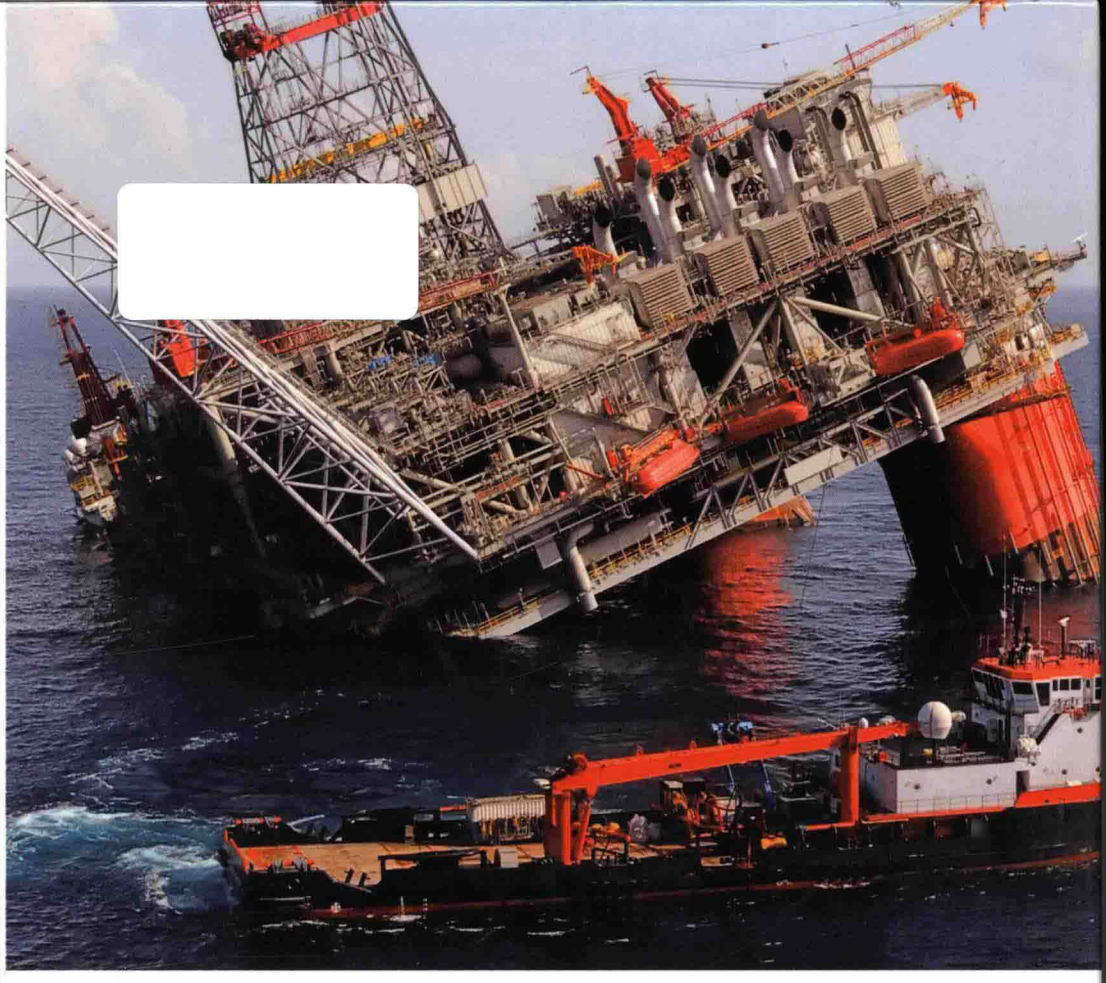

OIL SPILLS & GAS LEAKS

Environmental Response, Prevention, and Cost Recovery

Stephen M. Testa • James A. Jacobs

Mc Graw Hill Education

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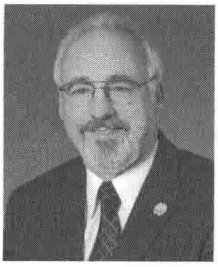

Stephen M. Testa, P.G., C.E.G., C.P.G., has undergraduate and graduate degrees in geology. He has written over 125 articles in the field of geology and environmental science, as well as publishing several books. He is an expert on soil and groundwater remediation, hydrocarbon recovery, resource recovery, and reuse and recycling of soils, sediments, and wastes. From 1976 until August 2005, he served as an engineering and environmental consultant for such firms as Bechtel, Dames and Moore, Converse Consultants, and Engineering Enterprises, and as Chief Executive Officer of the international consulting firm Applied Environmental Services and later Testa Environmental Corporation. He entered public service in August 2005 when he was appointed Executive Officer of the California State Mining and Geology Board. He is the author of numerous books and over 125 publications, including *Geological Aspects of Hazardous Waste Management, The Reuse and Recycling of Contaminated Soil, Restoration of Contaminated Aquifers: Petroleum Hydrocarbons and Organic Compounds, Petroleum and the Environment,* and most recently *One Man's Planet—Earth in Today's Political Culture.* He has served as an instructor at the California State University at Fullerton and the University of Southern California, and has provided numerous workshops and technical presentations. He can be reached at stesta@goldrush.com.

