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## Air Research

### EMISSIONS: GENERAL

#### Compendium of Greenhouse Gas Emissions Estimation Methodologies for the Oil and Gas Industry

##### API Tools for Estimating GHG Emissions

Accurate estimation of greenhouse gas emissions is indispensable to responsibly addressing climate change. Through API, the U.S. oil and natural gas industry has provided a suite of tools for estimating emissions. It includes API's updated 2009 compendium of emissions estimation methodologies, software for emissions estimation and inventorying, and guidelines (created by the International Petroleum Industry Environmental Conservation Association) to assist in the accounting and reporting of emissions. Pages: 807

August 2009 | Available for download at [https://www.api.org/~media/files/ehs/climate-change/2009\\_ghg\\_compendium.ashx](https://www.api.org/~media/files/ehs/climate-change/2009_ghg_compendium.ashx)

#### DR 141

##### Global Emissions of Carbon Dioxide from Petroleum Sources

Describes carbon dioxide emission estimates developed for a broadly defined petroleum industry whose five segments include (1) exploration and extraction; (2) crude petroleum transportation to refineries; (3) refining operations; (4) refinery products transportation; and (5) end uses. Emission estimates for carbon dioxide have been developed for each industry segment and for each country. Activity factors describe the activity level for a particular industrial activity. Corresponding emission factors for each activity factor were developed from U.S. Environmental Protection Agency and industry documents. Pages: 91

July 1991 | Product Number: I00141 | Price: \$65.00

#### Publ 326

##### The Cost Effectiveness of VOC and NO<sub>x</sub> Emission Control Measures

Provides air pollution control planners and other interested parties in ozone nonattainment areas with a "menu" of possible control options using the most up-to-date information and accurate analyses for significant sources of volatile organic compounds (VOCs) and NO<sub>x</sub>. The menu provides a preliminary demonstration of how cost-effective packages of attainment strategies and control measures can be developed to reduce VOC emissions by 15% by 1996. Appendices provide a detailed analysis of costs, effectiveness, and application limitations. Pages: 354

September 1994 | Product Number: J32600 | Price: \$160.00

#### Publ 332

##### Comparison of Screening Values from Selected Hydrocarbon Screening Instruments

Describes a study carried out at two refineries to compare differences in equipment leak screening values obtained from four instruments commonly used to measure fugitive emissions. The effect of screening distance was also evaluated, and the results from the study were compared to those of an earlier study conducted in 1979. Adjustment factors to relate screening values from one instrument are presented, which are applicable to marketing, transportation, and exploration and production facilities as well as refineries. Pages: 128

August 1995 | Product Number: J33200 | Price: \$98.00

#### Publ 342 and Publ 343

##### Fugitive Emissions from Equipment Leaks I: Monitoring Manual and Fugitive Emissions from Equipment Leaks II: Calculation Procedures for Petroleum Industry Facilities

A number of federal, state, and local regulations are designed to control fugitive emissions of volatile organic compounds and hazardous air pollutants. API sponsored this project to present options and recommendations on procedures for obtaining inspection and maintenance data from certain process equipment with the potential to leak fugitive emissions. The two resulting manuals focus on the recommended fugitive emission practices in the petroleum industry, specifically for refineries, marketing terminals, and the oil and gas production industries. Pages: 204

June 1998

Product Number for Publ 342: J34200 | Price: \$69.00

Product Number for Publ 343: J34300 | Price: \$69.00

#### Publ 344

##### Critical Review of Source Sampling and Analysis Methodologies for Characterizing Organic Aerosol and Fine Particulate Source Emission Profiles

Intended for use in designing future measurement programs for characterizing emissions from stationary sources that contribute to fine particle concentrations in the atmosphere. The benefits and drawbacks of various measurement approaches are discussed, and a recommended approach for combustion sources is presented. Pages: 128

June 1998 | Product Number: J34400 | Price: \$80.00

#### Publ 348

##### Air Toxics Emission Factors for Combustion Sources Using Petroleum-Based Fuels, Volume 1—Development of Emission Factors Using API/WSPA Approach

This project was performed with the cooperation of the California Air Resources Board (CARB) and Western States Petroleum Association to develop updated air toxic emission factors for combustion sources using petroleum-based fuels. The emission factors developed using the best available source testing information in this project will help the U.S. Environmental Protection Agency to revise AP-42. In addition, the emission factors will be integrated into CARB's California Air Toxics Emission Factor database. Environmental, health, and safety engineers can use these emission factors to develop more accurate and complete emission inventories without additional source testing, which could help facilities in the permitting process. Pages: 88

August 1998 | Product Number: J34800 | Price: \$109.00

#### Publ 4653

##### Fugitive Emission Factors for Crude Oil and Product Pipeline Facilities

Presents the results of a study to determine equipment component fugitive emission factors for crude oil and product pipeline facilities. The emission factors presented in this report will allow pipeline operators to estimate total hydrocarbon emissions from equipment components located at pipeline facilities in light crude service, heavy crude service, and product service. Pages: 50

June 1997 | Product Number: I46530 | Price: \$86.00

#### Publ 4703

##### Gas Fired Boiler—Test Report Site A: Characterization of Fine Particulate Emission Factors and Speciation Profiles from Stationary Petroleum Industry Combustion Sources

In 1997, the U.S. Environmental Protection Agency (EPA) promulgated new ambient air standards for particulate matter (PM) smaller than 2.5 micrometers in diameter (PM 2.5). Source emissions data are needed to

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assess the contribution of petroleum industry combustion sources to ambient PM 2.5 concentrations. This report presents particulate measurement results from a 550,000 pounds per hour steam boiler firing refinery process gas. The particulate stack measurements were made using both a dilution tunnel research test method and traditional EPA sampling methods. Pages: 119

July 2001 | Product Number: I47030 | Price: \$96.00

### Publ 4704

#### Gas Fired Heater—Test Report Site B: Characterization of Fine Particulate Emission Factors and Speciation Profiles from Stationary Petroleum Industry Combustion Sources

In 1997, the U.S. Environmental Protection Agency (EPA) promulgated new ambient air standards for particulate matter (PM) smaller than 2.5 micrometers in diameter (PM 2.5). Source emissions data are needed to assess the contribution of petroleum industry combustion sources to ambient PM 2.5 concentrations. This report presents particulate measurement results from a 114 million British thermal unit (MMBtu) per hour gas-fired refinery process heater. The particulate stack measurements were made using both a dilution tunnel research test method and traditional EPA sampling methods. Pages: 118

August 2001 | Product Number: I47040 | Price: \$96.00

### Publ 4712

#### Gas-Fired Steam Generator—Test Report Site C: Characterization of Fine Particulate Emission Factors and Speciation Profiles from Stationary Petroleum Industry Combustion Sources

In 1997, the U.S. Environmental Protection Agency promulgated new ambient air standards for particulate matter (PM) smaller than 2.5 micrometers in diameter (PM 2.5). Source emissions data are needed to assess the contribution of petroleum industry combustion sources to ambient PM 2.5 concentrations. This report presents that the gas fired steam generator has a maximum heat input of 62.5 MMBtu/Hr with an average rate of approximately 50 MMBtu/hr. Pages: 100

July 2001 | Product Number: I47120 | Price: \$90.00

### Publ 4720

#### Comparison of API and EPA Toxic Air Pollutant Emission Factors for Combustion Sources

Compares and explains differences in published toxic air pollutant emission factors for combustion sources and recommends priorities for gathering additional emission factor information. Pages: 50

September 2002 | Product Number: I47200 | Price: \$100.00

### Publ 4772

#### Measuring Particulate Emissions from Combustion Sources

Since the inception of the Clean Air Act, the petroleum refining industry has been faced with the need to determine criteria pollutant emissions from combustion sources. While some of these species, such as NO<sub>x</sub>, SO<sub>2</sub>, and CO remain in the vapor phase during and after combustion and are relatively simple to measure, particulate matter (PM) measurements are much more challenging. This is because while some PM such as fly ash or catalytic cracking catalyst fines is clearly solid material that is readily collected and measured on a sampling filter, other species that may exist in the vapor phase during combustion can later condense into aerosols downstream from the combustion zone. This can occur before or after any control devices, depending upon the temperature and composition of the combustion gases. Consequently, it has been customary to refer to PM as being composed of two PM components, filterable and condensable, the relative amounts of each depending on the stack gas composition and temperature, control devices in use at the unit, and the method for measuring PM. While measuring filterable PM is relatively straightforward (i.e. PM collected on a filter), condensable PM is a more esoteric quantity and its contribution to total PM emissions is very much dependent upon the choice of the measurement method. The U.S. Environmental Protection Agency apparently recognized this issue, and until the interest in measuring and controlling

PM 2.5 emissions emerged in the 1990s, their PM sampling methods were centered on measuring only filterable PM. At the time that these methods were originally instituted, the best available pollution control devices were mainly limited to filterable PM and could not control the condensable portion of PM emissions. As interest in the health effects associated with PM emissions increased, efforts were centered on determining the contribution of the PM 2.5 fraction that was believed to most responsible for these effects and principally composed of condensable matter. This report will review the conditions leading to the formation of condensable particulate matter from stack gas components along with the methods used to measure PM emissions from refinery combustion sources. Pages: 27

September 2008 | Product Number: I47720 | Price: \$68.00

### Publ 4775

#### Simulating the Effect of Aerobic Biodegradation on Soil Vapor Intrusion into Buildings—Evaluation of Low Strength Sources Associated with Dissolved Gasoline Plumes

Aerobic biodegradation can contribute significantly to the attenuation of petroleum hydrocarbon vapors in the unsaturated zone; however, most regulatory guidance for assessing potential human health risks via vapor intrusion to indoor air either neglect biodegradation or only allow for one order of magnitude additional attenuation for aerobically degradable compounds, which may be overly conservative in many cases. This paper describes results from three-dimensional numerical model simulations of vapor intrusion for petroleum hydrocarbons to assess the influence of aerobic biodegradation on the attenuation factor for a variety of source concentrations and depths for buildings with basements and slab-on-grade construction. Provided that oxygen is present in the vadose zone, aerobic biodegradation of petroleum hydrocarbon vapors in the unsaturated zone will reduce the soil gas concentrations and the potential risks from vapor intrusion to indoor air compared to nondegrading compounds. At lower source concentrations and/or deeper source depths, aerobic biodegradation may result in a reduction in vapor intrusion attenuation factors by many orders of magnitude. The magnitude of the reduction depends on site-specific conditions, which should be considered in the development of a conceptual site model for each site. However, oxygen supply and degradation rates are likely to be sufficient at many sites to mitigate potential risks from vapor intrusion for low vapor concentration sources (less than about 2 mg/L-vapor total hydrocarbons). The simulations conducted in this study provide a framework for understanding the degree to which bio-attenuation will occur under a variety of scenarios and provide insight into site conditions that will result in significant biodegradation. This improved understanding may be used to select site-specific attenuation factors for degradable compounds and develop soil vapor screening levels appropriate for particular combinations of source concentrations, source depth, and building characteristics, which should be defined as part of a site conceptual model. Pages: 53

April 2009 | Product Number: I47750 | Price: \$117.00

### Publ 4776

#### A Guide to Understanding, Assessment and the Regulation of PAHs in the Aquatic Environment

Designed to be an introductory guide to understanding and assessing polycyclic aromatic hydrocarbons (PAHs) in the aquatic environment (water and sediments). API prepared this guide primarily for refinery personnel and home office environmental staff who may have to address PAH issues. In addition, this guide may also be useful to staff in regulatory agencies that work with PAHs in wastewater discharge permits, waste load allocations (total maximum daily loadings), and sediment investigation and remediation.

The guide provides an overview on the chemistry, fate, and sources of PAHs in the environment and the regulatory implications. The guide also includes descriptions of the different sources of PAHs (petrogenic, pyrogenic, diagenic, biogenic) and techniques for differentiating these sources through their characteristic fingerprints, including straightforward ways to help identify or rule out potential sources. Pages: 60

September 2011 | Product Number: I47760 | Price: \$116.00

## EMISSIONS: EXPLORATION AND PRODUCTION

### Publ 4589

#### Fugitive Hydrocarbon Emissions from Oil and Gas Production Operations

The emission factors derived in this report indicate that fugitive emissions from production facilities are considerably lower than they were in the late 1970s. Investigators use portable detectors to screen more than 180,000 components at 20 offshore and onshore facilities. Mass emission rates from "bagged" emitters, valves, connectors, and other components, such as seals and vents, are used to develop emission factors for individual components and groups of components. A workbook included in the report provides site operators with three different options to calculate emissions from their facilities. See also Publ 4615. Pages: 263

December 1993 | Product Number: I45890 | Price: \$154.00

### Publ 4615

#### Emission Factors for Oil and Gas Production Operation

Supplements the information found in Publ 4589 and contains revised emission factors developed from 1993 API data using correlation equations established by the U.S. Environmental Protection Agency in 1994. The report contains emissions factors for five types of production operations—light crude production, heavy crude production, gas production, gas processing plants, and offshore production. It also contains profiles of speciated emissions including air toxics and assesses regional differences in fugitive emissions and control efficiency of inspection and maintenance programs. Component inventory data, screening data, and leak emission data are also included. See also Publ 4589. Pages: 56

January 1995 | Product Number: I46150 | Price: \$67.00

### Publ 4638

#### Calculation Workbook for Oil and Gas Production Equipment Fugitive Emissions

This workbook, which is the result of five years of field testing of equipment components at production facilities across the United States, is a valuable tool for petroleum producers who are interested in estimating fugitive emissions from their oil and gas production sites. Four methods of calculating fugitive emissions are presented: EPA average emission factor method, EPA screening value range emission method, EPA correlation method, and leak quantification method. Pages: 62

July 1996 | Product Number: I46380 | Price: \$67.00

### Publ 4661

#### Exploration and Production Emission Calculator II (EPEC II) User's Guide

The Exploration and Production Emission Calculator Version 2.0 (EPEC II) is a software tool that can be used to estimate emissions for exploration and production facilities. EPEC II integrates user inputs, emission calculations, and data summaries for many equipment types common to exploration and production facilities. The calculation techniques and emission factors utilized by the EPEC II software were, in most cases, established by the U.S. Environmental Protection Agency, API, and the Gas Research Institute. Published references that provide background information for the calculation methods used in EPEC II are given for each equipment type in both the software and in each section of this user's guide. Pages: 96

2nd Edition | January 2007 | Product Number: I46610 | Price: \$136.00

### Publ 4662

#### Evaluation of a Petroleum Production Tank Emissions Model

E&P TANK was evaluated for petroleum production tanks in an emission measurement project sponsored by API and the Gas Research Institute. Emission testing was performed on storage tank vents located at seven sites in widely diverse oil and gas producing regions across the United States. Measured emissions were found to be in agreement with E&P TANK model predictions. Pages: 338

October 1997 | Product Number: I46620 | Price: \$128.00

### Publ 4679

#### Amine Unit Air Emissions Model and User's Guide, AMINECalc Version 1.0

AMINECalc is a user-friendly Windows®-based software program that estimates hydrocarbon emissions from amine-based sour gas and natural gas liquid sweetening units. The output generated by the software can be used for regulatory reporting by unit operators according to the requirements of the Clean Air Act Amendments of 1990. AMINECalc performs three types of calculation options: (1) mass balance calculation, (2) gas process (gas feed) simulation, and (3) NGL process (liquid feed) simulation. Mass emission rates of hazardous air pollutants, including benzene, toluene, ethylbenzene, and xylenes (BTEX), and volatile organic compounds can be estimated with the use of AMINECalc. System requirements for running AMINECalc Version 1.0 are IBM PC 486 compatible or higher, 8 MB RAM or more, and Windows® 95/98/NT. Approximately 2 MB of hard disk space are required to hold the program and its supporting run-time libraries. For better interface viewing, it is recommended that the user set the monitor to a high color 16 bit (or higher) resolution. See also Publ 4680. Pages: 76

January 1999 | Product Number: I46790 | Price: \$535.00

### Publ 4680

#### Amine Unit Air Emissions Model Evaluation

The implementation of the 1990 Clean Air Act Amendments in the United States has created the need for a reliable method to estimate and report hydrocarbon emissions from amine units. A simulation package, called Amine Unit Air Emission Model (AMINECalc) Version 1.0 was developed. This report evaluates the AMINECalc model by comparing the simulation results with field data collected from operating gas plants. It also recommends improvements and modifications to refine the predictions. See also Publ 4679. Pages: 96

December 1998 | Product Number: I46800 | Price: \$131.00

### Publ 4683

#### Correlation Equations to Predict Reid Vapor Pressure and Properties of Gaseous Emissions for Exploration and Production Facilities

Establishes simple techniques for exploration and production (E&P) operators of petroleum storage tank facilities to use for the preparation of site-specific emission inventories to meet environmental regulations. Analyses were performed of oil and gas sampling results and emissions modeling results for more than 100 crude oil E&P storage tanks. Correlation equations or statistical averages were recommended to estimate Reid Vapor Pressure, vented flash gas molecular weight, vented working and standing gas molecular weight, hydrocarbon speciation (including hazardous air pollutants), and separator gas specific gravity. Pages: 82

December 1998 | Product Number: I46830 | Price: \$86.00

### Publ 4697

#### Production Tank Emissions Model (E&P TANK, Version 3.0)

E&P TANKS (API Publ 4697) is a computer-based software designed to use site-specific information to predict emission from petroleum production storage tanks, now compatible with 32-bit and 64-bit Windows 7 as well as Windows 2000/XP/Vista. It estimates flashing, working, and standing losses and calculates losses using specific operations for each user's tank. Cited by the Environmental Protection Agency (EPA), it allows the user to enter specific tank condition information to generate air emission reports.

API has discontinued the sale of E&P Tanks v3.0; no new licenses for the software will be issued.

Existing customers should contact [support@eptanks.com](mailto:support@eptanks.com) for assistance in transferring an existing E&P Tanks v3.0 license from one user to another user.

API will continue to offer support for existing customers who encounter errors inputting data into software in accordance with E&P Tanks user guide (Publication 4697).

(Note that API provides no support for earlier versions of E&P Tanks.)

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### EMISSIONS: MARKETING

#### Publ 4588

##### Development of Fugitive Emission Factors and Emission Profiles for Petroleum Marketing Terminals, Volume 1

To evaluate the accuracy of fugitive emission estimates for petroleum marketing terminals, a study was designed to determine average emission factors and fugitive emission correlation equations for components in light liquid and gas vapor services. Four marketing terminals were tested, and the results of the study are presented in this report. See also appendices to this document, Publ 45881. Pages: 146

May 1993 | Product Number: I45880 | Price: \$134.00

#### Publ 45881

##### Development of Fugitive Emission Factors and Emission Profiles for Petroleum Marketing Terminals, Volume 2

This volume is the appendix to Publ 4588. Appendices include statistical analyses of data, field inventory sheet data, emitter data, nonaromatic speciation data, and aromatic speciation data. See also Publ 4588. Pages: 217

May 1993 | Product Number: I45881 | Price: \$124.00

### EMISSIONS: REFINING

#### Validation of Heavy Gas Dispersion Models with Experimental Results of the Thorney Island Trials

Volumes I & II

June 1986

#### Publ 4587

##### Remote Sensing Feasibility Study of Refinery Fenceline Emissions

Reviews the state of the art of optical remote sensing (ORS) technology and examines the potential use of ORS systems combined with ancillary measurements, such as meteorological and tracer gas release data to determine fugitive emission rates. The report also highlights some issues to consider in planning an ORS field study and clarifies the attendant tradeoffs for issues such as selection of appropriate ORS systems, consideration of detection limits and beam placement, choice of dispersion models, use of tracer gas releases, time scale and timing of field studies, and the requisite meteorological measurements. Pages: 105

April 1994 | Product Number: I45870 | Price: \$76.00

#### Publ 4677

##### Fugitive Emissions from Refinery Process Drains, Volume I, Fugitive Emission Factors for Refinery Process Drains

Emissions from refinery process drains are under increasing scrutiny, particularly with regard to volatile organic compounds (VOCs) and hazardous air pollutants because of the Clean Air Act Amendments of 1990. This publication is volume one of a three-part study initiated by API to update the AP-42 emission factor for refinery process drains, which may overestimate refinery process drain fugitive emissions. This volume contains simplified emission factors that can be used to quickly estimate total VOC emissions from refinery process drains. See also Publ 4639, Publ 4678, and Publ 4681. Pages: 132

April 1999 | Product Number: I46770 | Price: \$105.00

#### Publ 4678

##### Fugitive Emissions from Refinery Process Drains, Volume II, Fundamentals of Fugitive Emissions from Refinery Process Drains

Volume two of a three-part study initiated by API to update the AP-42 emission factor for refinery process drains, which may overestimate refinery process drain fugitive emissions. This volume describes theoretical concepts and equations that may be used in a model (APIDRAIN) to estimate speciated

volatile organic compound emissions. The model can provide insight on how to change process drain variables (flow rate, temperature, etc.) to reduce emissions. See also Publ 4639, Publ 4677, and Publ 4681. Pages: 104

April 1999 | Product Number: I46780 | Price: \$105.00

#### Publ 4681

##### Fugitive Emissions from Refinery Process Drains, Volume III, Process Drain Emission Calculator: APIDRAIN Version 1.0

Volume three of a three-part study—the computer model with user's guide to estimate emissions from refinery process drains. APIDRAIN is a user-friendly Windows®-based software program operating under the Microsoft Excel® for Windows® environment. The model allows the user to sum up the emissions from a refinery process unit area or from the entire refinery. The model user can quickly and easily predict the contribution of process drain emissions to the total emission inventory of a refinery. Unit operators can use the output generated by the software for regulatory reporting according to the requirements of the Clean Air Act Amendments of 1990. The minimum system requirements for running APIDRAIN Version 1.0 are PC 486 DX2 Windows® 3.11 platform, 8 MB RAM, and Windows 95®/Windows NT®. The user must have Windows® and Excel® installed on a personal computer to begin using the software. The APIDRAIN model is enhanced with automatic functions that enable the user to easily summarize important reporting information and to generate tabular emissions totals for both specific refinery process units and for the entire refinery. It is not necessary for the user to possess a rigorous understanding of Excel® to use APIDRAIN; only a few common principles of the Windows® operating environment are needed (such as point-and-click and navigation of tab and arrow keys). See also Publ 4639, Publ 4677, and Publ 4678. Pages: 92

April 1999 | Product Number: I46810 | Price: \$446.00

#### Publ 4713

##### Test Report: Fluidized Catalytic Cracking Unit at a Refinery (Site A), Characterization of Fine Particulate Emission Factors and Speciation Profiles from Stationary Petroleum Industry Combustion Sources

There are few existing data on emissions and characteristics of fine aerosols from petroleum industry combustion sources, and the limited information that is available is incomplete and outdated. API developed a test protocol to address this data gap, specifically to:

- develop emission factors and speciation profiles for emissions of primary fine particulate matter (i.e. particulate present in the stack flue gas including condensable aerosols), especially organic aerosols from gas-fired combustion devices, and
- identify and characterize secondary particulate (i.e. particulate formed via reaction of stack emissions in the atmosphere) precursor emissions.

