monitoring, III. Risk, Reliability, & Regulation, and IV. Site Evaluation. There was also a keynote speech by David Ziegele, Director of EPA's Office of Underground Storage Tanks. The title of his speech was "Speeding Up UST Site Assessment and Remediation: EPA's View". He addressed the increasing number of confirmed UST releases (170,000) and how EPA is trying to streamline the regulatory process and get cleanups started early with new, innovative approaches. While his paper is not in this volume a few additional papers, not presented at the Symposium, are published here.

Internal Monitoring

The book opens with a discussion of statistical inventory reconciliation (SIR) by Warren Rogers. This approach to UST leak detection deserves close attention because it is a relatively low-cost alternative with no equipment needs. SIR is receiving increased attention with the number of supporters and detractors both rising. Rogers makes the basic and important point that determination of a leak rate is related to the time between observations of fluid at rest as well as the precision of an observation. In other words, the shorter time that you look at a tank level the more precise you need to be for leak detection. The next paper, by Don Fleischer, is an enlightening look at the errors associated with internal monitoring of tanks when using automatic tank gauges. This information, based on several years of UST testing, demonstrates how such errors can occur and puts them in proper perspective.

Flora, Glauz, and Hennon provide an excellent, comprehensive overview (including estimated costs) of the various leak-detection options for airport hydrant systems. Clearly the greatest problem at airports is dealing with relatively large, long, pressurized pipelines rather than the tanks per se. Maresca and Eckert examine one approach to this problem in their research paper that applies acoustic sensing to the location of leaks in pressurized pipelines.

External Monitoring

UST leaks can also be detected by monitoring the environment surrounding the tanks. The two primary methods are to monitor for hydrocarbon vapors in the soil gas or to detect fuel floating on top of

the ground water. External monitoring is dependent upon the capability of the sensor, their number, location, and analysis of the data they generate. External monitoring is greatly complicated by the fact that each site has its own specific characteristics.

Schreiber and Rosenberg report how soil gas and groundwater conditions, following injection of hydrocarbons, can be modelled with computer programs. They demonstrate that diffusion of hydrocarbon vapors in a sandy backfill is influenced by temperature, soil moisture, and the type of organic compound. Their results have been validated with a large, outdoor physical model by Richard Johnson of the Oregon Graduate Institute. Schreiber and Rosenberg also demonstrate that computer modelling can address how fuel drains down to the water table and spreads out upon it.

The hardware for external monitoring is obviously important. Portnoff et al. present the results of research comparing the two types of vapor sensors that are commercially available for monitoring at UST sites. Each type has its own advantages and disadvantages. The review paper by Grey provides information on fiber optic sensors that have the future potential of providing more accurate data for monitoring hydrocarbon vapors as well as fuel dissolved in ground water.

The paper by Durgin and Michelson provides some field results using various types of vapor sensors. Published continuous vapor data and analysis from field sites has been sorely lacking. Their conclusion is that variations in vapor concentrations are real and explainable but there are so many that automatic data analysis becomes necessary.

External monitoring has also addressed the issue of pipeline leakage. Martin and Jensen provide information on how leaks can be detected and their location determined by pulling a vacuum in a permeable tube laid along the pipeline. Thompson and Golding present a similar approach but describe how tracer chemicals can provide additional information.

Regulations and Standards

This section of the book deals primarily with protocols, regulations, and standards that help maintain quality in UST leak detection. Young provides an overview of how the USEPA set up third-party testing of leak-detection equipment/methods and the reasoning behind it. Glauz et al. focuses on EPA's test protocol for pipeline leak detection and suggests revisions for improvement.

While UST leak detection is required throughout the U.S. there are questions about the level of compliance. Sutton-Mendoza demonstrates how New Mexico has taken the UST regulations to the field, enforced them, and quantified their success in expediting enforcement. There is a need to have similar types of information from other states as the USEPA proceeds with encouraging enforcement of leak detection throughout the country. Gullledge addresses how performance criteria and standards, such as those from ASTM, can influence insurance programs in both a positive and negative manner.

Site and Risk Evaluation

One of the driving forces behind leak-detection monitoring is the desire to reduce the financial risk incurred when tank leakage contaminates the subsurface. There are a variety of factors that can increase the risk at a site. One of these is the type of chemical in the tank and Hillger et al. provide an informative survey of the

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chemicals that are stored in UST

Several organizations have faced the task of having to deal with a large number of USTs yet not knowing where to start. Ferguson demonstrates how the U S Postal Service assessed the environmental and regulatory risk they faced at each UST site in the Northeast Region and prioritized them for future attention and funding. Golding and Wichman evaluated site contamination by collecting soil gas, soil, and/or groundwater samples from about 500 UST sites in Iowa. They conducted tests in the field with additional testing at laboratories. They also evaluated about 200 of the sites by using a tracer test method.

Once it is clear that a site is contaminated and needs clean up, specific site factors should be addressed to help decide on the method of remediation. Fan and Tafuri present a method that helps to screen the various remediation technologies and find the most appropriate one.

The Symposium Co-Chairmen gratefully acknowledge the efforts of the authors, reviewers, and ASTM personnel that have made this publication possible.

Philip B. Durgin Ph.D.

Veeder-Root Co., Simsbury, CT 06070
Symposium Chairman and Editor

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