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Introduction

This practical book is focused on oil and gas drilling, spills, and leaks. These are the side effects or unintended consequences of resource extraction. Chapters include geology of petroleum, oil and gas drilling techniques and methods, oil spills, and gas leaks. Other detailed chapters include drill site/production site assessment, remediation, and leak and spill prevention. Other topics include conflicts in jurisdictions, spill response, unintended consequences of complex systems (missteps that result in a series of errors contributing to a catastrophic event), the cleanup details of recent oil spills, the laws and policies associated with marine and terrestrial spills, and litigation/cost recovery issues.

It is hoped that the book will provide the necessary information to facilitate communication, objectives, and goals for engineers and scientists, property owners, regulators, and attorneys, and to articulate and integrate site assessment, corrective action, and site restoration plans into oil and gas production and abandonment projects early in the activity cycle.

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Mokelumne Hill, California

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Mill Valley, California

Contents

CHAPTER 1

Role and Environmental Impact of Petroleum in Society

1.1 Introduction

The business of providing society's energy from petroleum employs more people than any other in the United States or, for that matter, in the world. The sheer magnitude of this industry and the extensive infrastructure it requires to recover, process, and distribute petroleum products for our use make it a daily influence on our lives. It is thus understandable that concerns about the environmental impact of petroleum have developed. From an environmental perspective, much attention has focused on the release of oil and petroleum products in the environment from accidental spills, and other impacts such as air pollution and greenhouse gas emissions. Responsible stewardship of our soil, water, air, and resources requires better understanding of the environmental consequences of producing, processing, transporting, storing, and using petroleum products. The important environmental considerations associated with the oil and gas industry activities are illustrated in Fig. 1.1.

The impact of petroleum in the environment can take many forms, and once an environmental impact has occurred, the significance of the impact can become very difficult to evaluate. Many of today's petroleum-related environmental problems are actually inherited from antiquated facilities or operational practices that are no longer in use (Fig. 1.2). However, considering the huge volume of oil and petroleum products that are moved, stored, and used every day, spills and leaks are inevitable. Overall, much progress has been made in understanding and mitigating the environmental impacts of oil and

Schematic diagram showing a cradle to grave overview of environmental concerns related to oil and gas.

Exploration for field → Infrastructure development (building or roads, etc.)

Exploratory drilling → Blow outs, waste fluids generated.

Recovery (primary, secondary, tertiary) → Blow outs possible, rig fires, associated oil spills, induced seismicity, disposal of oil rigs.

Transport → Oil spills, gas line explosions

Refining → Emissions (flare offs), waste product disposal, soil and ground-H_2O contamination

Storage → LUST (leaky underground storage tanks), explosions

Use → Emissions and air pollution, carbon dioxide

Figure 1.1 Important environmental considerations associated with oil and gas exploration, production, transportation, refining, storage, and use. (*Source: USGS.*)

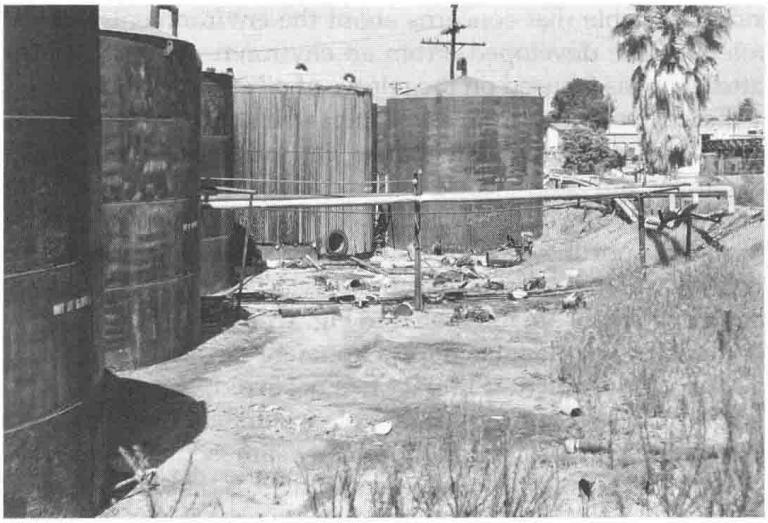

Figure 1.2 Past leakage of crude oil from an aboveground storage tank farm at an antiquated refinery site. The tanks were set on gravel without bottoms within an unlined bermed area. Similar crude oil storage methods were also used at oil production facilities. (*Image from Stephen Testa.*)