This report presents the results of a pilot project to evaluate the test protocol on a refinery fluid catalytic cracking unit. Pages 113

March 2002 | Product Number: I47130 | Price: \$157.00

#### Publ 4723-A

##### Refinery Stream Composition Data—Update to Speciation Data in API 4723

Since the publication of API 4723 in 2002, new regulatory requirements have resulted in many changes in refinery processes that may have altered process stream compositions. Changing feedstocks, new process additives, and new catalysts may also have affected the concentrations of chemical species present in specific process streams.

Based on an assessment of the range and depth of more recent stream speciation data, the Petroleum Environmental Research Forum (PERF) elected to update the stream speciation profiles in API 4723 using more recent composition sampling. The updated profiles are provided in this report. PERF members believe that the newer data are more representative due to improved sampling and analytical techniques and that these newer analyses better reflect changes in refinery operations over recent years.

A large database of records was collated for the current study, representing information from 25 refineries.

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The original study reported on 24 chemical species and the current study provides data on 89 species. The original study reported on 65 refinery process streams and the current project provides data on 68 process streams.

The material contained in this report will be of use in estimating the emissions of specific chemical species, preparing permit applications, and performing other environmental assessments. API, PERI, and the project participants make no claims as to the suitability or acceptability of the stream composition data reported herein for specific reporting or regulatory purposes. Pages: 278

December 2018 | Product Number: I4723A | Price: \$158.00

### EMISSIONS: VEHICLES

#### Publ 4642

##### A Study to Quantify On-Road Emissions of Dioxins and Furans from Mobile Sources: Phase 2

Presents the results of a study to assess on-road emissions of dioxins and furans from light- and heavy-duty vehicles in the United States. This study was conducted in response to the U.S. Environmental Protection Agency's (EPA) draft dioxin reassessment document, which was based on data developed from studies conducted outside of the United States. Emissions were measured in the Fort McHenry Tunnel in Baltimore, MD, based on techniques tested and proven in Phase 1 of this study. The emission factor determined for heavy-duty diesel vehicles in this work was less than the EPA estimate. Pages: 96

December 1996 | Product Number: I46420 | Price: \$141.00

#### Publ 4646

##### Evaluation of Fuel Tank Flammability of Low RVP Gasolines

Twenty-two test fuels were varied with respect to Reid vapor pressure (RVP), pentane-to-butane ratio, and addition of ethanol and methyl tert-butyl ether (MTBE), to evaluate the conditions under which vapors from reformulated gasoline contained in automobile fuel tanks become flammable. The results show that temperature limits of flammability correlate with RVP; the addition of ethanol or MTBE or both affects the upper flammability limits; and the ratio of pentane to butane has no consistent effect at similar RVP levels. Pages: 144

December 1996 | Product Number: I46460 | Price: \$105.00

### EXPOSURE: ASSESSMENT AND MONITORING

#### Publ 4617

##### A Monte Carlo Approach to Generating Equivalent Ventilation Rates in Population Exposure Assessments

Describes a study to improve breathing rate simulations in computer-based models used to estimate the exposures of urban populations to ozone and carbon monoxide. Algorithms producing equivalent ventilation rate values according to age, gender, activity, activity duration, and breathing rate category were developed from measured rates in primary-school children, high-school children, outdoor adult workers, and construction workers. Seven additional time/activity databases not used in the current pNEM methodology are described as well as models simulating maximum sustainable ventilation rates as a function of exercise duration, age, and gender. Pages: 168

March 1995 | Product Number: I46170 | Price: \$86.00

#### Publ 4622

##### Petroleum Industry Data Characterizing Occupational Exposures to Methyl Tertiary Butyl Ether (MTBE): 1983-1993

Describes the results of a survey of API member companies to acquire data relating to occupational exposure to MTBE for various activities associated with petroleum facilities. It provides a detailed description of the survey

questionnaire as well as a statistical analysis of some 1,833 workplace concentration measurements associated with potential occupational exposures. Pages: 105

August 1995 | Product Number: I46220 | Price: \$67.00

#### Publ 4625

##### Service Station Personnel Exposures to Oxygenated Fuel Components

Describes a study in four ozone nonattainment areas to measured exposures of refueling attendants and mechanics to fuel oxygenate species—methyl tertiary butyl ether, tertiary amyl methyl ether, tertiary butyl alcohol, ethanol, and butyl alcohol—at service stations. The aromatics—benzene, toluene, xylene, para-xylene, and ethylbenzene—were also measured. Full shift (approximately 8-hour time-weighted average) and short-term (15-20 minutes) samples were collected at each station. Volatility and meteorological measurements were also taken. Pages: 144

August 1995 | Product Number: I46250 | Price: \$71.00

#### Publ 4629

##### Hexavalent Chromium Exposures During Hot Work

Details the findings from an air sampling survey contracted by API to evaluate inhalation exposures to hexavalent chromium [chromium (VI)] during seven types of hot work: carbon arc cutting (CAC), flux cored arc welding (FCAW), gas metal arc welding (GMAW or MIG), grinding, gas tungsten arc welding (GTAW or TIG), oxyfuel gas cutting (OFC or torch cutting), and shielded metal arc welding (SMAW or stick). After the First Edition of this report was published, it was determined that 15 samples from one of the projects were listed as carbon steel base metal and should have been listed as stainless steel. While the original report was careful to point out the use of electrodes typical for stainless work, it was felt that a complete update was needed. Eighty-three samples were collected in October and November 2005 at two petroleum sites during maintenance turnarounds by API member companies. An additional 188 samples were collected April-June 2006 at three different petroleum company sites by ICU Environmental Health and Safety. Of the 271 total samples, 63 samples were at or above the Occupational Safety and Health Administration (OSHA) action level of 2.5 µg/m<sup>3</sup> and 51 were at or above the OSHA permissible exposure limit of 5 µg/m<sup>3</sup>. Pages: 12

June 2007 | Product Number: I46290 | Price: \$93.00

### MODELING

#### Publ 4546

##### Hazard Response Modeling Uncertainty (a Quantitative Method): Evaluation of Commonly-Used Hazardous Gas Dispersion Models—Volume 2

Contains an evaluation of a group of 14 hazardous gas dispersion models. All available measurement programs were considered for the evaluation, covering both the releases of dense gases and nondense tracer gases; eight data sets are used in the evaluation. The models are reviewed for their scientific validity. Statistical procedures and residual plots are used to characterize performance. A number of the models give predictions that reasonably match field data. Pages: 351

October 1992 | Product Number: I45460 | Price: \$154.00

#### Publ 4628

##### A Guidance Manual for Modeling Hypothetical Accidental Releases to the Atmosphere

Presents methods for modeling hypothetical accidental releases of fluids and gases into the atmosphere from process operations. Given a particular type of release and the chemicals or petroleum fractions involved, methods for modeling the release and subsequent dispersion phenomena are treated

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in a step-wise, comprehensive manner. Detailed simulation of eight hypothetical release scenarios are presented to demonstrate how the modeling procedures can be implemented. Pages: 212

November 1996 | Product Number: I46280 | Price: \$154.00

### Publ 4669

#### Review of Air Quality Models for Particulate Matter

API has published a review of existing source and receptor models available for analyzing particulate matter (PM) concentrations. This report critically reviews existing air modeling tools for PM, recommends models for State Implementation Plan applications, and identifies areas where the models need improvement. If you would like API to provide you with a hard copy of this publication for a cost of \$45.00, please contact the Intellectual Property Department at API, 1200 Massachusetts Avenue NW, Suite 1100, Washington, DC 20001-5571; e-mail: apipubs@api.org; phone: 202-682-8156. Pages: 311

March 1998

## OZONE

### Publ 305

#### Protecting Agricultural Crops from Ozone Exposures—Key Issues and Future Research Directions

Identifies and reviews some of the key issues related to assessing the effects of ozone exposure on vegetation. This report analyzes information on components of ozone exposure that elicit adverse effects on vegetation; ways to describe these components in the form of ozone exposure indices that may be useful in the standard-setting process for protecting vegetation; the change in nonattainment status that may occur should the existing ozone national ambient air quality standards be modified; and the need for future research efforts to explore the development of a suitable multiparameter index to protect vegetation from ozone exposure. Pages: 156

August 1991 | Product Number: J30500 | Price: \$90.00

### Publ 309

#### Current Status and Research Needs Related to Biogenic Hydrocarbons

Describes the literature on the state of science on biogenic hydrocarbons. Among the areas covered are biogenic emission measurements, ambient concentration measurements, emission inventories, chemical kinetics, and modeling studies from 1960 to 1992. The results of the review are used to identify areas of understanding as well as uncertainty in present-day knowledge. A list of references with 163 abstracts is included. Pages: 240

June 1992 | Product Number: J30900 | Price: \$122.00

### Publ 4616

#### The Importance of Using Alternative Base Cases in Photochemical Modeling

A series of Urban Airshed Model sensitivity studies were conducted using two summer O<sub>3</sub> episodes. Plausible alternative conditions were established to define acceptable base cases, some of which provided model performance comparable to the best achieved for the episodes. The alternative base cases used in this study produced significant differences in estimates of the air quality benefits of hypothetical emissions reductions. The study strongly recommends that current photochemical modeling practices include this type of analysis to reduce the risk of focusing on the wrong ozone precursor, underestimating control requirements, or incurring costs to implement unnecessary controls. Pages: 364

September 1994 | Product Number: I46160 | Price: \$149.00

Phone Orders: +1 303 397 7956 (Local and International)

## Environment and Safety Data

The following summaries report on cases that are recorded under the U.S. Bureau of Labor Statistics' recordkeeping guidelines. The surveys are based on data submitted to API by oil and gas companies. The reports include information regarding injuries, illness, fatalities, lost workday cases, and incidence rates by function.

### 1989 Summary of Occupational Injuries, Illnesses, and Fatalities in the Petroleum Industry

January 1989 | Product Number: K19996 | Price: \$64.00

### 1990 Summary of Occupational Injuries, Illnesses, and Fatalities in the Petroleum Industry

July 1991 | Product Number: K19988 | Price: \$89.00

### 1991 Summary of Occupational Injuries, Illnesses, and Fatalities in the Petroleum Industry

September 1992 | Product Number: K19987 | Price: \$89.00

### 1992 Summary of Occupational Injuries, Illnesses, and Fatalities in the Petroleum Industry

August 1993 | Product Number: K19986 | Price: \$89.00

### 1993 Summary of Occupational Injuries, Illnesses, and Fatalities in the Petroleum Industry

June 1994 | Product Number: K19985 | Price: \$104.00

### 1994 Summary of U.S. Occupational Injuries, Illnesses, and Fatalities in the Petroleum Industry

June 1995 | Product Number: K19984 | Price: \$104.00

### 1995 Summary of U.S. Occupational Injuries, Illnesses, and Fatalities in the Petroleum Industry

May 1996 | Product Number: K19983 | Price: \$104.00

### Publ 2375

#### 1996 Summary of Occupational Injuries, Illnesses, and Fatalities in the Petroleum Industry

June 1997 | Product Number: K23751 | Price: \$104.00

### Publ 2376

#### 1997 Summary of Occupational Injuries, Illnesses, and Fatalities in the Petroleum Industry

June 1998 | Product Number: K23761 | Price: \$104.00

### Publ 2377

#### 1998 Summary of Occupational Injuries, Illnesses, and Fatalities in the Petroleum Industry

March 1999 | Product Number: K23771 | Price: \$112.00

### Publ 2378

#### 1999 Survey on Petroleum Industry Occupational Injuries, Illnesses, and Fatalities Summary Report: Aggregate Data Only

June 2000 | Product Number: K23781 | Price: \$112.00

### Publ 2379

#### 2000 Survey on Petroleum Industry Occupational Injuries, Illnesses, and Fatalities Summary Report: Aggregate Data Only

March 2001 | Product Number: K23790 | Price: \$112.00

### Publ 2380

2001 Survey on Petroleum Industry Occupational Injuries, Illnesses, and Fatalities Summary Report: Aggregate Data Only

March 2002 | Product Number: K23801 | Price: \$112.00

### Publ 2381

2002 Survey on Petroleum Industry Occupational Injuries, Illnesses, and Fatalities Summary Report: Aggregate Data Only

June 2003 | Product Number: K23811 | Price: \$112.00

### Publ 2382

2003 Survey on Petroleum Industry Occupational Injuries, Illnesses, and Fatalities Summary Report: Aggregate Data Only

May 2005 | Product Number: K23821 | Price: \$112.00

### Publ 2383

2004 Survey on Petroleum Industry Occupational Injuries, Illnesses, and Fatalities Summary Report: Aggregate Data Only

March 2005 | Product Number: K23831 | Price: \$112.00

### Publ 2384

2005 Survey on Petroleum Industry Occupational Injuries, Illnesses, and Fatalities Summary Report: Aggregate Data Only

May 2006 | Product Number: K23841 | Price: \$112.00

### Publ 2385

2006 Survey on Petroleum Industry Occupational Injuries, Illnesses, and Fatalities Summary Report: Aggregate Data Only

June 2007 | Product Number: K23851 | Price: \$112.00

### Publ 2386

2007 Survey on Petroleum Industry Occupational Injuries, Illnesses, and Fatalities Summary Report: Aggregate Data Only

May 2008 | Product Number: K23861 | Price: \$112.00

### Publ 2387

2008 Survey on Petroleum Industry Occupational Injuries, Illnesses, and Fatalities Summary Report: Aggregate Data Only

March 2009 | Product Number: K23871 | Price: \$112.00

### Publ 2388

2009 Survey on Petroleum Industry Occupational Injuries, Illnesses, and Fatalities Summary Report: Aggregate Data Only

April 2010 | Product Number: K23881 | Price: \$112.00

### Publ 4714

**A Guide to Polycyclic Aromatic Hydrocarbons for the Non-Specialist**

Provides an introduction to polycyclic aromatic hydrocarbons (PAHs) for persons working in the petroleum industry. It describes in general terms what PAHs are and how they are formed; PAH environmental transport, fate, and health effects; regulatory requirements related to PAHs; and analytical methods for measuring PAH concentrations in the environment. This information is of particular relevance to the petroleum industry due to the natural presence of PAHs in crude oil, the formation of PAHs during some refining processes, and the potential for production of PAHs during the combustion of petroleum products. The intended audience for this report includes environmental professionals who must address PAH regulatory issues and field personnel who are responsible for the sampling and analyses of PAHs. Pages: 36

February 2002 | Product Number: I47141 | Price: \$86.00

## Human Health Related Research

### TR 400

**Toluene: A Preliminary Study of the Effect of Toluene on Pregnancy of the Rat**

Describes a preliminary experiment performed on the pregnant rat to determine appropriate exposure levels of toluene, for future investigation of embryofetal toxicity in the rat when administered via the inhalation route from days 5 to 15 of pregnancy inclusive. The inhalation route of administration was chosen as the most likely route of exposure in humans. The exposure levels were chosen following a review of currently available information. See related document TR 401. Pages: 113

June 1993 | Product Number: I00400 | Price: \$67.00

### TR 401

**Toluene: The Effect on Pregnancy of the Rat**

Describes a study to assess the toxicity of toluene on the pregnant rat as well as on the developing fetus. Pregnant rats were exposed to 250, 750, 1500, and 3000 ppm toluene via inhalation for 6 hours a day from days 6 to 15 of pregnancy. Control rats were exposed to filtered air for the same length of time. Throughout the exposure period, animals were observed for clinical signs of toxicity. On day 20, the females were sacrificed and examined for abnormalities. The number and distribution of live young as well as the number of fetal deaths and abnormalities were also recorded. See related document TR 400. Pages: 215

June 1993 | Product Number: I00401 | Price: \$95.00

### TR 403

**Closed-Patch Repeated Insult Dermal Sensitization Study of TAME in Guinea Pigs**

Describes a study to evaluate the allergic contact sensitization potential of tert-amyl methyl ether (TAME) in guinea pigs. Observations for mortality were made daily. Body weights were obtained and general health monitored weekly. Dermal evaluations were made approximately 24 and 48 hours after exposure. Pages: 32

February 1995 | Product Number: I00403 | Price: \$67.00

### TR 404

**An Inhalation Oncogenicity Study of Commercial Hexane in Rats and Mice, Part I—Rats**

This abridged report, the first part of a two-part set, evaluates the oncogenic potential of commercial hexane administered to four groups of 50 Fischer 344 rats at concentrations of 0, 900, 3000 and 9000 ppm in air. Summary text as well as pertinent data on changes in body weight, pathology, and individual and overall tumor incidence including differences in survivorship between control and exposed groups are provided. The amendment and table of contents to the unabridged final report are included. Pages: 152

January 1995 | Product Number: I00404 | Price: \$86.00

### TR 405

**An Inhalation Oncogenicity Study of Commercial Hexane in Rats and Mice, Part II—Mice**

This abridged report, the second part of a two-part set, evaluates the oncogenic potential of commercial hexane administered to four groups of 50 B6C3F1 mice at concentrations of 0, 900, 3000 and 9000 ppm in air. Summary text and pertinent data on differences in survivorship between control and exposed groups, changes in body weight, and pathology are provided. The table of contents to the unabridged final report is included. Pages: 106

January 1995 | Product Number: I00405 | Price: \$67.00

## Health and Environmental Issues

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### TR 409

#### Primary Skin Irritation Study in Rabbits of API 91-01 and PS-6 Unleaded Test Gasolines

Describes a study conducted to assess primary dermal irritation data for two motor fuels according to Toxic Substances Control Act and Federal Hazardous Substances Act guidelines. Test rabbits were exposed dermally to unleaded gasoline according to a specified protocol and observed daily for signs of skin irritation. Such information is valuable for accurate hazard assessment and first aid treatment. Pages: 58

March 1995 | Product Number: I00409 | Price: \$67.00

### TR 410

#### Chromosome Aberrations in Chinese Hamster Ovary (CHO) Cells Exposed to Tertiary Amyl Methyl Ether (TAME)

Evaluates the clastogenic potential of TAME using CHO cells compared to the solvent control group. Based on the findings of this study, TAME was concluded to be positive for the induction of structural chromosome aberrations in CHO cells. Pages: 56

December 1996 | Product Number: I00410 | Price: \$95.00

### TR 411

#### Chinese Hamster Ovary (CHO) HGPRT Mutation Assay of Tertiary Amyl Methyl Ether (TAME)

Describes a study conducted to evaluate the mutagenic potential of the test article, TAME based on quantitation of forward mutations at the hypoxanthine-guanine phosphoribosyl transferase (HGPRT) locus of CHO cells. Under the conditions of this study, TAME was concluded to be negative in the CHO/HGPRT mutation assay. Pages: 46

December 1996 | Product Number: I00411 | Price: \$95.00

### TR 412 and TR 414

#### A Range-Finding Developmental Inhalation Toxicity Study of Unleaded Gasoline Vapor Condensate in Rats and Mice via Whole-Body Exposure and an Inhalation Developmental Toxicity Study of Unleaded Gasoline Vapor Condensate in the Rat via Whole-Body Exposure

This two-part inhalation study sought to specifically evaluate the potential of unleaded gasoline for developmental toxicity in rodents. The composition of the unleaded gasoline vapor condensate and the treatment pattern used are representative of real-world exposure conditions encountered at service stations and in other occupational settings. The results show that developmentally there were no differences between treated and control groups in malformations, total variations, resorptions, fetal body weight, or viability. Under the conditions of the study, unleaded gasoline vapors did not produce evidence of developmental toxicity. (This volume includes publications TR 412 and TR 414.) Pages: 300

April 1998 | Product Number: I00412 | Price: \$105.00

### Publ 4592

#### Odor Threshold Studies Performed with Gasoline and Gasoline Combined with MTBE, ETBE and TAME

Examines the effects on odor detection and recognition of adding oxygenates such as methyl tertiary butyl ether (MTBE), ethyl tertiary butyl ether (ETBE), and tertiary amyl methyl ether (TAME), to gasoline. Commercial grade MTBE is also evaluated for its taste threshold in water. The odor detection threshold is the minimum concentration at which 50 % of a given population can differentiate between a sample containing the odorant and a sample of odor-free air. The recognition threshold is the minimum concentration at which 50 % of a given population can recognize the odorant. The addition of 11 % to 15 % by volume MTBE or 15 % by volume of TAME or ETBE reduce the odor detection and recognition thresholds of gasoline. Pages: 76

January 1994 | Product Number: I45920 | Price: \$86.00

### Publ 4623

#### Anecdotal Health-Related Complaint Data Pertaining to Possible Exposures to Methyl Tertiary Butyl Ether (MTBE): 1993 and 1994 Follow-Up Surveys

Describes the development and administration of an informal survey of API member companies and state agencies to acquire anecdotal complaint data relating to MTBE exposure. Data associated with 71 occupational and 13 nonoccupational health-related complaints including reported symptoms are presented. Pages: 33

September 1995 | Product Number: I46230 | Price: \$67.00

### Publ 4634

#### Index and Abstracts of API Health-Related Research

This compendium of health-related research provides author, organization, and subject indices for research investigations and scientific reviews conducted for API between 1959 and 1994. It covers industrial hygiene and exposure assessment, toxicology, environmental biology, product safety, and community and occupational health research areas. Informative abstracts provide useful background on each study and give information on publication availability. Pages: 160

September 1995 | Product Number: I46340 | Price: \$86.00

### Publ 4647

#### Brain Glial Fibrillary Acidic Protein (GFAP) as a Marker of Neurotoxicity During Inhalation Exposure to Toluene

Evaluates the concentration of GFAP in the rat's brain as a practical biomarker of toluene-induced neurotoxicity. Adult male rats received inhalation exposure to toluene scfomheduled to approximate occupational exposure for up to 42 days. During and after exposure, the concentration of GFAP was determined in four brain regions and compared with standard criteria of neurotoxicity: behavioral or neuropathological changes. Pages: 44

June 1997 | Product Number: I46470 | Price: \$86.00

### Publ 4648

#### Human Neurobehavioral Study Methods: Effects of Subject Variables on Results

Behavioral tests from two consensus neurotoxicity batteries were administered to 715 subjects aged 26–45. These people had 0–18 years of education and represented the following cultural groups: European-descent majority, Native American Indian, African American, and Latin American. Differences in educational level and locale (rural vs. urban) and gender were examined. All factors affected the outcome of the behavioral tests studied. Results suggested that education and cultural group should be controlled in the design of the study rather than in the statistical analysis, and failure to do so could lead to false conclusions about the presence or absence of neurotoxic effects. Pages: 110

December 1996 | Product Number: I46480 | Price: \$105.00

### Publ 4689

#### Chemical Human Health Hazards Associated with Oil Spill Response

Contains an overview of human health hazards that could be encountered by personnel involved with spills or leaks of petroleum products. The discussion includes potential risks of basic components and products of concern. Environmental factors that may affect exposure and a brief summary of other exposure considerations are also included. Pages: 51

August 2001 | Product Number: I46890 | Price: \$90.00

### Publ 4743

#### Hazard Narrative for Tertiary-Butyl Alcohol (TBA), CAS Number 75-65-0

The purpose of this investigation was to conduct a quantitative risk assessment according to U.S. Environmental Protection Agency guidelines in which data on the mode of action by which TBA induced renal tumors in rats and thyroid tumors in mice was considered. When data from animal studies,



such as the TBA bioassays, are extrapolated to humans to provide estimates of lifetime cancer risks, then potential differences in pharmacokinetics (metabolism) and pharmacodynamics (sensitivity and mode of action) between the animal species and humans is considered in the estimation of human equivalent doses and in extrapolation from high doses typically used in the animal bioassays to low doses to which humans may be potentially exposed. Pharmacokinetic, toxicity, and mode of action data for TBA were reviewed and data selected for quantitative dose-response modeling. Pages: 76

November 2005 | Product Number: I47430 | Price: \$161.00

## Publ 45592

### Results of Toxicological Studies Conducted for the American Petroleum Institute Health and Environmental Sciences Department

Lists and provides the results through December 1994 of all toxicological studies performed on petroleum-based materials, including gasoline and gasoline streams, middle distillates, lubes, heavy fuels, solvents, shale oils, and miscellaneous products. It also provides details of the tests performed and the species tested. A three-ring binder is provided to house this edition and future updates. Pages: 190

January 1995 | Product Number: I45592 | Price: \$86.00

## Natural Resource Damage Assessment

### Publ 304

#### Evaluation of Restoration Alternatives for Natural Resources Injured by Oil Spills

Builds upon previous work in the field of oil spill impact assessment and habitat restoration to assess the technical feasibility and practicality of proactive restoration following oil spills and presents an approach for evaluating tradeoffs between natural recovery and active restoration. The scenarios developed to represent a broad spectrum of possible oil spills were based on selected case studies. The report concludes that in general, available restoration techniques are not very effective for enhancing natural recovery and may, in certain cases, cause more severe impacts than the oil spill alone. Pages: 171

1st Edition | October 1991 | Product Number: J30400 | Price: \$90.00

### Publ 316

#### Identifying and Measuring Nonuse Values for Natural and Environmental Resources: A Critical Review

Takes an in-depth look at the theoretical arguments for using the contingent value method (CVM) as a scientifically valid and reliable tool for valuing nonuse public goods, specifically, environmental resources. The theory of option value is used to frame the concept of nonuse; prominent studies that feature nonuse measurement are highlighted. The potential biases of the CVM method are mentioned with suggestions on improving values. Pages: 134

August 1995 | Product Number: J31600 | Price: \$65.00

### DR 342

#### Toxicity Bioassays on Dispersed Oil in the North Sea: June 1996 Field Trials

The purpose of the study described in this report was to gain more information on water column impacts by taking advantage of the ongoing efficacy and monitoring studies done by the Norwegian Clean Seas Association for Operating Companies (NOFO) in order to conduct field toxicity tests.

The goal of this study was to obtain field effects data using shipboard, real-time toxicity tests with field water. These data can then be used in the future to link field effects to laboratory toxicity data. Pages: 108

June 2002 | Product Number: I34200 | Price: \$151.00

## Publ 4594

### A Critical Review of Toxicity Values and an Evaluation of the Persistence of Petroleum Products for Use in Natural Resource Damage Assessments

This document and accompanying 3.5-in. diskette provide a review of the literature (post-1970) on the toxicity of crudes and oil products in aquatic environments. Some 748 toxicity values for fish, invertebrates, and algae are assembled into a database—OILTOX. LC50 values can be identified as well as information on taxonomic groups and toxicity endpoints of interest. Key methodological aspects of toxicity tests can be made as well as determinations of which test procedures have a significant impact on results. Users need 640 KB RAM, DOS 2.0 or higher, and at least a 2 MB hard disk. Text may be downloaded onto a diskette and stored as a file or printed. Pages: 196

January 1995 | Product Number: I45940 | Price: \$128.00

## Pollution Prevention

### Publ 300

#### The Generation and Management of Waste and Secondary Materials in the Petroleum Refining Industry

In 1989, API initiated a census survey of domestic refineries to document the management of waste and secondary materials in 1987 and 1988. Outstanding responses by the refineries (115 out of the total U.S. population of 176 refineries participated) aided in making confident estimates of the amount of waste managed by the U.S. refining industry. Pages: 184

February 1991 | Product Number: J30000 | Price: \$80.00

### Publ 302

#### Waste Minimization in the Petroleum Industry: A Compendium of Practices

In early 1988, API undertook a project to develop a compendium of the waste minimization practices for several different segments of the petroleum industry. The compendium discusses a large variety of practices that can and are being utilized by the industry to reduce both the volume and toxicity of wastes. From "good housekeeping practices" for marketing facilities to the recycling of solvents, stormwater, and other traditional waste streams at refineries, the compendium illustrates the various practices available to minimize wastes in the industry. Pages: 152

November 1991 | Product Number: J30200 | Price: \$98.00

### Publ 303

#### Generation and Management of Wastes and Secondary Materials: 1989 Petroleum Refining Performance

This report is a follow-up to Publ 300 and documents the results of the 1989 Refining Solid Waste Survey. The quantitative results of the generation of the 28 waste and residual streams and their management according to the environmental management hierarchy (i.e. source reduction, recycling, treatment, and disposal) is presented. In addition, the document contains a discussion of the state of source reduction activities underway within the industry, including a quantitation of source reduction achievements on the 28 streams, and the methods used to calculate source reduction. Pages: 93

June 1992 | Product Number: J30300 | Price: \$98.00

### Publ 311

#### Environmental Design Considerations for Petroleum Refining Processing Units

Demonstrates the application of pollution prevention concepts in the design of a refinery crude processing unit. Included are realistic waste and emission reduction changes that would be economically and technically attractive to refiners. The document is intended to serve as a reference for refinery designers during the preliminary design phase of building a new crude unit or revamping an existing crude unit. Pages: 214

February 1993 | Product Number: J31100 | Price: \$160.00

## Health and Environmental Issues

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### Publ 31101

#### Executive Summary: Environmental Design Considerations for Petroleum Refining Crude Processing Units

Executive summary to Publ 311. Pages: 13

February 1993 | Product Number: J31101 | Price: \$63.00

### Publ 312

#### Responding to Environmental Challenge: The Petroleum Industry and Pollution Prevention

Informal proceedings of a pollution prevention plenary session held at API's 1990 Health and Environment Annual Meeting. Speakers representing federal and state government, public interest groups, and various petroleum industry segments presented their views on pollution prevention. This document also describes API's initiatives for pollution prevention research. Pages: 16

1990 | Product Number: J31200 | Price: Free\*

### Publ 317

#### Industry Experience with Pollution Prevention Programs

The API Pollution Prevention Task Force has been actively involved in promoting pollution prevention within the industry since 1990. Members of the Task Force have accumulated a comprehensive body of knowledge on the subject of pollution prevention and have compiled a resource brochure on the key elements that make pollution prevention programs successful. Pages: 4

June 1993 | Product Number: J31700 | Price: Free\*

### Publ 324

#### Generation and Management of Residual Materials: Petroleum Refining Performance 1990 Survey

This document is third in a series that presents the results of API's annual survey of the types and amounts of wastes and residuals generated and managed by the petroleum refining industry. For 1990, source reduction activities doubled over the previous year. The quantity of residuals generated increased to 18.2 million wet tons as compared to 16.3 million wet tons in 1989. Much of the increased quantity reflects generation peaks associated with construction and remediation activities. Two long-term trends are worth noting: (1) the amount of total residuals being recycled continues to rise, and (2) the amount of hazardous wastes going to land treatment and disposal continues to fall. Pages: 123

August 1993 | Product Number: J32400 | Price: \$97.00

### Publ 329

#### Generation and Management of Residual Materials: Petroleum Refining Performance 1991 Survey

This document is the fourth in a series that describes the 1991 data from API's annual survey of the types and amounts of residual materials generated and managed by the refining industry. In 1991, the industry generated 14.8 million wet tons of residual materials—the smallest quantity generated since API began this collection effort in 1987. The industry also reported that pollution prevention activities accounted for a reduction in 715,000 wet tons of materials. A trend analysis was performed on the last five years. Oil companies can use the data in this report to compare their residual generation and management practices with the rest of the industry. Pages: 172

June 1994 | Product Number: J32900 | Price: \$109.00

### Publ 331

#### Environmental Performance Indicators: Methods for Measuring Pollution Prevention

Presents methods that can be used to measure progress toward pollution prevention. It investigates a series of measurement parameters presented in five categories: program-based, activity-based, mass-based, normalized efficiency, and concentration-based. Within each category of measures, the benefits and limitations are discussed and illustrated with industry examples. Pages: 30

September 1994 | Product Number: J33100 | Price: \$69.00

### Publ 333

#### Generation and Management of Residual Materials

This report is the fifth in a series of reports detailing waste and residual and management practices in the refining sector. It presents the results of the 1992-1993 survey and includes information on how the industry has achieved compliance with the land disposal restrictions on Resource Conservation and Recovery Act (RCRA) listed hazardous K-wastes (K0448-K052). It also documents the influence of the primary sludge rule and new toxicity characteristic under RCRA. Pages: 170

February 1995 | Product Number: J33300 | Price: \$109.00

### Publ 336

#### Management of Residual Materials: 1994, Petroleum Refining Performance

This report is the sixth in a series of reports presenting the results of the API Annual Refining Residual Survey. It provides a detailed assessment of the size of refinery throughput, the types of crude oil utilized, the regions in which the refineries are located, the types of wastewater treatment processes used, the amounts of different residual streams produced and how they are managed, and the average cost of residual stream management. Pages: 98

August 1996 | Product Number: J33600 | Price: \$109.00

### Publ 339

#### Management of Residual Materials: 1995, Petroleum Refining Performance

This report is the seventh in a series of reports presenting the results of the API Annual Refining Residual Survey. Included in the report are detailed assessments of generated quantities and management practices for 14 individual and 2 combined residual streams, trends in management practices, average costs for selected residual stream management, types of wastewater treatment systems employed at refineries, pollution prevention activities, refinery capacities, and regions in which refineries are located. The data in this report indicate a decrease of greater than 25 % in the quantity of residuals generated by the refining industry from 1994 to 1995. Further, the industry trend towards increased recycling of residuals has continued. In 1995, over half of the refinery residuals generated were recycled rather than being treated or disposed. Pages: 106

July 1997 | Product Number: J33900 | Price: \$109.00

### Publ 345

#### Management of Residual Materials: 1996 Petroleum Refining Performance

This report is the eighth in a series of reports presenting the results of the API Annual Refining Residual Survey. Included in the report are detailed assessments of generated quantities and management practices for 14 residual streams representing approximately 80 % of all residuals managed at U.S. refineries. Industry trend towards increased recycling of residuals has continued. In 1996, well over half of the refinery residuals generated were recycled rather than being treated or disposed. Pages: 106

June 1998 | Product Number: J34500 | Price: \$109.00

### Soil and Groundwater Research

<https://www.api.org/groundwater>

#### Publ 4722

##### Groundwater Sensitivity Toolkit—Users Guide, Version 1.0

API and the California MTBE Research Partnership have produced a new software utility to help site managers, water purveyors, and regulators evaluate the sensitivity of a groundwater resource to a potential release of compounds of concern [e.g. a methyl tertiary-butyl ether (MTBE)-oxygenated fuel]. The toolkit examines three aspects of sensitivity: resource value, receptor vulnerability, and natural sensitivity. The user supplies site-specific information, and the toolkit returns a “scorecard” addressing the three aspects of sensitivity. Although this utility was designed with petroleum hydrocarbon releases in mind, it can be used when dissolved chlorinated and inorganic compounds are the chemicals of concern. The toolkit runs on Microsoft Excel® and comes with a user’s guide. Pages: 51

August 2002 | Product Number: I47220 | Price: \$65.00

#### API Soil and Groundwater Research Bulletins

API Soil and Groundwater Research bulletins summarize research results from project overseen by API’s Soil and Groundwater Technical Task Force. The Task Force disseminates information and research results through publications, presentations, and interaction with industry clients and regulatory agencies.

The bulletins listed below can be downloaded at <https://www.api.org/oil-and-natural-gas/environment/clean-water/ground-water/bulletins>

#### Bulletin No. 1

Summary of Processes, Human Exposures and Remediation Technologies Applicable to Low Permeability Soils

September 1996

#### Bulletin No. 3

Ten Frequently Asked Questions About MTBE in Water

March 1998

#### Bulletin No. 5

Evaluation of Sampling and Analytical Methods for Measuring Indicators of Intrinsic Bioremediation

March 1998

#### Bulletin No. 8

Characteristics of Dissolved Petroleum Hydrocarbon Plumes: Results from Four Studies

December 1998

#### Bulletin No. 9

Non-Aqueous Phase Liquid (NAPL) Mobility Limits in Soil

June 2000

#### Bulletin No. 10

Simulation of Transport of Methyl Tert-Butyl Ether (MTBE) to Ground-Water from Small-Volume Releases of Gasoline in the Vadose Zone

June 2000

#### Bulletin No. 11

Strategies for Characterizing Subsurface Releases of Gasoline Containing MTBE

August 2000

#### Bulletin No. 12

No-Purge Sampling: An Approach for Long-Term Monitoring

October 2000

#### Bulletin No. 13

Dissolution of MTBE from a Residually Trapped Gasoline Source

September 2001

#### Bulletin No. 14

Predicting the Effect of Hydrocarbon and Hydrocarbon-Impacted Soil on Groundwater

September 2001

#### Bulletin No. 15

Vadose Zone Natural Attenuation of Hydrocarbon Vapors: An Empirical Assessment of Soil Gas Vertical Profile Data

December 2001

#### Bulletin No. 16

Migration of Soil Gas Vapors to Indoor Air: Determining Vapor Attenuation Factors Using a Screening-Level Model and Field Data from the CDOT-MTL

April 2002

#### Bulletin No. 17

Identification of Critical Parameters for the Johnson and Ettinger (1991) Vapor Intrusion Model

May 2002

#### Bulletin No. 18

Answers to Frequently Asked Questions About Managing Risk at LNAPL Sites

June 2018

#### Bulletin No. 19

Evaluation of Small-Volume Releases of Ethanol-Blended Gasoline at UST Sites

October 2003

#### Bulletin No. 20

Answers to Frequently Asked Questions About Ethanol Impacts to Groundwater

December 2003

#### Bulletin No. 21

Evaluation of Potential Vapor Transport to Indoor Air Associated with Small-Volume Releases of Oxygenated Gasoline in the Vadose Zone

January 2005

#### Bulletin No. 22

Maximum Potential Impacts of Tertiary Butyl Alcohol (TBA) on Groundwater from Small-Volume Releases of Ethanol-Blended Gasoline in the Vadose Zone

January 2005

#### Bulletin No. 23

The Impact of Gasohol and Fuel-Grade Ethanol on BTX and Other Hydrocarbons in Ground Water: Effect on Concentrations Near a Source

December 2005

### Bulletin No. 24

Downward Solute Plume Migration: Assessment Significance and Implications for Characterization and Monitoring of "Diving Plumes"

April 2006

### Bulletin No. 25

Remediation Progress at California LUFT Sites: Insights from the GeoTracker Database

February 2012

### Bulletin No. 26

Tertiary Butyl Alcohol (TBA) Biodegradation: Some Frequently Asked Questions

March 2012

## CONTAMINANT FATE AND TRANSPORT

### Publ 4531

Chemical Fate and Impact of Oxygenates in Groundwater: Solubility of BTEX from Gasoline-Oxygenate Mixtures

Oxygenated hydrocarbon compounds may be added to gasoline mixtures to improve emission quality and octane ratings or to conserve petroleum resources, which may alter the behavior of dissolved organic compounds in groundwater following a fuel spill. This study evaluates the effects of oxygenate additives such as methanol or methyl tertiary-butyl ether on the aqueous solubility of dissolved aromatic hydrocarbons (benzene, toluene, ethylbenzene, and the isomers of xylene, collectively referred to as BTEX) from gasoline. It also explores the nature of the dissolved contaminant plumes that could develop from a spill of gasoline containing methanol. Pages: 110

August 1991 | Product Number: I45310 | Price: \$67.00

### Publ 4593

Transport and Fate of Non-BTEX Petroleum Chemicals in Soils and Groundwater

This literature survey documents available information on the chemical composition of petroleum products and the subsurface fate and transport of selected non-BTEX (benzene, toluene, ethylbenzene, and xylenes) constituents of these products. The evaluation focuses on a representative group of 12 hydrocarbons and hetero-organic compounds based on their abundance in petroleum products and anticipated future interest from regulatory agencies. Pages: 200

September 1994 | Product Number: I45930 | Price: \$71.00

### Publ 4601

Transport and Fate of Dissolved Methanol, MTBE and Monoaromatic Hydrocarbons in a Shallow Sand Aquifer

Describes a field investigation into the effect of oxygenates methanol and methyl tertiary-butyl ether (MTBE) on the fate and transport of benzene, toluene, ethylbenzene, and xylenes (BTEX) in groundwater. Natural gradient tracer experiments were conducted to simulate the transport of dissolved plumes resulting from subsurface releases of oxygenated fuels. In these experiments, methanol, MTBE, and BTEX concentrations were monitored by sampling from a dense network of multilevel piezometers, and plume contours were mapped through application of moment analysis. A laboratory study on the effects of methanol and MTBE on the biodegradation of BTEX in groundwater was also conducted. The relative mobility and persistence of BTEX and the oxygenates were characterized based on field and laboratory study data. Pages: 338

April 1994 | Product Number: I46010 | Price: \$134.00

### Publ 4627

In-Situ and On-Site Biodegradation of Refined and Fuel Oils: A Review of Technical Literature 1988-1991

Reviews more than 200 technical articles published between 1988 and 1991 in the area of on-site and in-situ bioremediation of petroleum hydrocarbons. It focuses specifically on current field and laboratory research related to petroleum hydrocarbon biodegradation including biodegradation of crude oil and solvents. Recent work in fate and transport modeling that can be applied to petroleum hydrocarbon contamination in groundwater is also covered. The review is designed to complement an earlier (pre-1988) review published by the U.S. Navy. Pages: 146

June 1995 | Product Number: I46270 | Price: \$67.00

### Publ 4633

Barium in Produced Water: Fate and Effects in the Marine Environment

Provides a summary of what is currently known about the physical and chemical behavior of barium in produced water and in the ocean. It discusses the factors that influence the rate of precipitation of barium as barite. The toxicity of barium to marine and freshwater organisms and humans is discussed in relation to the concentrations and forms in which it occurs in aquatic environments. Pages: 68

September 1995 | Product Number: I46330 | Price: \$65.00

### Publ 4643

Estimation of Infiltration and Recharge for Environmental Site Assessment

A risk-based corrective action analysis of a site suspected of chemical contamination requires site-specific knowledge of the rate water infiltrates through the soil to the water table. A comprehensive discussion of the current physical/chemical methods and mathematical models available to quantify those rates along with suggestions for selecting an appropriate technique, depending on site conditions, are provided in this report. Pages: 204

July 1996 | Product Number: I46430 | Price: \$105.00

### Publ 4654

Field Studies of BTEX and MTBE Intrinsic Bioremediation

A gasoline release field site in the Coastal Plain of North Carolina was monitored for more than three years to allow calculation of in-situ biodegradation rates. Laboratory microcosm experiments were performed to further characterize the biodegradation of benzene, toluene, ethylbenzene, and xylenes (BTEX) and methyl tertiary-butyl ether (MTBE) under ambient, in-situ conditions. Finally, groundwater modeling studies were conducted to facilitate the interpretation of field data and to evaluate various approaches for predicting the fate and effects of these gasoline constituents in the subsurface. Pages: 244

October 1997 | Product Number: I46540 | Price: \$82.00

### Publ 4674

Assessing the Significance of Subsurface Contaminant Vapor Migration to Enclosed Spaces—Site-Specific Alternative to Generic Estimates

Vapors in enclosed spaces pose two levels of concern. First, enclosed-space vapors may be found at concentrations near those that pose immediate flammability and/or health risks. These sites warrant immediate attention and response as required by most state and federal regulatory guidance. In the second class of sites, concentrations are lower and the concern is for longer term health risks. This report focuses exclusively on this second class of sites, where advection and diffusion occur through a soil layer and into an enclosed space, and time is available to adequately address the problem on a site-specific basis. The options considered in this document include the following:

- direct measurement through sampling of enclosed-space vapors,
- use of near-foundation or near-surface soil gas sampling results,

- use of site-specific homogeneous and layered soil diffusion coefficients in generic algorithms, and
- assessment of bioattenuation potential. Pages: 56

December 1998 | Product Number: I46740 | Price: \$86.00

## Publ 4734

### Modeling Study of Produced Water Release Scenarios

Provides a scientific basis for operators, regulators, and landowners to determine if assessment or remediation of produced water releases will provide a meaningful environmental benefit.

The two principal research objectives of this study are (1) the identification of produced water release scenarios that have a potential to cause groundwater quality impairment in homogeneous subsurface geologic profiles and (2) the prediction of chloride movement through the vadose zone for different release scenarios. Secondary objectives of the study included evaluation of the effect of heterogeneity on the migration of chloride through the vadose zone, the impact of repeat releases, and the effect on groundwater quality of surface soil restoration by revegetation and soil leaching.

The sensitivity analysis performed in this study provides an overview of the likelihood of groundwater impairment for large release volumes (100 bbls and 10,000 bbls). Assuming homogeneous unsaturated zone soil profiles, the results of over 1000 modeled release scenarios reveal that 49 % of single-event releases do not cause impairment of groundwater above drinking water standards for chloride (250 mg/L) in a monitoring well that is adjacent to the edge of the release. In 70 % of these scenarios, chloride concentrations in groundwater do not exceed 1000 mg/L. Although these numbers give no information about the fate of chloride from a specific produced water release, they do indicate that a release does not necessarily cause groundwater impairment. Pages: 124

January 2005 | Product Number: I47340 | Price: \$134.00

## Publ 4758

### Strategies for Addressing Salt Impacts of Produced Water Releases to Plants, Soil, and Groundwater

The exploration and production industry uses great care during the handling and disposal of the produced water that is generated as part of oil and gas production. However, unintentional releases can occur. Depending on the chemical composition of the produced water and the nature of the local environment, salts associated with such releases can impair soils, vegetation, and water resources.

Provides a collection of simple rules of thumb, decision charts, models, and summary information from more detailed guidance manuals to help you address the following assessment and response issues:

- Will a produced water release cause an unacceptable impact on soils, plants, and/or groundwater?
- In the event of such an impact, what response actions are appropriate and effective? Pages: 29

1st Edition | September 2006 | Product Number: I47580 | Price: \$76.00

## Publ 4784

### Quantification of Vapor Phase-Related Natural Source Zone Depletion Processes

Natural source zone depletion (NSZD) has emerged as an important concept within the realm of environmental remediation. NSZD is a term used to describe the collective, naturally occurring processes of dissolution, volatilization, and biodegradation that results in mass losses of light non-aqueous phase liquid (LNAPL) petroleum hydrocarbon constituents from the subsurface.

This document provides practical guidance on NSZD theory, application, measurement methods, and data interpretation. It is intended to be used by practitioners to help plan, design, and implement NSZD monitoring programs in support of petroleum hydrocarbon site remediation. Pages: 124

1st Edition | May 2017 | Product Number: I47840 | Price: \$131.00

## REMEDIAL TECHNOLOGIES

### DR 225

#### Remediation of a Fractured Clay Till Using Air Flushing: Field Experiments at Sarnia, Ontario

This study was conducted over a three-year period at a well-characterized test site located in Canada near Sarnia, Ontario. A synthetic gasoline blend of known mass, volume, and composition was released into a test cell. Samples were collected and analyzed for gasoline range organics to establish the three-dimensional distribution of the release. Conventional air flushing technologies, soil vapor extraction and in-situ air sparging, were able to remove ~40 % of the spilled mass during the initial two months of operation. Following active remediation, primarily low-volatility compounds remained in the soil and almost no benzene or toluene remained. Based on mass balance data, a significant portion of the benzene, toluene, ethylbenzene, and xylene compounds was biodegraded. Pages: 220

October 1998 | Product Number: I00225 | Price: \$105.00

### Publ 4525

#### A Compilation of Field-Collected Cost and Treatment Effectiveness Data for the Removal of Dissolved Gasoline Components from Groundwater

Documents, summarizes, and evaluates cost and treatment effectiveness data for air stripping and carbon adsorption systems designed to remove dissolved petroleum hydrocarbons from groundwater. The compounds of primary interest were benzene, toluene, ethylbenzene, and xylene isomers (BTEX) as well as the oxygenates methyl tertiary-butyl ether and isopropyl ether. Operating data were gathered from 57 field sites throughout the United States, and treatment system profiles were generated for each site. The data will be used to assist companies in planning pump-and-treat remediation systems for removal of BTEX and oxygenates from groundwater. Pages: 240

November 1990 | Product Number: I45250 | Price: \$86.00

### Publ 4609

#### In-Situ Air Sparging: Evaluation of Petroleum Industry Sites and Considerations for Applicability, Design and Operation

Describes the important literature findings as well as the hands-on experiences of the petroleum industry at 59 air sparging sites. Design and operational data are analyzed for relationships that can be used to optimize the technology or provide a better understanding of its fundamental processes. Topics covered include: site characterization; pilot testing; system design and installation; and system operation, monitoring, and performance. Pages: 132

May 1995 | Product Number: I46090 | Price: \$105.00

### Publ 4631

#### Petroleum Contaminated Low Permeability Soil: Hydrocarbon Distribution Processes, Exposure Pathways and In-Situ Remediation Technologies

Presents a set of 10 papers on light nonaqueous phase liquids (LNAPLs) in low permeability soils. Collectively, the papers address four key areas: (1) processes affecting the migration and removal of LNAPLs; (2) exposure potential posed by clay soil and hydrocarbons via soil, groundwater, and air pathways; (3) models for predicting LNAPL removal; and (4) techniques of remediation. Pages: 298

September 1995 | Product Number: I46310 | Price: \$95.00

### Publ 4655

#### Field Evaluation of Biological and Non-Biological Treatment Technologies to Remove MTBE/Oxygenates from Petroleum Product Terminal Wastewaters

A pilot/demonstration study was conducted on three treatment technologies—the fluidized bed biological reactor process, the activated sludge process incorporated with iron flocculation, and the ultraviolet light/

## Health and Environmental Issues

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hydrogen peroxide process—to evaluate their effectiveness in the treatment of petroleum marketing terminal wastewater contaminated with methyl tert-butyl ether (MTBE). Contaminated groundwater was the primary constituent of the wastewater, which also contained benzene, toluene, ethylbenzene, and xylenes (BTEX). All three technologies were able to remove at least 95 % of the MTBE and BTEX in the feed waters. Pages: 194

August 1997 | Product Number: I46550 | Price: \$134.00

### Publ 4671

#### Technical Bulletin on Oxygen Releasing Materials for In-Situ Groundwater Remediation

Oxygen releasing materials (ORMs) are commercially available materials that are being used to enhance bioremediation treatment of petroleum hydrocarbon contaminated groundwater aquifers. This technical bulletin provides a systematic approach for evaluating the utility of ORM treatment and for designing ORM installations. It summarizes the current state of understanding of this technology to provide guidance for site managers evaluating options for enhanced groundwater remediation. Pages: 52

July 1998 | Product Number: I46710 | Price: \$76.00

### Publ 4715

#### Evaluating Hydrocarbon Removal from Source Zones and its Effect on Dissolved Plume Longevity and Concentration

Provides valuable information and utilities for regulators and practitioners interested in understanding the possible benefits of free-product removal. This report provides theory and concepts needed to evaluate light nonaqueous phase liquid (LNAPL) source distribution, chemistry, dissolution, and the effects various remediation strategies may have on risk reduction for the groundwater and vapor exposure pathways. The companion software, API-LNAST, links the multiphase and chemical processes controlling in-situ LNAPL distribution, mobility, and cleanup to quantify estimates of the time-dependent concentrations within the LNAPL source and the down gradient dissolved plume. API-LNAST users can screen whether incremental LNAPL removal provides any risk-reduction benefit over a time frame of interest, e.g. 30 years.

September 2002 | Software and documentation can be downloaded at <https://www.api.org/oil-and-natural-gas/environment/clean-water/ground-water/lnapl/evaluating-hydrocarbon-removal>

### Publ 4730

#### Groundwater Remediation Strategies Tool

Provides strategies for focusing remediation efforts on (1) the change in contaminant mass flux in different subsurface transport compartments (e.g. the vadose zone, smear zone, or a zone within an aquifer of interest) and (2) the change in remediation timeframe.

In this approach, groundwater flow and contaminant concentration data are combined to estimate the rate of contaminant mass transfer past user-selected transects across a contaminant plume. The method provides the user with a means to estimate the baseline mass flux and remediation timeframe for various transport compartments and then evaluate how different remedies reduce the mass flux and the remediation timeframe in each transport compartment. Pages: 71

December 2003 | Product Number: I473000 | Price: \$138.00

### Publ 4760

#### LNAPL Distribution and Recovery Model (LDRM)

Simulates the performance of proven hydraulic technologies for recovering free-product petroleum liquid releases to groundwater. The LDRM provides information about light nonaqueous phase liquid (LNAPL) distribution in porous media and allows the user to estimate LNAPL recovery rates, volumes, and times. Documentation for the LDRM is provided in two volumes. Volume 1—Distribution and Recovery of Petroleum Hydrocarbon Liquids in Porous Media—documents the LDRM and provides background information necessary to characterize the behavior of LNAPL in porous media with regard to performance of LNAPL liquid recovery technologies. Volume 2—User and Parameter Selection Guide—provides step-by-step instructions for the LDRM

software. Four example problem applications are presented which highlight model use, parameter estimation using the API LNAPL Parameters Database, and limitations of scenario-based models.

January 2007 | Software and documentation can be downloaded at <https://www.api.org/oil-and-natural-gas/environment/clean-water/ground-water/lnapl/ldrm>

### Publ 4762

#### API LNAPL Transmissivity Workbook: A Tool for Baildown Test Analysis-User Guide

LNAPL transmissivity is a measure of lateral mobility of free-product hydrocarbon liquid within the groundwater environment. The magnitude of LNAPL transmissivity has been suggested as a possible endpoint criterion for LNAPL mass removal using LNAPL hydraulic recovery systems. Such hydraulic recovery systems include skimmer wells, single-pump wells, dual-pump wells, and trenches. Coupled with the LNAPL CSM, the magnitude of LNAPL transmissivity will assist in the selection of recovery system. As such, methods and their consistent application for estimating LNAPL transmissivity are significant. Perhaps the simplest methods for estimating LNAPL transmissivity are borehole slug test methods, or baildown tests, in which a volume of LNAPL is rapidly removed from a well and the rate of fluid-level recovery (water and LNAPL) is measured and analyzed. Several analytical methods are available to analyze the data from baildown tests to estimate LNAPL transmissivity and described herein. Following a brief description of suggested well configuration, pre-test and test measurements and methods, application of the spreadsheet tool is discussed. Subsequent sections provide a more detailed discussion of significant parameters and basis for the various analysis procedures. A number of example applications are presented. Further details on the different methods are provided in the appendices. Pages: 40

April 2016 | Product Number: I47620 | For a free copy of this document, please visit [https://www.api.org/~media/4762%20LNAPL%20Tn%20wkbk%20Baildown%20userguide%20Apr2016%20\(2\).pdf](https://www.api.org/~media/4762%20LNAPL%20Tn%20wkbk%20Baildown%20userguide%20Apr2016%20(2).pdf)

## SITE CHARACTERIZATION

### Publ 4599

#### Interlaboratory Study of Three Methods for Analyzing Petroleum Hydrocarbons in Soils

Presents the results of an interlaboratory study of three methods—diesel-range organics, gasoline-range organics, and petroleum hydrocarbons—used to analyze hydrocarbons in soils. Each method is validated, its performance judged from measurements of accuracy and precision, and practical qualification levels are estimated for each method. The full text of each method is included in the report. Pages: 166

July 1994 | Product Number: I47990 | Price: \$105.00

### Publ 4635

#### Compilation of Field Analytical Methods for Assessing Petroleum Product Releases

Presents a compilation of the most widely used field analytical methods available to perform on-site analyses of organic compounds in soil and groundwater. These methods include total organic vapor analyzers, field gas chromatography, immunoassay, infrared analyzers, and dissolved oxygen/oxidation-reduction potential electrodes. Practical applications and limitations of each method are discussed and an objective-oriented data quality classification scheme is presented to assist in selecting an appropriate method. Information is also presented on emerging technologies. Pages: 100

December 1996 | Product Number: I46350 | Price: \$95.00

**Publ 4657**

**Effects of Sampling and Analytical Procedures on the Measurement of Geochemical Indicators of Intrinsic Bioremediation: Laboratory and Field Studies**

Evaluates the effects of various sampling and analytical methods of collecting groundwater geochemical data for intrinsic bioremediation studies. Sampling and analytical methods were tested in the laboratory and in the field. Several groundwater sampling and analytical methods may be appropriate for measuring geochemical indicators of intrinsic bioremediation. The methods vary in accuracy, level of effort, and cost. Pages: 86

November 1997 | Product Number: I46570 | Price: \$67.00

**Publ 4658**

**Methods for Measuring Indicators of Intrinsic Bioremediation: Guidance Manual**

Intended to be a resource for practitioners of intrinsic bioremediation in allowing selection of sampling and analytical methods that meet project-specific and site-specific needs in scoping field investigations, providing procedures that will improve the representative quality of the collected data, and considering potential biases introduced into data through the sampling and analytical techniques employed in the site investigation. Pages: 96

November 1997 | Product Number: I46580 | Price: \$76.00

**Publ 4659**

**Graphical Approach for Determining Site-Specific Dilution-Attenuation Factors (DAFs): Technical Background Document and User's Guide**

The DAF plays a key role in assessing potential impact from the soil-to-groundwater pathway at sites where groundwater quality is, or may be, affected by a leak, spill, or other accidental release of hydrocarbons or other chemicals of concern. A simplistic, graphically-based approach for determining generic and site-specific DAFs was developed, allowing for varying levels of site specificity. Currently, to develop a DAF, one must make complicated calculations by hand or use computer-based modeling software. This publication consists of two documents. The first document describes the technical basis for the graphical approach for determining site-specific dilution attenuation factors. The second document, the user's guide, provides a concise set of instructions for use of the graphical approach. Pages: 233

February 1998 | Product Number: I46590 | Price: \$128.00

**Publ 4668**

**Delineation and Characterization of the Borden MTBE Plume: An Evaluation of Eight Years of Natural Attenuation Processes**

In 1988, a natural gradient tracer test was performed in the shallow sand aquifer at Canada Forces Base Borden to investigate the fate of a methyl tertiary-butyl-ether (MTBE) plume introduced into the aquifer. Solutions of groundwater mixed with oxygenated gasoline were injected below the water table along with chloride (Cl<sup>-</sup>), a conservative tracer. The migration of benzene, toluene, ethylbenzene, and xylenes (BTEX); MTBE; and Cl<sup>-</sup> was monitored in detail for about 16 months. The mass of BTEX in the plume diminished significantly with time due to intrinsic biodegradation. MTBE, however, was not measurably attenuated. In 1995-1996, a comprehensive groundwater sampling program was undertaken to define the mass of MTBE still present in the aquifer. Only about 3% of the initial MTBE mass was found, and it is hypothesized that biodegradation played an important role in its attenuation. Additional evidence is necessary to confirm this possibility. Pages: 88

June 1998 | Product Number: I46680 | Price: \$67.00

**Publ 4670**

**Selecting Field Analytical Methods—A Decision-Tree Approach**

Presents a decision-tree approach for selecting and using field analytical methods for on-site analyses of organic compounds in soil, groundwater, and soil gas samples at petroleum release sites. This approach will assist project or site managers with guidance for on-site investigations from initial

site assessment to site closure. The decision-tree charts are supported by quality control packages to increase the credibility of the data by documenting method performance. The publication also provides training suggestions for personnel who will perform the testing. Easy to use checklists for field quality control and formal documentation are included. Pages: 88

August 1998 | Product Number: I46700 | Price: \$95.00

**Publ 4699**

**Strategies for Characterizing Subsurface Releases of Gasoline Containing MTBE**

Applies the principles of risk-informed decision making to the evaluation of methyl tertiary-butyl ether (MTBE)-affected sites by adding exposure and risk considerations to the traditional components of the corrective action process. The risk factors at a given site are evaluated through a "conceptual site model," which is an inventory of all known or potential oxygenate sources, pathways, and receptors. Based on these risk factors, three levels of assessment are defined: standard, limited, and detailed. The appropriate level of assessment is initially determined based on receptor data, which can typically be obtained from a survey of nearby wells and land uses. A subsurface investigation may then be conducted to obtain information on sources and pathways. The level of assessment can be "upgraded" or "downgraded" as warranted by the resulting source and pathway information. Includes a review of the chemical properties and subsurface behavior of MTBE and other oxygenated fuel additives. It also provides an overview of characterization monitoring issues at oxygenate release sites, as well as a detailed review of the tools and techniques used for subsurface assessment. The expedited site assessment process and the use of modern direct-push tools are particularly emphasized, since these approaches are especially well suited for use at MTBE-affected sites. Pages: 120

February 2000 | <https://www.api.org/oil-and-natural-gas/environment/clean-water/ground-water/oxygenates/site-characterization>

**Publ 4709**

**Risk-Based Methodologies for Evaluating Petroleum Hydrocarbon Impacts at Oil and Natural Gas E&P Sites**

The process of calculating human health risk-based screening levels for total petroleum hydrocarbons (TPH) is described in an easy-to-understand question and answer format. [Risk-based screening levels (RBSLs) are chemical-specific concentrations in environmental media that are considered protective of human health.] Risk assessment concepts developed by the U.S. Environmental Protection Agency and research groups such as the Petroleum Environmental Research Forum and the Total Petroleum Hydrocarbon Criteria Working Group are used to calculate RBSLs for TPH in crude oil and condensates obtained from around the world. These methodologies were also applied to polyaromatic hydrocarbons, metals, and benzene in TPH. Additional resources contained in this manual include a description of the physical and chemical characteristics of crude oil, condensate, and exploration and production (E&P) wastes (contrasted with refined products), a summary of the federal regulatory status of E&P wastes, and a listing of key equations used for calculating RBSLs. Pages: 100

February 2001 | Product Number: I47090 | Price: \$90.00

**Publ 4711**

**Methods for Determining Inputs to Environmental Petroleum Hydrocarbon Mobility and Recovery Models**

This publication is an invaluable reference for operators, consultants and regulators responsible for cleanup of subsurface petroleum releases. Important fluid and soil property parameters are explained. Methods to measure each parameter are presented in order of relevance for use in environmental free-product mobility/recovery assessments. Fluid property parameters covered include density, viscosity, surface tension, and interfacial tension. Laboratory-scale soil property parameters include: capillary pressure vs. saturation, relative permeability vs. saturation, water and nonaqueous phase liquid saturation, and Brooks-Corey and van Genuchten model parameters. Field-

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scale bail-down and production tests are explained and cited. Sample collection and handling procedures are summarized. A listing and abstract of relevant ASTM methods are provided in the appendix. Pages: 72

July 2001 | Product Number: I47110 | Price: \$121.00

### Publ 4731

#### Light Non-Aqueous Phase Liquid (LNAPL) Parameters Database—Version 2.0—Users Guide

A collection of information about samples that have had their capillary parameters determined, as well as other physical parameters measured. Capillary properties are critical in multiphase calculations, and those results have very high sensitivity to these properties. The primary purpose of this database is to provide information to users who are trying to characterize the movement and distribution of LNAPL within a site that has a limited set of direct observations of the capillary properties of the site. Other databases of related parameters have typically been derived from measurements in the agricultural or the petroleum extraction industries; neither being necessarily representative of near-surface environmental conditions. This database give the user the opportunity to understand the range of capillary characteristics observed at sites that are geologically similar, but where there are more direct and laboratory observations available.

December 2003 | Product Number: I47310 | Price: \$138.00

The database is available from API's website:

<https://www.api.org/oil-and-natural-gas/environment/clean-water/ground-water/lnapl/parameter-database>

### Publ 4739

#### API Interactive LNAPL Guide—Version 2.0.4

A comprehensive and easy-to-use electronic information system and screening utility. The guide is designed to provide an overall approach for evaluating light nonaqueous phase liquid (LNAPL) at a site, assessing its potential risk, quantitatively defining mobility and recoverability, developing remedial strategies, and examining methods to enhance site closure opportunities.

The guide includes the following:

- 11 primers covering all aspects of LNAPL from LNAPL basics to remediation;
- 14 assessment tools, including API-LNAST Version 2.0, "Charbeneau" spreadsheets for LNAPL recovery (August 2003), the API LNAPL Parameter Database;
- LNAPL decision-making frameworks;
- videos and animated figures; and
- an extensive reference list.

February 2006 | Available for download at

<http://www.api.org/oil-and-natural-gas/environment/clean-water/ground-water/lnapl/interactive-guide>

### Publ 4761

#### Technical Protocol for Evaluating the Natural Attenuation of MtBE

Addresses data collection, evaluation, and interpretation procedures that consider the physical, chemical, and biological properties of methyl tert-butyl ether (MtBE) and other oxygenates and degradation byproducts. A tiered approach is provided that can be used by stakeholders to interpret several lines of evidence to evaluate natural attenuation on a site-specific basis. Several resources are provided to support an MNA evaluation, including the following:

- a review of basic scientific principles relevant to the evaluation of MtBE natural attenuation, including biodegradation and physicochemical attenuation mechanisms;
- a discussion of data that can be used to assess MtBE (and other oxygenates or degradation byproducts) natural attenuation;
- technical references for relevant chemical properties, analytical methods, and field sampling techniques;

• guidance for data quality assurance and interpretation, including statistical analysis; and

• guidance on the presentation of natural attenuation data/information to facilitate regulatory and other stakeholder review and acceptance of MNA remedies. Pages: 186

May 2007 | Available from API's website: <https://www.api.org/oil-and-natural-gas/environment/clean-water/ground-water/oxygenates>

## Environmental Stewardship Program Publications

### RP 75

#### Safety and Environmental Management System for Offshore Operations and Assets

Provides companies engaged in offshore operations with a framework for the establishment, implementation, and maintenance of a Safety and Environmental Management System (SEMS) to manage and reduce risks associated with safety and the environment to prevent incidents and events.

This recommended practice applies, in part or whole, to companies engaged in offshore operations, from lease evaluation through decommissioning.

This document is not intended to be prescriptive or limiting on the expectations of each SEMS element; rather, it allows flexibility appropriate to the size, scope, and risk of a Company's assets and operations. It is advised that users of this document review and comply with applicable legal and regulatory requirements, and conform with applicable industry codes and standards.

Consideration may be given to using this document to help systematically manage other aspects of operations, such as security and health. Pages: 34

4th Edition | December 2019 | Product Number: G07504 | Price: \$110.00

### Publ 9100

#### Model Environmental, Health and Safety (EHS) Management System and Guidance Document

Comes with a binder complete with both Publ 9100A and Publ 9100B—see descriptions listed below. Pages: 65

October 1998 | Product Number: R9100S | Price: \$171.00

### Publ 9100A

#### Model Environmental, Health and Safety (EHS) Management System

Intended to be used as a voluntary tool to assist companies interested in developing an EHS management system or enhancing an existing system. The model, which applies a quality systems approach to managing EHS activities, focuses on people and procedures by pulling together company EHS policies, legal requirements, and business strategies into a set of company or facility expectations or requirements.

Please refer to the companion document Publ 9100B for additional information. Publ 9100A and Publ 9100B are intended to be companion documents and can be purchased as a set or individually. Pages: 20

October 1998 | Product Number: R9100A | Price: \$82.00

### Publ 9100B

#### Guidance Document for Model EHS Management System

Provides assistance to corporate and operating organization employees who are developing, implementing, and assessing environmental, health and safety management systems. It intends to serve as self-study source material that enhances efficiency of interchange among employees by use of common terminology, clarifies relationships between operating and other systems, describes how to evaluate effectiveness of an EHS management system and its elements, and facilitates system continuity over time.

Those using this guidance document should be familiar with Publ 9100A. Publ 9100A, and Publ 9100B are intended to be companion documents and can be purchased as a set or individually. Pages: 43

October 1998 | Product Number: R9100B | Price: \$118.00



## Storage Tank Research

### Publ 301

#### Aboveground Storage Tank Survey: 1989

Presents a survey of petroleum aboveground storage tanks. Estimates are made of the number, capacity, and age of the tanks in each sector of the petroleum industry. Survey forms and statistical extrapolations methodology are included in the report. Pages: 44

April 1989 | Product Number: J30100 | Price: \$69.00

### Publ 306

#### An Engineering Assessment of Volumetric Methods of Leak Detection in Aboveground Storage Tanks

Provides the results of a leak detection project in aboveground storage tanks that utilized volumetric methods to detect leaks. A series of field tests were conducted on a 114-ft diameter tank that contained a heavy naphtha petroleum product. The analytical and experimental results of this project suggest that volumetric leak detection methods can be used to detect small leaks in aboveground storage tanks. Pages: 43

October 1991 | Product Number: J30600 | Price: \$80.00

### Publ 307

#### An Engineering Assessment of Acoustic Methods of Leak Detection in Aboveground Storage Tanks

Provides the results of a leak detection project in aboveground storage tanks that utilized acoustic methods to detect leaks. A series of field tests were conducted on a 114-ft diameter tank that contained a heavy naphtha petroleum product. The analytical and experimental results of this project suggest that passive-acoustic leak detection methods can be used to detect small leaks in aboveground storage tanks. Pages: 76

January 1992 | Product Number: J30700 | Price: \$80.00

### Publ 315

#### Assessment of Tankfield Dike Lining Materials and Methods

To assess tankfield materials and methods of containment, API commissioned a review of environmental regulations as well as a survey of candidate liner materials and installation methods to explore the technology base. The study was limited to diked areas surrounding storage tanks. Liner installations for secondary containment underneath tanks were excluded. Pages: 50

July 1993 | Product Number: J31500 | Price: \$80.00

### Publ 322

#### An Engineering Evaluation of Acoustic Methods of Leak Detection in Aboveground Storage Tanks

Describes a set of controlled experiments conducted on a 40-ft diameter refinery tank to determine the nature of acoustic leak signals and ambient noise under a range of test conditions. The features of a leak detection test needed for high performance are explored. The report concludes that accurate and reliable leak detection of aboveground storage tanks can be achieved through the use of acoustic methods. Pages: 80

January 1994 | Product Number: J32200 | Price: \$80.00

### Publ 323

#### An Engineering Evaluation of Volumetric Methods of Leak Detection in Aboveground Storage Tanks

Two volumetric approaches to detecting leaks from aboveground storage tanks—precision temperature sensors and mass measurement approaches—are evaluated in this report. A set of controlled experiments on a 117-ft diameter refinery tank is used to examine the effects of differential pressure on conventional level and temperature measurement systems. The features of a leak detection test needed for high performance are also explored. Pages: 86

January 1994 | Product Number: J32300 | Price: \$80.00

### Publ 325

#### An Evaluation of a Methodology for the Detection of Leaks in Aboveground Storage Tanks

Describes the results of the fourth phase of a program to define and advance the state of the art of leak detection for aboveground storage tanks (ASTs). Three leak detection technologies are examined—passive-acoustic, soil-vapor monitoring, and volumetric—over a wide range of tank types, petroleum fuels, and operational conditions. This study also assesses the applicability of a general leak detection methodology involving multiple tests and product levels as well as determines the integrity of 14 ASTs using two or more test methods. Pages: 94

May 1994 | Product Number: J32500 | Price: \$98.00

### Publ 327

#### Aboveground Storage Tank Standards: A Tutorial

Presents procedures and examples to help designers, owners, and operators of aboveground storage tanks understand and comply with API's recommended practices, standards, and specifications concerning leak prevention. These API documents provide requirements designed to minimize environmental hazards associated with spills and leaks. The tutorial also shows how the API inspection and maintenance requirements influence the design of such tanks. It does not attempt to address additional rules and requirements imposed by individual jurisdictions or states. Pages: 70

September 1994 | Product Number: J32700 | Price: \$80.00

### Publ 328

#### Laboratory Evaluation of Candidate Liners for Secondary Containment of Petroleum Products

Provides comparative data on the physical properties of liner materials as a function of their controlled exposure to fuels and/or additives. Six membrane and two clay liners were tested. Project test results were used to rank the liners in terms of vapor permeation and relative changes in properties such as chemical resistance and liquid conductivity measured after immersion. Pages: 142

January 1995 | Product Number: J32800 | Price: \$90.00

### Publ 334

#### A Guide to Leak Detection for Aboveground Storage Tanks

Written for terminal managers, tank owners, operators, and engineers, this report provides useful background on leak detection technologies—volumetric, acoustic, soil-vapor monitoring, and inventory control—for aboveground storage tanks. Characteristics affecting the performance of each technology are discussed. Pages: 38

September 1992 | Product Number: J33400 | Price: \$80.00

### Publ 340

#### Liquid Release Prevention and Detection Measures for Aboveground Storage Facilities

Written for managers, facility operators, regulators, and engineers involved in the design and selection of facility components and prevention of liquid petroleum releases, this report presents an overview of available equipment and procedures to prevent, detect, or provide environmental protection from such releases. Also presented are the advantages, disadvantages, and relative costs, as well as maintenance and operating parameters of various control measures. Pages: 116

October 1997 | Product Number: J34000 | Price: \$90.00

### Publ 341

#### A Survey of Diked-Area Liner Use at Aboveground Storage Tank Facilities

In 1997, API conducted a survey designed to evaluate the effectiveness of diked-area liner systems and to document operational problems involved with their use. The survey data indicated that the effectiveness of liners in protecting the environment is limited because liner systems frequently fail. The data further showed that there are few releases from aboveground

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storage tanks that would be addressed by diked-area liners. Because there were few releases, the data do not directly demonstrate the effectiveness or ineffectiveness of liner systems in containing releases; however, it was concluded that measures that prevent aboveground storage tank releases are more effective in protecting the environment and are more cost-effective in the long run. Pages: 32

February 1998 | Product Number: J34100 | Price: \$80.00

### Publ 346

#### Results of Range-Finding Testing of Leak Detection and Leak Location Technologies for Underground Pipelines

This study reviewed the current leak detection and leak location methods for pressurized underground piping commonly found at airports, refineries, and fuel terminals. Four methods for testing underground pipes of 6 in. to 18 in. in diameter and 250 ft to 2 miles in length were selected for field demonstration. These technologies were constant-pressure volumetric testing, pressure-decay testing, chemical tracer testing, and acoustic emission testing. No single leak detection system was found to work in all situations; site-specific conditions may affect any method, and combinations of methods may provide the most effective approach. Pages: 252

November 1998 | Product Number: J34600 | Price: \$90.00

### Publ 353

#### Managing Systems Integrity of Terminal and Tank Facilities

Although the risk management principles and concepts in this document are universally applicable, this publication is specifically targeted at integrity management of aboveground liquid petroleum storage facilities. The applicable petroleum terminal and tank facilities covered in this document are associated with distribution, transportation, and refining facilities as described in Std 2610 and Publ 340.

This document covers the issues of overall risk management, risk assessment, risk ranking, risk mitigation, and performance measures applicable to an overall integrity management program. The appendices include two possible methodologies for conducting a risk assessment and a workbook that can be used to perform the risk assessment method outlined in Appendix A. Pages: 316

1st Edition | October 2006 | Product Number: J35300 | Price: \$158.00

### Publ 4716

#### Buried Pressurized Piping Systems Leak Detection Guide

Analyzes the performance of different types of leak detection technologies that were applied to buried pressurized piping systems used in airport hydrant fueling and petroleum product terminals. The study was conducted by Argus Consulting and Ken Wilcox Associates on behalf of the Air Transport Association of America and API. This report is intended to provide an overview of the study methodology and results. Pages: 47

April 2002 | Product Number: I47160 | Price: \$102.00

## Surface Water Research

### DR 342

#### Toxicity Bioassays on Dispersed Oil in the North Sea: June 1996 Field Trials

The purpose of the study described in this report was to gain more information on water column impacts by taking advantage of the ongoing efficacy and monitoring studies done by the Norwegian Clean Seas Association for Operating Companies (NOFO) in order to conduct field toxicity tests.

The goal of this study was to obtain field effects data using shipboard, real-time toxicity tests with field water. These data can then be used in the future to link field effects to laboratory toxicity data. Pages: 108

June 2002 | Product Number: I34200 | Price: \$151.00

### DR 343

#### Automated Validation System for the Offshore Operations Committee Mud and Produced Water Discharge Model

Describes the development of an automated validation system for the Offshore Operators Committee Mud and Produced Water Discharge Model (the "OOC Model"), a computer program that predicts the initial fate of drilling fluids, drill cuttings, and produced water discharged into the marine environment. The system automates the process of validating OOC Model predictive capabilities by comparing model predictions with the results of laboratory and field studies of plume behavior. The system was developed to automate the laborious process of confirming that model code enhancements do not degrade the predictive abilities of the OOC Model. The automated validation system approach described here also serves as a template for routine documentation of discharge model performance that could be applied to other models used by industry, consultants, or regulatory agencies. Two of relevant studies found in a literature search were incorporated into the suite of automated test cases for the OOC Model. Summaries of the data sets used for OOC Model validation were prepared in such a way that they could be used conveniently outside of the automated system to validate any relevant discharge model.

November 2002 | CD-ROM Only

### Publ 4664

#### Mixing Zone Modeling and Dilution Analysis for Water-Quality-Based NPDES Permit Limits

This report is designed to

- provide an overview of the U.S. Environmental Protection Agency's (EPA) policies and technical guidance on the role of mixing zones in the National Pollutant Discharge Elimination System (NPDES) permitting process;
- present state mixing zone regulations, policies, and guidance;
- introduce important concepts related to the hydrodynamics of effluent dilution in receiving waters and the design of outfall diffusers;
- review available mixing zone models;
- identify EPA sources for the models;
- discuss strategic issues for dischargers to consider when applying models; and
- describe the use of dye tracer studies as alternatives or supplements to mixing zone models. Pages: 176

April 1998 | Product Number: I46640 | Price: \$105.00

### Publ 4672

#### The Use of Treatment Wetlands for Petroleum Industry Effluents

Treatment wetlands are becoming widely used for cleansing some classes of wastewater effluents. Although the use of treatment wetlands is well established for wastewater categories such as municipal waste, stormwater, agricultural wastewater, and acid mine drainage water, their use in treating a variety of industrial wastewaters is less well developed. Constructed treatment wetlands hold considerable promise for managing some wastewaters generated by the petroleum industry. Several large-scale wetland projects currently exist at oil refineries, and numerous pilot studies of constructed treatment wetlands have been conducted at terminals, gas and oil extraction and pumping stations, and refineries. This report summarizes current information about the use of treatment wetlands for managing petroleum industry wastewaters and also presents background information on the general performance, design, and operation of treatment wetlands based on experience with a variety of wastewater types. Pages: 222

October 1998 | Product Number: I46720 | Price: \$105.00

## Publ 4676

### Arsenic: Chemistry, Fate, Toxicity, and Wastewater Treatment Options

Arsenic is a naturally occurring element in rocks, soils, water, sediments, and biological tissues. It is also present in fossil fuels. Arsenic in the environment has both anthropogenic and natural sources, and certain anthropogenic sources have caused localized adverse effects on ecological systems and human health. Based on extensive review of the literature, this monograph is intended to serve as a reference volume on the sources of arsenic in the environment, the chemistry and fate of arsenic compounds, biomedical effects, the toxicity of arsenic to aquatic and terrestrial species, wastewater treatment options, and regulatory standards for arsenic in the environment. Pages: 196

October 1998 | Product Number: I46760 | Price: \$105.00

## Publ 4688

### Temporary Treatment Options for Petroleum Distribution Terminal Wastewaters

Provides guidance to terminal operators and engineers in evaluating mobile treatment systems for wastewater generated at petroleum distribution terminals. Some of the variables that must be considered include the characteristics of the wastewater, the permitting process, and contractor experience. This document provides sufficient information to guide an operator/engineer through evaluation of mobile treatment systems, including problem definition, treatment technology selection, contractor selection, and implementation. Pages: 73

November 1999 | Product Number: I46880 | Price: \$133.00

## Publ 4694

### Laboratory Analysis of Petroleum Industry Wastewaters

Assists in arranging for and understanding laboratory analysis of petroleum industry wastewaters. Designed for environmental coordinators, managers, corporate staff, and others who must address environmental compliance reporting and regulatory issues. It is also useful for field personnel responsible for obtaining wastewater sample analyses to fulfill environmental regulatory requirements. Guidance and information are provided for setting data quality objectives; planning analyses; selecting a laboratory; and reviewing laboratory reports, detection and quantification limits, quality assurance/quality control practices, method references, method-defined analytes, and statistical calculations. Examples of case studies, laboratory reports, and data calculations are given throughout the manual. Checklists are provided to help users understand, plan, and review laboratory data. Pages: 175

December 1999 | Product Number: I46940 | Price: \$133.00

## Publ 4695

### Understanding and Preparing Applications for Petroleum Facility NPDES Discharge Permits

Assists member companies and others in preparing applications and negotiating with permit authorities for National Pollutant Discharge Elimination System (NPDES) permits for wastewater discharges. The manual is intended to help permittees and permit applicants to understand the permit process from application to final permit and to provide tools and strategies for assuring that the permit is fair and properly implements the applicable regulations. Much of the information in this manual is based on practical experience with many NPDES permits and applications. Examples and case histories are provided to help the user understand the permit application process. Pages: 220

December 1999 | Product Number: I46950 | Price: \$140.00

## Publ 4698

### A Review of Technologies to Measure the Oil and Grease Content of Produced Water from Offshore Oil and Gas Production Operations

Identifies and evaluates practical alternative methods for routine monitoring of oil and grease in produced waters. Traditional monitoring methods relied on Freon-113r extraction of oil and grease; however, owing to the phase-out of Freon-113r these methods can no longer be used, and new methods

must be sought. This study evaluates two infrared detection methods and one fluorescence detection method for identifying and measuring oil and grease in produced waters. Performance information and the correlation of analytical results with the U.S. Environmental Protection Agency's hexane extraction method, Method 1664, are provided. Pages: 138

November 1999 | Product Number: I46980 | Price: \$133.00

## Publ 4717

### Predictors of Water-Soluble Organics (WSOs) in Produced Water—A Literature Review

Reviews the scientific literature on the identity and physical/chemical characteristics of the WSOs in produced water in relation to characteristics of fossil fuels and their reservoirs. Pages: 24

March 2002 | Product Number: I47170 | Price: \$80.00

## Publ 4721

### Analytical Detection and Quantification Limits: Survey of State and Federal Approaches

The purpose of this review was to determine the analytical detection and quantification limit policies of various state agencies. Of particular interest were policies for setting wastewater discharge permit limits at or below detection or quantification limits, for determining compliance with such limits, and for using alternative approaches to determining detection or quantification limits. Although the main focus of this review was on state policies involving water quality issues, included in the review were the policies of programs in other environmental areas as well as in federal regulations and statutes. Pages: 129

June 2002 | Product Number: I47210 | Price: \$151.00

## Publ 4736

### Identification of Key Assumptions and Models for the Development of Total Maximum Daily Loads

Provides the reader with an understanding of the use of models in the development and implementation of total maximum daily loading (TMDL) studies.

The report focuses on the types of models used for TMDLs, the key assumptions underlying the models, how models are selected for specific surface waters and impairments, the data required to apply the models to a specific surface water and impairment, and how the predictive capability of the models is assessed. Pages: 64

November 2006 | Product Number: I47360 | Price: \$161.00

## Publ 4750

### Cyanide Discharges in the Petroleum Industry: Sources and Analysis

Because both industrial and municipal dischargers have been issued National Pollutant Discharge Elimination System permits with low (5–20 µg/L) effluent limits for cyanide, there has been considerable interest in the reliability of the available test methods at these low concentrations. This report provides guidance on the measurement, as well as the presence and environmental fate, of cyanide compounds and related chemical species in petroleum industry wastewater effluents. Pages: 42

November 2008 | Product Number: I47500 | Price: \$102.00

## Publ 4751

### Evaluation of Water Quality Translators for Mercury

Discusses the technical issues and constraints associated with translation of a mercury fish tissue concentration into a water quality criterion, in the use and implementation of the U.S. Environmental Protection Agency's fish-tissue-based criterion for methylmercury. The report focuses on available analytical methods for evaluating mercury in fish and water; proposed methods for translating a fish tissue concentration for mercury into a concentration in water; and implementation of the mercury criterion in the development of total maximum daily loads and water quality-based effluent limits. Pages: 37

1st Edition | December 2005 | Product Number: I47510 | Price: \$76.00

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### Publ 4756

#### Interim Permitting Manual—Navigating NPDES Permit Issues on Impaired Waters

Addresses many water quality standards issues that facilities may encounter, including existing uses, use attainability analyses to revise designated uses, fish consumption advisories, whole effluent toxicity criteria, and sediment criteria. The manual will provide guidance on a number of listing issues, including listings due to violations of narrative criteria and fish consumption advisories, delisting, listing waters that are impaired but do not need a total maximum daily loading (TMDL) because they are expected to meet standards through other means, and challenging an erroneous listing determination.

The second part of this manual will discuss permitting discharges to impaired waters during the interim period before TMDLs are developed. The manual will describe the development of water quality-based effluent limitations on impaired waters and will also discuss a number of issues for affected facilities to consider during the permitting process, including timing (when the permit should be issued), watershed permitting, verifying the impairment determination before the permit is issued, other controls available to bring the water into attainment, reasonable potential calculations, voluntary reduction measures, nonnumeric effluent limitations, and calculating numeric effluent limitations. Pages: 41

November 2006 | Product Number: I47560 | Price: \$82.00

### Publ 4782

#### Petroleum Refining Industry Contribution to Nationwide Surface Water Nutrient Loadings

This analysis was commissioned by API to provide member companies and the public with a better understanding of the water quality problems associated with nutrient discharges to the nation's surface waters, the current federal and state regulatory responses to nutrient-related water quality problems, the scientific and implementation challenges of nutrient controls, and the petroleum refining industry's relative contribution to nationwide nutrient discharges to surface waters. This study is based on using available published data on nutrient enrichment of U.S. surface waters; the U.S. Environmental Protection Agency (EPA) and state nutrient control guidance, policy, and water quality standards; prior analysis performed for API by a third-party consultant; petroleum refinery effluent quality data from the EPA Integrated Compliance Information System/National Pollutant Discharge Elimination System (ICIS-NPDES); and permit data collected from the files of the Texas Commission on Environmental Quality (TCEQ). Pages: 35

August 2016 | Product Number: I47820 | Price: \$81.00

### Publ 4783

#### Water Management and Stewardship in Midstream, Downstream, and Delivery Operations in the Oil and Gas Industry

This report uses the oil and gas (petroleum) life cycle as an organizing framework for explanation and discussion. The scope of this study is focused on the midstream, downstream, and delivery components of the oil and gas life cycle. Upstream components of the life cycle will be addressed in a future report. This study is intended to inform stakeholders about how the oil and gas industry uses water in the midstream, downstream, and delivery phases of the petroleum life cycle and the various industry-led and regulatory practices employed to conserve and protect water resources. Pages: 46

December 2016 | Product Number: D47830 | Price: \$81.00

## BIOMONITORING

### TR 402

#### Toxicity to Freshwater Alga, *Selenastrum apicornutum*

Describes a study conducted to assess the effect of tert-amyl methyl ether on the growth of the freshwater alga, *Selenastrum apicornutum*. At 24-hour intervals, cell counts and observations of the health of the cells were recorded. EC10, EC50, and EC90 values (the concentration of test material that reduced cell densities by 10 %, 50 %, and 90 %, respectively) were calculated based on cell density 72 and 96 hours after exposure. Pages: 76

February 1995 | Product Number: I00402 | Price: \$67.00

### TR 406

#### TAME—Acute Toxicity to Daphnids Under Flow-Through Conditions

Describes the measurement of acute toxicity of tertiary amyl methyl ether (TAME) to daphnids under flow-through conditions. Nominal concentrations of TAME—690, 410, 250, 150, and 89 mg A.I./L—were maintained in exposure vessels and mean exposure concentrations calculated. Biological observations and physical characteristics were recorded at test initiation and at 3, 6, 24, and 48 hours. Pages: 76

February 1995 | Product Number: I00406 | Price: \$67.00

### TR 407

#### TAME—Acute Toxicity to Mysid Shrimp (*Mysidopsis bahia*) Under Static Renewal Conditions

Describes the measurement of acute toxicity of tertiary amyl methyl ether (TAME) to mysid shrimp under static renewal conditions. Nominal concentrations of TAME—1.6, 4.0, 7.3, 15, 30, and 60 mg A.I./L—were maintained by renewing solutions at 24, 48, and 72 hours of exposure. Observations were recorded at test initiation and every 24 hours until the test was terminated. Pages: 84

February 1995 | Product Number: I00407 | Price: \$67.00

### TR 408

#### TAME—Acute Toxicity to Rainbow Trout Under Flow-Through Conditions

Describes the measurement of acute toxicity of tertiary amyl methyl ether (TAME) to rainbow trout under flow-through conditions. During the test, nominal concentrations of TAME—950, 570, 340, 210, and 120 mg A.I./L—were maintained and mean exposure concentrations calculated. Biological observations and physical characteristics were recorded at test initiation and every 24 hours thereafter until test termination. Pages: 80

February 1995 | Product Number: I00408 | Price: \$68.00

### Publ 4610

#### Critical Review of Draft EPA Guidance on Assessment and Control of Bioconcentratable Contaminants in Surface Waters

Reviews the U. S. Environmental Protection Agency's proposed methods and underlying assumptions for assessing bioconcentratable contaminants in petroleum industry effluents. It focuses on the effluent option and its application to National Pollutant Discharge Elimination System (NPDES)-permitted discharges from oil refineries, petroleum product marketing terminals, and oil/gas production platforms. The review also includes a general evaluation of the suitability of the tissue residue option for evaluating oil industry effluents. Pages: 134

January 1995 | Product Number: I46100 | Price: \$76.00

## Publ 4656

### Bioaccumulation: How Chemicals Move from the Water into Fish and Other Aquatic Organisms

Provides an intermediate-level primer on the accumulation of chemicals by aquatic organisms with emphasis on polycyclic aromatic hydrocarbons. Key factors governing bioaccumulation are described to enhance understanding of this complex phenomenon. Approaches for assessing the bioaccumulation potential of chemicals are examined and an evaluation of each method's advantages and shortcomings is offered. Pages: 54

May 1997 | Product Number: I46560 | Price: \$95.00

## Publ 4666

### The Toxicity of Common Ions to Freshwater and Marine Organisms

Whole effluent toxicity (WET) tests have become a common tool in the evaluation of effluent for discharge acceptability. Recent investigations have indicated that deficiencies or excesses of "common" ions (inorganic ions that are nearly always present in most aquatic systems at nontoxic concentrations) can cause significant acute or chronic toxicity in WET tests. This report presents the results of a review of toxicological and physiological data on inorganic ions that have been implicated in causing significant toxicity—bicarbonate, borate, bromide, calcium, chloride, fluoride, magnesium, potassium, strontium, and sulfate. Pages: 114

April 1999 | Product Number: I46660 | Price: \$105.00

## Publ 4701

### Bioaccumulation: An Evaluation of Federal and State Regulatory Initiatives

August 2000 | Product Number: I47010 | Price: \$96.00

## EFFLUENTS: EXPLORATION AND PRODUCTION

### DR 351

#### Proceedings: Workshop to Identify Promising Technologies for the Treatment of Produced Water Toxicity

Presents the discussions, conclusions and recommendations of an API workshop held in October 1994 to identify technologies that could potentially be used for the treatment of produced water toxicity offshore. Background information on the candidate technologies; information on produced water toxicity limitations, characteristics, and composition; results of toxicity identification evaluations; and a discussion of the engineering restrictions imposed by offshore platforms are included. Pages: 122

June 1996 | Product Number: I00351 | Price: \$79.00

## Publ 4611

### Interlaboratory Study of EPA Methods 1662, 1654A and 1663 for the Determination of Diesel, Mineral and Crude Oils in Drilling Muds from Offshore and Gas Industry Discharges

Describes an interlaboratory round-robin study to validate the tiered approach of the U.S. Environmental Protection Agency's three methods—1662, 1654A, and 1663—for monitoring diesel oil in drilling muds. Various extraction methods were evaluated and analytical measurement techniques were tested for measuring diesel oil. Pages: 106

April 1995 | Product Number: I46110 | Price: \$79.00

## Publ 4633

### Barium in Produced Water: Fate and Effects in the Marine Environment

Provides a summary of what is currently known about the physical and chemical behavior of barium in produced water and in the ocean. It discusses the factors that influence the rate of precipitation of barium as barite. The toxicity of barium to marine and freshwater organisms and humans is discussed in relation to the concentrations and forms in which it occurs in aquatic environments. Pages: 68

September 1995 | Product Number: I46330 | Price: \$65.00

## Publ 4641

### Summary of Produced Water Toxicity Identification Evaluation Research

Summarizes the results of a three-part study to evaluate the ability of U.S. Environmental Protection Agency proposed toxicity identification evaluations (TIEs) to determine the potential toxicants in produced water from oil and gas production operations in various locations. Factors affecting the results of the TIEs were identified as well as potential toxicants. Suggestions for improving TIE procedures are included. Pages: 102

June 1996 | Product Number: I46410 | Price: \$96.00

## Publ 4702

### Technologies to Reduce Oil and Grease Content of Well Treatment, Well Completion, and Workover Fluids for Overboard Disposal

Technologies to reduce oil and grease content of well treatment, well completion, and workover fluids for overboard disposal. Pages: 54

March 2001 | Product Number: I47020 | Price: \$133.00

## EFFLUENTS: MARKETING

## Publ 4602

### Minimization, Handling, Treatment and Disposal of Petroleum Products Terminal Wastewaters

Intended to be a basic guide and information resource for all wastewater operations at petroleum product terminals. It includes the regulatory framework for wastewater issues, a detailed description of the sources of terminal wastewater and associated contaminants as well as guidance on means for analyzing the wastewater situation at a terminal, for minimizing wastewater flow contamination, and for wastewater handling and disposal. Pages: 120

September 1994 | Product Number: I46020 | Price: \$141.00

## Publ 4665

### Analysis and Reduction of Toxicity in Biologically Treated Petroleum Product Terminal Tank Bottoms Water

Objectives of this study were to measure toxicity in biologically treated petroleum product terminal tank bottoms waters, identify the chemical constituents causing that toxicity, identify treatment options, and measure the effectiveness of the treatment techniques in removing the constituents and reducing toxicity. Nine gasoline and two diesel tank bottoms water samples were collected from petroleum product terminals at various geographical locations. The samples were normalized to a fixed chemical oxygen demand, then subjected to biological treatment. Treated samples were tested for acute toxicity in 24-hour exposure tests using *Mysidopsis bahia* and for chronic toxicity in 7-day static renewal toxicity tests also using *Mysidopsis bahia*. Biological treatment was observed to effectively remove metals but produced highly variable degrees of chemical oxygen demand, biochemical oxygen demand, and total organic carbon. Pages: 84

April 1998 | Product Number: I46650 | Price: \$86.00

## Publ 4673

### Impacts of Petroleum Product Marketing Terminals on the Aquatic Environment

Examines the potential impact of petroleum product marketing terminal (PPMT) wastewater discharges to aquatic environments to ascertain if there is a need for more stringent regulations. Wastewater discharges by PPMTs were evaluated, the constituents normally present in these waste streams were identified, and their possible aquatic impacts were investigated. It was determined that PPMT wastewater discharges pose little environmental risk; therefore, stricter regulations for PPMT dischargers are unwarranted. Pages: 52

April 1999 | Product Number: I46730 | Price: \$105.00

### Publ 4690

#### A Guide for the Use of Semipermeable Membrane Devices (SPMDs) as Samplers of Waterborne Hydrophobic Organic Contaminants

Provides basic information and guidance on SPMD technology and its appropriate use in aquatic systems. Emphasis is given to methods, applications, and theoretical issues related to the use of SPMDs for monitoring priority pollutant polycyclic aromatic hydrocarbons, but other classes of hydrophobic organic contaminants are covered as well. This document includes key information on SPMD background, rationale, theory and modeling, technical considerations, supplier/source, chemical analysis and quality control, bioassay screening, comparability to biomonitors, examples of use, and sources of addition information. However, covering all potential environmental applications (e.g. vapor phase sampling) and relevant research results is beyond the scope of this work. Finally, use of this guide does not obviate the need for proper review and oversight procedures prior to the initiation of a project with SPMDs. Pages: 172

March 2002 | Product Number: I46900 | Price: \$143.00

### Publ 4700

#### Primer for Evaluating Ecological Risk at Petroleum Release Sites

Designed to help site and facility managers acting as site investigators decide how and to what extent to address ecological risks that may result from a release of petroleum products. The focus is on "downstream" operations related to transportation, distribution, or marketing of petroleum products, but the general principles may be adapted to other parts of the industry as well. The ecological risk assessment process is briefly described, and guidance is given about the preliminary investigation to assess the possible nature and extent of risk. This information is an initial part of a tiered decision-making process used to determine the depth and breadth of the site investigation. Pages: 52

May 2001 | Product Number: I47000 | Price: \$112.00

## EFFLUENTS: REFINING

### DR 148

#### Identification of Organic Toxicants in Treated Refinery Effluents

Effluents from five oil refineries were examined for the presence of chronic toxicity caused by nonpolar, organic compounds. U.S. Environmental Protection Agency (EPA) guidelines for Phase I toxicity characterization procedures were used. The refinery effluent containing the most nonpolar toxicity was selected for more detailed analyses and identification of the nonpolar toxicants using Phase II procedures. Extraction and elution conditions were modified to increase chronic toxicity recovery and also reduce the complexity of the nonpolar organic effluent fraction containing toxicity. Results showed that simple modifications of EPA guidance for C<sub>18</sub> solid phase extraction procedures, combined with proper toxicity testing conditions, successfully tracked and isolated toxicity in an effluent fraction. Findings also indicated that sources of refinery effluent toxicants were a phenol associated with a jet fuel additive, and two brominated organics believed to be reaction products of cooling tower water treatment chemicals, rather than from crude oil constituents. Pages: 64

December 1997 | Product Number: I00148 | Price: \$67.00

### Publ 352

#### Management of Residual Materials: 1997 Petroleum Refining Performance

This report is the ninth in a series of reports presenting the results of the API Annual Refining Residual Survey. Included in the report are detailed assessments of generated quantities and management practices for 14 residual streams representing approximately 80 % of all residuals managed at U.S. refineries. Prior to the 1997 survey, the management techniques had included recycling to the cat cracker, which referred to routing a residual to a catalytic cracking unit. Further study revealed that the quantity for residuals actually recycled to a cracking unit was very small—perhaps nonexistent—and was therefore deleted from the 1997 survey. Data for prior years were adjusted. Industry trend toward increased recycling of residuals has continued. Pages: 108

September 1999 | Product Number: J35200 | Price: \$133.00

## OIL SPILLS

### Swift Water Spill Response Guide ■

Contains a set of operational tools and references to assist in the response to spilled oils on inland swift waters, which are waters traveling at speeds greater than 2.5 mph. Pages: 41

1st Edition | April 2021 | Product Number: GD1605

You may download a PDF of this document from <https://www.oilspillprevention.org>

### Bull D16

#### Suggested Procedure for Development of a Spill Prevention Control and Countermeasure Plan

Assists the petroleum industry in understanding the SPCC regulation in light of the latest rule (40 CFR Part 112) and to offer guidance for developing SPCC Plans wherever they are needed. Included is a template for developing SPCC plans (i.e. onshore excluding production; onshore oil production, oil drilling or workover; or offshore oil drilling, production, or workover) in accordance with the regulation and guidance, instruction, and clarification for completing each section of the template. The purpose of this rulemaking was to establish procedures, methods, and equipment to prevent and contain discharges of oil from non-transportation-related onshore and offshore facilities, thus preventing pollution of navigable waters of the United States. The development of this bulletin was commissioned by API and performed by O'Brien's Response Management Inc. The purchase of D16 includes; Bulletin D16, the Plan Template, and a CD-ROM with the Microsoft® Word version of the Plan Template.

5th Edition | April 2011 | Product Number: GD1605

Price: \$279.00 | Template Only: Price: \$103.00

### DR 145

#### Identification of Oils that Produce Non-Buoyant In-Situ Burning Residues and Methods for Their Recovery

There is an environmental concern about the possibility of sinking residues from in-situ burns (ISBs), leading to the potential for damage to the aquatic bottom zone. The objective of the study presented in this publication was to start the process of establishing operational tools and procedures for dealing with such nonbuoyant burn residues. There were two tasks: develop protocols for identifying ISB residues likely to sink, and evaluate options for dealing with those residues in the field. Pages: 62

February 2002 | Product Number: IDR1450 | Price: \$102.00

### TR 425

#### Options for Minimizing Environmental Impacts of Inland Spill Response

The purpose of this guide is to support contingency planners and emergency responders in evaluating response techniques and selecting those techniques that will most effectively prevent or minimize adverse environmental impacts from inland spills. In this guide, inland spills are defined as those that affect terrestrial and freshwater habitats, whereas coastal and marine spills affect water bodies and habitats that are under the influence of tides and marine waters. Inland spills have unique characteristics and behavior, may have the potential to pose greater risks to the public, and often necessitate more intensive removal methods, compared to coastal and marine spills. Therefore, choosing the best response options and implementing these in the most environmentally appropriate manner can minimize adverse impacts of a response. Pages: 102

October 2016 | Product Number: I42500 | For a free copy of this document, please visit <http://www.oilspillprevention.org/~media/Oil-Spill-Prevention/spillprevention/r-and-d/inland/options-for-minimizing-e20161228t134857.pdf>

## TR 1149-3

### Canine Oil Detection: Field Trials Report

Field trials were undertaken in June 2015 to evaluate the applicability of canine oil detection teams (referred to as K9-SCAT) to support assessment surveys to locate and delineate the horizontal extent of subsurface oil for shoreline and inland spills response operations. The study is part of the American Petroleum Institute (API) Joint Industry Task Force (JITF) Shoreline Protection & Clean-Up Technical Working Group within the Oil Spill Preparedness and Response program. Pages: 59

June 2016 | Product Number: I114930 | For a free copy of this document, please visit <http://www.oilspillprevention.org/~media/Oil-Spill-Prevention/spillprevention/r-and-d/shoreline-protection/canine-oil-detection-field-trials-report.pdf>

## TR 1149-4

### Canine Oil Detection (K9-SCAT) Guidelines

The purpose of these Guidelines is to provide information on the potential for detection canines to support a shoreline or inland oiled area assessment (SCAT) program. This information includes how oil detection dogs use their sense of smell and what they can do to locate and delineate surface and subsurface oil, the current state of knowledge regarding situations and types of support surveys that a K9-SCAT team can undertake as part of a SCAT program, and how to plan and design a K9-SCAT survey and collect the appropriate data to document that mission. Pages: 81

July 2016 | Product Number: I114940 | For a free copy of this document, please visit <http://www.oilspillprevention.org/~media/Oil-Spill-Prevention/spillprevention/r-and-d/shoreline-protection/canine-oil-detection-k9-scat-guidelines.pdf>

## TR 1151-4

### Mechanical Treatment of Sand Beaches Historical Library Report

This report describes the Mechanical Treatment Library, which represents part of a multiphase study conducted by the American Petroleum Institute to improve the mechanized treatment of spilled oil on sand beaches. Pages: 5

June 2016 | Product Number: I115140 | For a free copy of this document, please visit <http://www.oilspillprevention.org/~media/Oil-Spill-Prevention/spillprevention/r-and-d/shoreline-protection/mechanical-treatment-of-sand-beaches-his.pdf>

## TR 1152

### Industry Recommended Subsea Dispersant Monitoring Plan

Describes a proposed method for monitoring the efficacy of subsea dispersant injection (SSDI) to inform operational oil spill response decision-making by the Unified Command (UC). It is intended to be used as a model that can be modified to meet the needs of a specific incident. This plan is intended to complement the Subsea Dispersant Operations Plan, and it is imperative that effective communications be maintained between the organizational units that implement both. Pages: 5

November 2020 | Product Number: I115201 | For a free copy of this document, please visit <http://oilspillprevention.org/~media/Oil-Spill-Prevention/spillprevention/r-and-d/dispersants/api-1152-e1-industry-recommended-subsea.pdf>

## TR 1153-1

### Tidal Inlet Protection Strategies (TIPS): Phase 1—Final Report

This report presents an approach for the development of Tidal Inlet Protective Strategies (TIPS) that are based on knowledge of the physical systems involved and feasibility of tactical options. Strategies and tactics identified using the results of this study are subject to real-time conditions and pre-spill planned strategies should be re-evaluated during a response. The report considers potential tactics at a level appropriate for strategic planning, but is not intended to provide instructions for the implementation of those tactics.

The guide is intended to be used by strategic planners and responders, and may be appropriate for inclusion in an Area Contingency Plan (ACP) or a Geographic Response Plan (GRP). Pages: 53

January 2014 | Product Number: I115310 | For a free copy of this document, please visit <http://www.oilspillprevention.org/~media/oil-spill-prevention/spillprevention/r-and-d/shoreline-protection/tidal-inlet-protection-strategies-final.pdf>

## TR 1153-2

### Tidal Inlet Protection Strategies (TIPS) Field Guide

This field guide is intended to be used by strategic planners and responders with the purposes of explaining the physical dynamics and characterization of a tidal inlet, identifying oil transport and operational constraints and opportunities for tidal inlet protection, identifying potential strategies for protection, and providing considerations and checklists for tidal inlet protection. Pages: 27

January 2016 | Product Number: I115320 | For a free copy of this document, please visit <http://www.oilspillprevention.org/~media/Oil-Spill-Prevention/spillprevention/r-and-d/shoreline-protection/tips-field-guide-final.pdf>

## TR 1154-1

### Sunken Oil Detection and Recovery

The purpose of this report is to identify and document current best practices and proven technologies possessing the potential to more effectively (1) detect, delineate, and characterize, (2) contain, and (3) recover sunken oil, defined as the accumulation of bulk oil on the bottom of a water body; and recommend research and development for the highest potential new technologies. Pages: 116

February 2016 | Product Number: I115410 | For a free copy of this document, please visit <http://www.oilspillprevention.org/~media/Oil-Spill-Prevention/spillprevention/r-and-d/inland/sunken-oil-technical-report-pp2.pdf>

## TR 1154-2

### Sunken Oil Detection and Recovery Operational Guide

This operational guide is a companion document to the technical report, *Sunken Oil Detection and Recovery*, which identifies and documents current best practices and alternative technologies possessing the potential to more effectively detect, contain, and recover sunken oil, defined as the accumulation of bulk oil on the bottom of a water body. The technical report includes summaries and lessons learned for 36 case studies of oil spills where a significant amount of the oil sank. For each technology, it includes a detailed description of the method, advantages and disadvantages, and summary tables—the kinds of information needed to select the most effective approaches to sunken oil detection and recovery. Please refer to the technical report for supporting information not in this guide. Pages: 28

February 2016 | Product Number: I115420 | For a free copy of this document, please visit <http://www.oilspillprevention.org/~media/Oil-Spill-Prevention/spillprevention/r-and-d/inland/sunken-oil-ops-guide.pdf>

## TR 1155-1

### Shoreline In Situ Treatment (Sediment Mixing and Relocation) Library Report

The American Petroleum Institute (API) completed a study to improve the knowledge and understanding of shoreline sediment mixing and relocation techniques. The objective of the study is to provide the following tools: (1) Shoreline In Situ Treatment Library: an online library containing academic, scientific, technical, and operational literature, including links to electronic documents, where available; (2) Shoreline In Situ Treatment Fact Sheet: a non-academic educational guide, providing an overview of in situ treatment and Oil Particle Aggregate (OPA) formation for training and planning (TR 1154-2); and (3) Shoreline In Situ Treatment Job Aid: a non-academic operations tool for use during a response by Operations, the Environmental

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Unit (EU), and Shoreline Cleanup Assessment Technique (SCAT) teams for in situ treatment planning and operations, and to demonstrate to agencies how effectiveness and effects would be monitored (TR 1154-3). This report describes the first item of this program, the Shoreline In Situ Treatment Library, which is intended to locate and make available documents relevant to shoreline in situ (sediment mixing and relocation) treatment techniques. The library is provided in simple MS Excel spreadsheet and MS Access database formats, which are described in this report. Pages: 5

June 2016 | Product Number: I115510 | For a free copy of this document, please visit [www.oilspillprevention.org/~media/Oil-Spill-Prevention/spillprevention/r-and-d/shoreline-protection/shoreline-in-situ-treatment-report.pdf](http://www.oilspillprevention.org/~media/Oil-Spill-Prevention/spillprevention/r-and-d/shoreline-protection/shoreline-in-situ-treatment-report.pdf)

### TR 1155-2

#### Shoreline In Situ Treatment (Sediment Mixing and Relocation) Fact Sheet

This fact sheet explains the use of shoreline in situ techniques, including wet and dry mixing (also known as tilling or aeration) and sediment relocation (also known as surf washing or berm relocation) for oil spill cleanup. Burning is outside the scope of this fact sheet. Pages: 20

June 2016 | Product Number: I115520 | For a free copy of this document, please visit <http://www.oilspillprevention.org/~media/Oil-Spill-Prevention/spillprevention/r-and-d/shoreline-protection/shoreline-in-situ-treatment-fact-sheet.pdf>

### TR 1155-3

#### Shoreline In Situ Treatment (Sediment Mixing and Relocation) Job Aid

The purpose of this job aid is to provide:

- a non-technical tool for planning and conducting shoreline in situ treatment for use by Shoreline Cleanup Assessment Technique (SCAT) teams as they develop shoreline treatment recommendations (STRs); Environmental Unit personnel and planners during the decision process; and Shoreline Operations to implement the treatment tactics.
- Decision guides and checklists to assist in understanding the advantages and consequences of shoreline in situ treatment options, and the decision, review, and approval process for shoreline in situ treatment.

This job aid provides guidance for the planning and implementation of in situ techniques on shorelines and rivers, including wet and dry mixing (also known as tilling or aeration) and sediment relocation (also known as surf washing or berm relocation) for oil spill cleanup. Burning on the shoreline is outside the scope of this job aid. Pages: 26

June 2016 | Product Number: I115530 | For a free copy of this document, please visit <http://www.oilspillprevention.org/~media/Oil-Spill-Prevention/spillprevention/r-and-d/shoreline-protection/shoreline-in-situ-treatment-job-aid.pdf>

### TR 1253

#### API Selection and Training Guidelines for In Situ Burning Personnel

This guidance is intended to be international in its scope with United States regulatory requirements used as exemplars that may be replaced by applicable jurisdictional requirements. References to the Hazardous Waste Operations and Emergency Response (HAZWOPER) regulation (29 CFR 1910.120) and the Incident Command System (ICS) may be replaced by local jurisdictional requirements outside of the United States. In the absence of applicable local requirements, HAZWOPER and ICS should be considered as a recognized standard of practice. This guidance is not intended to instruct the reader on how to conduct an in situ burn, or overlap with either of the in situ burn manuals (TR 1251 and TR 1252). The purpose of this guidance is to provide a systematic approach to assist users in the selection of responder qualifications and the training requirements for responders to in situ burning of spilled oil in the open water environment, ice conditions on water bodies, and the inland environment, including spills affecting waterways and those lakes not considered open water. It is not intended to describe when to use in situ burning. Pages: 84

October 2016 | Product Number: I12530 | For a free copy of this document, please visit <http://www.oilspillprevention.org/~media/Oil-Spill-Prevention/spillprevention/r-and-d/in-situ-burning/training-guide-for-isb-personnel.pdf>

[Spill-Prevention/spillprevention/r-and-d/in-situ-burning/training-guide-for-isb-personnel.pdf](http://www.oilspillprevention.org/~media/Oil-Spill-Prevention/spillprevention/r-and-d/in-situ-burning/training-guide-for-isb-personnel.pdf)

### TR 1254

#### In-Situ Burning Guidance for Safety Officers and Safety and Health Professionals

Supports the incident Safety Officer (SOFR) and other safety and health professionals involved or having responsibilities in the incident response during oil spills where the strategy of controlled in-situ burning (ISB) can be used. Typically, oil spill response operations, including those involving ISB, are conducted using the organization structure prescribed by the National Incident Management System Incident Command Systems (NIMS/ICS) (DHS, 2009). The SOFR is position appointed as part of the Command Staff. As stated in NIMS/ICS guidance, the SOFR's function "is to develop and recommend measures for ensuring personnel safety and to assess and/or anticipate hazardous and unsafe situations." (DHS, 2009). This would include operations relating to ISB if this response action is selected for use during an oil spill. Pages: 114

January 2018 | Product Number: I12541 | For a free copy of this document, please visit <http://www.oilspillprevention.org/~media/Oil-Spill-Prevention/spillprevention/r-and-d/in-situ-burning/in-situ-burning-guidance-for-safety-offi.pdf>

### TR 1256

#### In Situ Burning: A Decision Maker's Guide

This report is intended to describe the use of and requirements for in situ burning (ISB) as an effective response technology for oil spills on land (including wetlands), on water, or in ice and snow. It was developed to serve as a reference for oil spill response policy makers and decision makers (government, industry, and other stakeholders). This report discusses requirements for ISB and includes a summary of oil chemistry, behavior, and weathering, which are important factors when making decisions to use ISB. Further, it allows decision makers to better understand the anticipated benefits and limitations to be considered when using this technology for an oil spill. Pages: 74

October 2016 | Product Number: I12560 | For a free copy of this document, please visit <http://www.oilspillprevention.org/~media/Oil-Spill-Prevention/spillprevention/r-and-d/in-situ-burning/api-technical-report-1256-in-situ-burnin.pdf>

### Publ 4558

#### Options for Minimizing Environmental Impacts of Freshwater Spill Responses

Developed for contingency planners and field responders, this guide provides information on 29 response methods and classifies their relative environmental impact for combinations of 4 oil types and 12 freshwater environments and habitats. Spill topics of concern in freshwater settings are discussed, including public health, conditions under which oil might sink in freshwater, oil behavior in ice conditions, permafrost, and firefighting foam use. Pages: 146

February 1995 | Product Number: I45580 | Price: \$95.00

### Publ 4640

#### Petroleum in the Freshwater Environment: An Annotated Bibliography, 1946-1993

The growing concern for petroleum contamination in freshwater ecosystems led API to generate an annotated bibliography to serve as a valuable resource of existing literature on petroleum and its impact on the freshwater environment. It cites literature from 1946 through 1993 on the impact of petroleum products and oil spill cleanup agents on the biota of freshwater ecosystems, on the chemistry and fate of petroleum and cleanup agents in freshwater, and on the review of cleanup methods in freshwater systems. The electronic companion infobase has been prepared in two versions to enhance the value of the annotations: (1) the VIP editable version of the infobase allows the user to add new references, make personal annotations (e.g. bookmarks, notes, highlights, and pop-ups), and delete unwanted



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references, and (2) the standard noneditable version is read-only. Both versions are completely searchable; each word in the bibliography is indexed. Pages: 224

March 1997

(noneditable) Product Number: I46400 | Price: \$66.00

(VIP editable) Product Number: I46401 | Price: \$81.00

### Publ 4649

#### The Use of Chemical Countermeasures Product Data for Oil Spill Planning and Response, Volumes I and II

Addresses many of the issues related to potential uses of chemical countermeasure products in mitigating the environmental impacts of spilled oil. Volume I summarizes workshop deliberations and presents consensus recommendations from the sessions on environmental effects, effectiveness, and decision making. Volume II contains 13 background papers for workshop participants on various scientific and operational topics, e.g. aquatic toxicity, oil weathering, and decision making. Pages: 380

April 1995 | Product Number: I46490 | Price: \$62.00

### Publ 4675

#### Fate and Environmental Effects of Oil Spills in Freshwater Environments

Provides basic information necessary for the formulation of spill response strategies that are tailored to the specific chemical, physical, and ecological constraints of a given spill situation. It summarizes environmental effects from inland oil spills into fresh surface waters. It provides technical information for persons responsible for inland spill response and cleanup, for researchers, and for others dealing with protection of the environment from possible oil spill hazards. This research identifies, describes, and compares the behavior, fate, and ecological implications of crude oil and petroleum products in inland waters. Pages: 160

December 1999 | Product Number: I46750 | Price: \$154.00

### Publ 4684

#### Compilation and Review of Data on the Environmental Effects of In-Situ Burning of Inland and Upland Oil Spills

Burning of spilled oil provides a relatively easy, low-cost cleanup method by reducing removal, transportation, and disposal costs as well as reducing the time required for cleanup. This study was commissioned by API to identify those environmental conditions under which burning should be considered as a response option for oil spilled in inland and upland habitats. This report presents a summary of the case histories and lessons learned from previous uses of burning in inland environments, with and without oil. While some information on human health and safety is included, the focus of this report is on the environmental fate and effects of in-situ burning. Pages: 198

March 1999 | Product Number: I46840 | Price: \$128.00

### Publ 4689

#### Chemical Human Health Hazards Associated with Oil Spill Response

Contains an overview of human health hazards that could be encountered by personnel involved with spills or leaks of petroleum products. The discussion includes potential risks of basic components and products of concern. Environmental factors that may affect exposure and a brief summary of other exposure considerations are also included. Pages: 51

August 2001 | Product Number: I46890 | Price: \$90.00

### Publ 4691

#### Fate of Spilled Oil in Marine Waters: Where Does It Go? What Does It Do? How Do Dispersants Affect It?

This is the first of three short summary publications commissioned for preparation by API for oil spill response decision-makers to provide concise easy-to-use information on understanding the fate of spilled oil and dispersants, their use, effectiveness, and effects. When making decisions regarding dispersant use, or any other oil spill response countermeasure, it is important to have a clear understanding of the overall fate of the oil entering the environment. With this publication you will receive a complete yet

concise review of oil chemistry and oil weathering. Also provided is information on how to interpret dispersant information more effectively and how dispersants alter or affect the weathering processes of oil. Pages: 30

March 1999 | Product Number: I46910 | Price: Free\*

### Publ 4692

#### A Decision-Maker's Guide to Dispersants: A Review of the Theory and Operational Requirements

This is the second of three short summary publications commissioned for preparation by the API for oil spill response decision-makers to provide concise easy-to-use information on understanding the fate of spilled oil and dispersants, their use, effectiveness, and effects. This publication provides a summary of dispersant technology. It focuses on chemical dispersant technology and the information needs of decision-makers regarding the use of chemical dispersants and their potential benefits and risks. A reference that every oil spill response decision-maker must have! Pages: 52

March 1999 | Product Number: I46920 | Price: Free\*

### Publ 4693

#### Effects of Oil and Chemically Dispersed Oil in the Environment

Crude oil is a complex, highly variable mixture of hydrocarbons and other trace compounds, and exposure may cause a variety of adverse effects. Dispersants are mixtures of chemicals, solvents, and surfactants used to reduce oil viscosity and help the oil break up and disperse into the water column. This booklet is intended to help bridge the gap in understanding information about exposure and effects of untreated oil and chemically dispersed oil in the marine environment. Pages: 50

May 2001 | Product Number: I46930 | Price: Free\*

### Publ 4706

#### Environmental Considerations for Marine Oil Spill Response

API is offering a new revision of Environmental Considerations for Marine Oil Spill Response, generally known as the "Marine Manual." API, the National Oceanographic and Atmospheric Administration, the U.S. Coast Guard and the U.S. Environmental Protection Agency developed the Marine Manual for oil spill contingency planners and field responders. The information allows both planners and responders to identify techniques that minimize the ecological impact of both the response action and the spilled oil. Matrix tables allow comparison of 28 different methods for response, and classify their relative environmental impacts for combinations of 5 different oil types and 25 marine habitats. Pages: 322

July 2001 | Product Number: I47060 | Price: \$82.00

### Bull 4719

#### Requesting Regulatory Concurrence for Subsea Dispersant Use

Provides guidelines, forms, and checklists recommended for use by industry. The API guidelines describe the RRT concurrence request process, proposed information submission recommendations that are specific to subsea dispersant injection, and the use of Spill Impact Mitigation Analysis (SIMA) and other forms of tradeoff analyses as decision support tools. Also included are practical flowcharts and checklists specific to Incident Management Team (IMT) positions that are integral to subsea dispersant use, and guidance on the preparation of subsea dispersant operations and monitoring plans. This document provides operational guidelines intended for actual events or exercises and provides a basis for engagement from a range of relevant stakeholders. Pages: 44

June 2017 | Product Number: I47911 | Price: \$86.00

### Publ 4724

#### Recovery of Four Oiled Wetlands Subjected to In-Situ Burning

Four sites, including a diversity of oil types burned and habitats, were selected for follow-up review and evaluation of the effects of in-situ burning (ISB): Mosquito Bay spill in Louisiana, burned in April 2001; Lakehead Pipe Line spill in Ruffy Brook, Minnesota, burned in July 2000; Louisiana Point pipeline spill, burned in February 2000; and Chevron Pipe Line Milepost 68 near Corinne, Utah, burned twice, in March and April 2000. Site visits were

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conducted in July (Minnesota and Utah) and October (two sites in Louisiana). All available data on each site were collected from those involved in the burns and the post-burn monitoring. State and local monitoring data provided additional information. The site was photographed from the same position and perspective as photographs taken during and shortly after the spill and burn, creating time-series photography as a visual record of the use of in-situ burning and vegetative recovery. In combination with quantitative field measurements, photography provides an excellent understanding of the specific site conditions and how the results might apply to other sites. Because this report includes a large number of color photographs for the sites, which would make traditional printing of hardcopy reports very expensive, the report is being published in digital format on CD-ROM.

June 2003 | Product Number: I47240 | Price: \$93.00

### Publ 4735

#### In-Situ Burning: The Fate of Burned Oil

The in-situ burn (ISB) is an oil spill response option that has been used far less frequently than mechanical countermeasures (booms, skimmers, etc.), and consequently, familiarity with ISB operations is limited. Decision-makers need a comprehensive understanding of the oil, how it acts in the environment, and aspects of the burn process in order to understand the behavior of any ISB by-products and the potential impacts from an in-situ burn. This document was designed to capture that knowledge and present it clearly and concisely so you will have the necessary information to understand issues associated with fate and effects of oil to which ISB has been applied. It is not a set of instructions for carrying out a specific ISB. Pages: 54

April 2004 | Product Number: I47351 | Price: Free\*

### Publ 4740

#### In-Situ Burning—A Decision-Maker's Guide to In-Situ Burning

This scenario is fictitious, but the circumstances are possible. In-situ burning (ISB) is a response option that has been used less frequently than countermeasures like booms and skimmers or contaminated soil removal. Consequently, familiarity with the pros and cons of this option is limited. There are ISB "experts" in the United States and internationally, but the intentional practice of this response tool remains relatively limited for both on-water and on-land situations.

This booklet is the second in a series that were developed as reference documents for oil spill response decision-makers. It provides the reader with a comprehensive, concise, yet clear summary of the operational requirements and limitations for ISB and allows decision-makers to better understand the function of in-situ burning and the tradeoffs facing decision-makers in smythies technology when responding to an oil spill on land or on water. Pages: 76

April 2005 | Available for download at <https://www.api.org/oil-and-natural-gas/environment/clean-water/oil-spill-prevention-and-response/~media/4BDBD6AABD534BF1B88EB203C6D8B8F4.ashx>

## OIL SPILLS: MSRC REPORTS

Marine Spill Response Corporation (MSRC) Research & Development Technical Reports are available from the Linda Hall Library. To order, contact Document Services at 800-662-1545 or 816-363-4600; fax: 816-926-8785; website: <https://www.lindahall.org>.

### TR 91-001

Priority Topics for Research and Development in Oil Spill Response

### TR 92-001

An Analysis of Historical Oil Spills and Current Cleanup Requirements to Aid in Selecting New Technologies for Spill Cleanup Operations

### TR 92-002

Airborne Surveillance Technology Options for Improving Oil Spill Cleanup and Response

### TR 92-003

Tenyo Maru Oil Spill (Remote Sensing Data Analysis)

### TR 92-004

Oil Spill Detection Using Satellite-Based SAR

### TR 92-006

Incorporation of State of the Art Technologies to Oil Spill Modeling

### TR 93-001

Evaluation of Marine Post-Spill Sites for Long-Term Recovery Studies

### TR 93-002.1

ROPME Sea Oil Spill Nearshore Geochemical Processes Study (Vol. 1)

### TR 93-002.2

ROPME Sea Oil Spill Nearshore Geochemical Processes Study (Vol. 2) (Hydrocarbon Chemistry Analytical Results for Year One)

### TR 93-002.3

ROPME Sea Oil Spill Nearshore Geochemical Processes Study (Vol. 3) (Remote Sensing Derived Habitat Classification and Error Evaluation for Year One)

### TR 93-003.1

Interlaboratory Calibration Testing of Dispersant Effectiveness: Phase 1

### TR 93-003.2

Interlaboratory Calibration Testing of Dispersant Effectiveness: Phase 2

### TR 93-004

Oil Spill Detection: Documentation of Historical Remote Sensing Projects and Status

### TR 93-006

MSRC Oil Spill Response Vessel Recovered Oil Systems Tests

### TR 93-007

Occupational Health Implications of Crude Oil Exposure: Literature Review and Research Needs

### TR 93-009.1

Aerial Dispersant Application: Assessment of Sampling Methods and Operational Altitudes, Vol. 1

### TR 93-012

MSRC Workshop Report: Research on Worker Health & Safety

### TR 93-013

MSRC Workshop Report: Research on Bioremediation of Marine Oil Spills

### TR 93-014

MSRC Workshop Report: Research on the Ecological Effects of Dispersants and Dispersed Oil

### TR 93-018

Formation and Breaking of Water-in-Oil Emulsions: Workshop Proceedings

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Mesocosm Test Facility Strawman Design

**TR 93-023**

Seminar on Software for Oil Spill Response and Contingency Planning

**TR 93-024**

Summary Report MSRC/IKU Flume Design Workshop

**TR 93-026**

Demulsification by Use of Heat and Emulsion Breaker

**TR 93-027**

Transfer of Crude Oil Weathering Technology

**TR 93-028**

Evaluation of a Toxicity Test Method Used for Dispersant Screening in California

**TR 93-029**

Technical Evaluation of the Coastal Oil Spill Simulation System Prototype

**TR 93-030**

Determination of Oil and Emulsions Viscosity and Interfacial Tension

**TR 93-031**

Recovered Oil and Oily Debris Handling to Facilitate Disposal

**TR 93-032**

Weathering Properties and Chemical Dispersibility of Crude Oils Transported in U.S. Waters

**TR 94-001**

In-Situ Burning of Water-in-Oil Emulsions

**TR 94-003**

Waterbird Deterrent Techniques

**TR 94-004**

A Review of the Methods and Ecological Consequences of Substrate Aeration for the Enhancement of Oil Bioremediation in Wetlands

**TR 94-005**

Coastal Oil Spill Simulation System Prototype Testing Program

**TR 94-006**

MSRC Workshop Report: Research on Waterbird Deterrents at Marine Oil Spills

**TR 94-007**

Phase 1: Oil Containment Boom at Sea Performance Test

**TR 94-008**

Rheological Correlation Studies on Water-in-Oil Emulsions

**TR 94-010**

Dispersed Oil and Dispersant Fate and Effects Research, California Program Results for 1993-94

**TR 94-011**

Toxicity Bioassays on Dispersed Oil in the North Sea: August 1994 Field Trials

**TR 94-012**

Demulsification by Use of Heat and Emulsion Breakers, Phase 2

**TR 94-013**

The Science, Technology and Effects of Controlled Burning of Oil Spills at Sea

**TR 94-015**

Comparison of Physically and Chemically Dispersed Crude Oil Toxicity Under Continuous and Spiked Exposure Scenarios

**TR 94-018**

Potential Use of the Microtox Assay as an Indicator of the Toxicity of Dispersed Oil

**TR 94-019**

Aerial Dispersant Application: Field Testing Research Program (Alpine, Texas)

**TR 95-001**

Phase 2: At Sea Towing Tests of Fire Resistant Oil Containment Booms

**TR 95-002**

Isolation and Identification of Compounds and Mixtures Which Promote and Stabilize Water-in-Oil Emulsions

**TR 95-003**

Phase 3: Oil Containment Boom at Sea Performance Tests

**TR 95-004**

Utility of Current Shoreline Cleaning Agent Tests in Field Testing

**TR 95-005**

An Analysis of Historical Opportunities for Dispersant and In-Situ Burning Use in the Coastal Waters of the United States Except Alaska

**TR 95-007**

Field Evaluation of Bioremediation in Fine Sediments

**TR 95-010**

Laboratory Studies of the Properties of In-Situ Burn Residues

**TR 95-011**

Formulation of New Fireproof Boom Designs

**TR 95-012**

Dispersed Oil and Dispersant Fate and Effects Research: California Program Results for 1994-1995

**TR 95-014**

The Effects of Oil and Chemically Dispersed Oil in Tropical Ecosystems: 10 Years of Monitoring Experimental Sites

**TR 95-015**

Reduction in the Toxicity of Crude Oil During Weathering on the Shore

**TR 95-017**

Mesoscale In-Situ Burn Aeration Test

**TR 95-018**

Proceedings of the Third Meeting of the Chemical Response to Oil Spills: Ecological Effects Research Forum

**TR 95-019**

A Mental Models Approach to Preparing Summary Reports on Ecological Issues Related to Dispersant Use

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Development of Protocols for Testing Cleaning Effectiveness and Toxicity of Shoreline Cleaning Agents (SCAs) in the Field

### TR 95-020.2

Test Cleaning Effectiveness and Toxicity of Shoreline Cleaning Agents (SCAs): Data Report

### TR 95-021

New Brunswick Bird Deterrent Study

### TR 95-022

Proceedings of the Workshop on Technical Issues Related to Mesocsm Research in the Coastal Oil Spill Simulation System Facility

### TR 95-024

Oil Weathering Study of the Morris J. Berman No. 6 Cargo Oil

### TR 95-025

Oil Weathering Study of Arabian Light Crude Oil

### TR 95-026

Oil Weathering Study of Maya Crude Oil

### TR 95-027

Weathering Characterization of Heavy Fuels

### TR 95-029

Dispersant Effectiveness: Phase 3

### TR 95-030

Standard Method for Viscosity Measurement of Water-in-Oil Emulsions

### TR 95-031

Toxicity Assessment of Oiled and Treated Sediments from and Experimental Bioremediation Site in Delaware Bay, USA

### TR 95-033

Large Scale Testing of the Effect of Demulsifier Addition to Improve Oil Recovery Efficiency

### TR 95-034

Evaluation of Oil Spill Cleanup Techniques in Coastal Environments

### TR 95-038

Key Factors that Control the Efficiency of Oil Spill Mechanical Recovery Methods

## BIENNIAL OIL SPILL CONFERENCE PROCEEDINGS

These conferences are sponsored by API, the U.S. Environmental Protection Agency, the U.S. Coast Guard, the International Petroleum Industry Environmental Conservation Association, and the International Maritime Organization. They address oil-spill prevention, behavior, effects, control, and cleanup.

### Publ 4575

Proceedings of the 1991 Oil Spill Conference Infobase

The Proceedings of the 1991 Oil Spill Conference are available on 3.5-in. or 5.25 in. computer diskette. More than 700 pages of proceedings, including hundreds of illustrations, can be loaded onto IBM or IBM-compatible personal computers. The minimum requirements of 512 KB RAM, hard disk drive, VGA monitor, and DOS 3.0 or higher, are listed in the reference manual that gives complete instructions for operating the infobase. A tutorial and glossary are included.

January 1993 | Product Number: I45751 | Price: \$71.00

### Publ 4675

Fate and Environmental Effects of Oil Spills in Freshwater Environments

Provides basic information necessary for the formulation of spill response strategies that are tailored to the specific chemical, physical, and ecological constraints of a given spill situation. It summarizes environmental effects from inland oil spills into fresh surface waters. It provides technical information for persons responsible for inland spill response and cleanup, for researchers, and for others dealing with protection of the environment from possible oil spill hazards. This research identifies, describes, and compares the behavior, fate, and ecological implications of crude oil and petroleum products in inland waters. Pages: 160

December 1999 | Product Number: I46750 | Price: \$154.00

### Publ 4684

Compilation and Review of Data on the Environmental Effects of In-Situ Burning of Inland and Upland Oil Spills

Burning of spilled oil provides a relatively easy, low-cost cleanup method by reducing removal, transportation, and disposal costs as well as reducing the time required for cleanup. This study was commissioned by API to identify those environmental conditions under which burning should be considered as a response option for oil spilled in inland and upland habitats. This report presents a summary of the case histories and lessons learned from previous uses of burning in inland environments, with and without oil. While some information on human health and safety is included, the focus of this report is on the environmental fate and effects of in-situ burning. Pages: 198

March 1999 | Product Number: I46840 | Price: \$128.00

### Publ 4686

1999 Oil Spill Conference Proceedings

1999 | CD-ROM Product Number: I4686A | Price: \$63.00

Hard Copy Product Number: I4686B | Price: \$63.00

### Publ 4710

2003 Oil Spill Conference Proceedings

CD-ROM Product Number: I4701A | Price: \$333.00

Hard Copy Product Number: I4701B | Price: \$333.00

### Publ 4718

2005 Oil Spill Conference Proceedings

CD-ROM Product Number: I47180A | Price: \$333.00

## SEDIMENTS

### Publ 4607

User's Guide and Technical Resource Document: Evaluation of Sediment Toxicity Tests for Biomonitoring Programs

Serves as a comprehensive guide for the selection of sediment toxicity tests. It compares the types of tests available, specific test methods, and selection of species for their strengths and weaknesses for a particular kind of habitat. Descriptions are provided on test types, test species, and sediment preparations. This publication additionally includes a user's guide for readers unfamiliar with sediment toxicity testing. See also Publ 4608. Pages: 236

November 1994 | Product Number: I46070 | Price: \$118.00

### Publ 4608

User's Guide: Evaluation of Sediment Toxicity Tests for Biomonitoring Programs

Provides an introduction to sediment toxicity testing and presents to those unfamiliar with such testing how the resource manual (Publ 4607) can be used. The document contains descriptions of habitat type, sediment test systems, and biological endpoints. Site-specific concerns are identified to aid in test selection. Brief summaries of sampling and data analysis issues are also presented. Pages: 34

November 1994 | Product Number: I46080 | Price: \$65.00

## Publ 4632

### Reducing Uncertainty in Laboratory Sediment Toxicity Tests

Evaluates some of the critical components of laboratory experiments that need to be considered to obtain accurate sediment toxicity assessments. The report describes the formulation and evaluation of a reference sediment, it examines the tolerances of common testing species to sediment characteristics, evaluates copper sulfate as a reference toxicant by determining the relative sensitivities of freshwater testing organisms, and evaluates potential sublethal endpoints for sediment potency. Pages: 152

September 1995 | Product Number: I46320 | Price: \$67.00

## Waste Research

### Guidelines for Commercial Exploration and Production Waste Management Facilities

Provides guidelines for the design and operations of commercial E&P waste management facilities to allow operators to identify areas where their facility could have impacts on the surrounding community and environment, and gives options for preventing/reducing those impacts. The guidelines are not meant to supersede any applicable local, state, or federal requirements. Pages: 80

March 2001 | Product Number: G00004 | For a free copy of this document, please visit [https://www.api.org/~media/Files/EHS/Environmental\\_Performance/E\\_P\\_Waste\\_Guidelines.pdf](https://www.api.org/~media/Files/EHS/Environmental_Performance/E_P_Waste_Guidelines.pdf)

### Overview of Exploration and Production Waste Volumes and Waste Management Practices in the United States

Presents the results of a survey of the industry covering 1995 that describes current volumes of wastes generated from the production of oil and gas, describes how those wastes are managed, and identifies changes in waste management practices over the past decade. The report includes numerous tables presenting the results from the survey.

May 2000

## DR 53

### Characterization of Exploration and Production Associated Wastes

Approximately 0.1 % of the total volume of exploration and production wastes generated annually by the oil and gas industry is classified as associated waste. This report presents the analytical characterization of 120 samples representing 12 different associated waste categories. Fate and transport modeling of the characterization data are also included. The modeling suggests that associated wastes do not pose a threat to groundwater when managed in accordance with API guidance on landspreading, roadspreparing, and burial. Pages: 160

November 1996 | Product Number: I00053 | Price: \$147.00

## Publ 351

### Overview of Soil Permeability Test Methods

The determination of soil permeability is one of the most important items in assessing aboveground storage tank facilities' secondary containment areas. This publication outlines various methods to test the permeability of soil and distinguishes between laboratory and field methods, though it does not supply an exhaustive list of all available permeability methods. These methods are identified according to their applicability to particular soil types. The methods presented in this report are applicable to fine-grained soils (silts and clays) and coarse-grained soils (sands and gravels), but may not be appropriate to organic soils, such as peat, or to materials such as construction and demolition debris. All methods should be fully investigated for appropriateness and to determine its suitability to a particular situation. Pages: 60

April 1999 | Product Number: J35100 | Price: \$98.00

## Publ 4465

### Evaluation of the Treatment Technologies for Listed Petroleum Refinery Wastes

Evaluated the efficacy of five treatment methods, alone and in combination, for listed petroleum refinery wastes: mechanical treatment (filtration), solvent extraction, thermal treatment (drying), chemical fixation, and pyrolysis. The use of all the methods resulted in wastes of substantially reduced hazard, as measured by total and leachable concentration of residues in the product solid. Pages: 200

December 1987 | Product Number: I44650 | Price: \$76.00

## Publ 4527

### Evaluation of Limiting Constituents Suggested for Land Disposal of Exploration and Production Wastes

Describes a study to develop salinity and petroleum hydrocarbon threshold guidance values that typically should not be exceeded for one-time land application of exploration and production wastes. Definition, technical justification, and guidance for application of threshold values are provided. Measurable parameters that serve as indices for proper environmental management of salinity and petroleum hydrocarbons include: electrical conductivity, sodium adsorption ratio and exchangeable sodium percentage for salinity, and oil and grease for petroleum hydrocarbons. Pages: 66

August 1993 | Product Number: I45270 | Price: \$67.00

## Publ 4600

### Metals Criteria for Land Management of Exploration and Production Wastes: Technical Support Document of API Recommended Guidance Values

Provides scientifically defensible guidelines for land management of exploration and production wastes containing metals. It provides the technical support for recommended maximum concentrations of 12 metals. The guidance values for arsenic, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, selenium, and zinc were adopted directly from sewage sludge regulations promulgated by the U.S. Environmental Protection Agency in 1993. A risk-based approach was used to develop guidance values for barium and boron. The report also provides practical information on sample collection, analyses, and calculation of waste application rates. Pages: 56

January 1995 | Product Number: I46000 | Price: \$65.00

## Publ 4618

### Characteristics and Performance of Supercritical Fluid Extraction (SFE) in the Analysis of Petroleum Hydrocarbons in Soils and Sludges

Summarizes the results of a study to evaluate and improve SFE methods and instrumentation for analytical-scale extractions of petroleum hydrocarbons from soils and sludges. The study determines which types of samples and waste are best suited for analysis by SFE and optimal conditions for complete extraction. Pages: 24

May 1995 | Product Number: I46180 | Price: \$65.00

## Publ 4663

### Remediation of Salt-Affected Soils at Oil and Gas Production Facilities

Water separated from oil and gas during production contains dissolved solids, including salt. If improperly handled, produced water with sufficient salt concentrations can damage plants and soils. Therefore, this manual was designed to assist the oil and gas environmental professional and field personnel to (1) assess sites with salt-affected soils; (2) evaluate remedial alternatives; and (3) conduct remedial activities, if necessary. It provides forms for organizing assessment information and conducting sample collection and analysis. Remediation options are divided into three primary groupings: natural remediation, in-situ chemical amendment remediation, and mechanical remediation. A decision tree and worksheets are provided to aid in the selection of a remedial option(s). Technical approaches for

applying each group of remedial options are discussed. A number of appendices provide supplementary information on various aspects of salt-affected soil remediation.

October 1997 | Product Number: I46630 | Price: \$119.00

### Publ 4733

#### Risk-Based Screening Levels for the Protection of Livestock Exposed to Petroleum Hydrocarbons

The purpose of this study was to develop toxicity values and screening guidelines for evaluating risks to livestock from exposure to petroleum hydrocarbons. This report addresses how to determine whether livestock should be included in a risk evaluation, and estimate risks of petroleum hydrocarbon exposures to livestock. Pages: 50

July 2004 | Product Number: I47330 | Price: \$100.00

### Publ 4734

#### Modeling Study of Produced Water Release Scenarios

Provides a scientific basis for operators, regulators, and landowners to determine if assessment or remediation of produced water releases will provide a meaningful environmental benefit.

The two principal research objectives of this study are (1) the identification of produced water release scenarios that have a potential to cause groundwater quality impairment in homogeneous subsurface geologic profiles and (2) the prediction of chloride movement through the vadose zone for different release scenarios. Secondary objectives of the study included evaluation of the effect of heterogeneity on the migration of chloride through the vadose zone, the impact of repeat releases, and the effect on groundwater quality of surface soil restoration by revegetation and soil leaching.

The sensitivity analysis performed in this study provides an overview of the likelihood of groundwater impairment for large release volumes (100 bbls and 10,000 bbls). Assuming homogeneous unsaturated zone soil profiles, the results of over 1000 modeled release scenarios reveal that 49 % of single-event releases do not cause impairment of groundwater above drinking water standards for chloride (250 mg/L) in a monitoring well that is adjacent to the edge of the release. In 70 % of these scenarios, chloride concentrations in groundwater do not exceed 1000 mg/L. Although these numbers give no information about the fate of chloride from a specific produced water release, they do indicate that a release does not necessarily cause groundwater impairment. Pages: 124

January 2005 | Product Number: I47340 | Price: \$134.00

### Publ 4758

#### Strategies for Addressing Salt Impacts of Produced Water Releases to Plants, Soil, and Groundwater

The exploration and production industry uses great care during the handling and disposal of the produced water that is generated as part of oil and gas production. However, unintentional releases can occur. Depending on the chemical composition of the produced water and the nature of the local environment, salts associated with such releases can impair soils, vegetation, and water resources.

Provides a collection of simple rules of thumb, decision charts, models, and summary information from more detailed guidance manuals to help you address the following assessment and response issues:

- Will a produced water release cause an unacceptable impact on soils, plants, and/or groundwater?
- In the event of such an impact, what response actions are appropriate and effective? Pages: 29

1st Edition | September 2006 | Product Number: I47580 | Price: \$76.00