Design of Secondary Containment in Petrochemical Facilities

Task Committee on Secondary Containment



ASCE

Design of Secondary Containment in Petrochemical Facilities

Prepared by the
TASK COMMITTEE SECONDARY CONTAINMENT
of the
PETROCHEMICAL COMMITTEE of the
ENERGY DIVISION of the
AMERICAN SOCIETY OF CIVIL ENGINEERS

Published by
ASCE American Society of Civil Engineers
345 East 47th Street
New York, New York 10017-2398

Abstract:

Current codes and standards do not address many of the structures found in the petrochemical industry. A task committee was established because of a significant interest in the petrochemical industry in dealing with environmental issues and in interpreting and complying with government environmental standards. The purpose of this task committee report is to help provide some uniformity to the current mix of internal and published criteria, and provide guidance in design of secondary containments. Though the makeup of the committee and the writing of this document are directed at petrochemical facilities, these guidelines are applicable to similar design structures in other industries.

Library of Congress Cataloging-in-Publication Data

Design of secondary containment in petrochemical facilities / prepared by the Task Committee on Secondary Containment of the Petrochemical Committee of the Energy Division of the American Society of Civil Engineers.
p. cm. ISBN 0-7844-0263-9
1. Petroleum refineries--Design and construction. 2. Petroleum refineries--Safety measures. 3. Petroleum chemicals--Storage. 1. American Society of Civil Engineers. Task Committee on Secondary Containment.
TH4571.D474 1997 97-20917
665.5'389--dc2 I CIP

The material presented in this publication has been prepared in accordance with generally recognized engineering principles and practices, and is for general information only. This information should not be used without first securing competent advice with respect to its suitability for any general or specific application.

The contents of this publication are not intended to be and should not be construed to be a standard of the American Society of Civil Engineers (ASCE) and are not intended for use as a reference in purchase specifications, contracts, regulations, statutes, or any other legal document.

No reference made in this publication to any specific method, product, process or service constitutes or implies an endorsement, recommendation, or warranty thereof by ASCE.

ASCE makes no representation or warranty of any kind, whether express or implied, concerning the accuracy, completeness, suitability, or utility of any information, apparatus, product, or process discussed in this publication, and assumes no liability therefore.

Anyone utilizing this information assumes all liability arising from such use, including but not limited to infringement of any patent or patents.

Photocopies. Authorization to photocopy material for internal or personal use under circumstances not falling within the fair use provisions of the Copyright Act is granted by ASCE to libraries and other users registered with the Copyright Clearance Center (CCC) Transactional Reporting Service, provided that the base fee of $4.00 per article plus $.25 per page is paid directly to CCC, 222 Rosewood Drive, Danvers, MA 01923. The identification for ASCE Books is 0-7844-0263-9/97/$4.00 + $.25 per page. Requests for special permission or bulk copying should be addressed to Permissions & Copyright Dept., ASCE.

Copyright© 1997 by the American Society of Civil Engineers.
All Rights Reserved.
Library of Congress Catalog Card No: 97-20917
ISBN 0-7844-0263-9
Manufactured in the United States of America.

Cover photograph of secondary containment courtesy of CB&I, Houston, TX.

ASCE Petrochemical Energy Committee

This publication is one of five state-of-the-practice engineering reports produced, to date, by the ASCE Petrochemical Energy Committee. These engineering reports are intended to be a summary of current engineering knowledge and design practice, and present guidelines for the design of petrochemical facilities. They represent a consensus opinion of task committee members active in their development. These five ASCE engineering reports are:

1) *Design of Anchor Bolts in Petrochemical Facilities*

2) *Design of Blast Resistant Buildings in Petrochemical Facilities*

3) *Design of Secondary Containment in Petrochemical Facilities*

4) *Guidelines for Seismic Evaluation and Design of Petrochemical Facilities*

5) *Wind Loads on Petrochemical Facilities*

The ASCE Petrochemical Energy Committee was organized by A. K. Gupta in 1991 and initially chaired by Curley Turner. Under their leadership, the five task committees were formed. More recently, this committee has been chaired by Joseph A. Bohinsky, followed by Frank J. Hsiu.

Frank J. Hsiu Chevron Research and Technology Co. Chairman	J. Marcell Hunt Hudson Engineering Corporation Secretary
Joseph A. Bohinsky	Brown & Root, Inc.
William Bounds	Fluor Daniel, Inc.
Clay Flint	Bechtel, Inc.
John Geigel	Exxon Chemical Company
Ajaya K. Gupta	North Carolina State University
Magdy H. Hanna	Jacobs Engineering Group Inc.
Steven R. Hemler	Eastman Chemical Company
Gayle S. Johnson	EQE International, Inc.
James A. Maple	J. A. Maple & Associates
Douglas J. Nyman	D. J. Nyman & Associates
Norman C. Rennalls	BASF Corporation
Curley Turner	Fluor Daniel, Inc.

The ASCE Task Committee On Secondary Containment

The purpose of this document is to provide a guideline for secondary containment design in Petrochemical Facilities. This document is a summary of current practice for the Petrochemical Facilities in compliance with the latest regulations. Another purpose of these guidelines is to provide some uniformity in design and practice for secondary containment structures, and to show state of the art. Even though this document was prepared for use at Petrochemical Facilities, the guidelines are applicable for all similar facilities.

These documents do not determine for the user when secondary containment is required. They only give the user some methods for providing secondary containment. Due to the rapid rate of changes in the field, and the length of time taken to publish a document, new materials and methods for providing secondary containment may be available, and may be more cost effective than those shown. The methods shown have proven to be effective, and can be constructed in the field.

These documents were developed over the course of three years. The governing regulations are constantly being updated and revised. These documents are not intended to be a design manual, code or standard. They represent a consensus opinion of several internal company standard practices, published documents, and an interpretation of the current regulations by the committee members. Any findings, conclusions or recommendations expressed in these documents are those of the authors and do not necessarily reflect the views of ASCE or the authors' respective organizations.

The ASCE Task Committee on Secondary Containment

In helping to create a consensus set of guidelines, a number of key individuals dedicated significant amounts of time to formulating, writing, and reviewing in detail, specific sections of this document. Those members are identified on the list of committee members and contributors.

Members and Contributors to Report

Magdy H. Hanna	Chairman	Jacobs Engineering Group Inc.
Carl C. Faller	Vice Chairman	DuPont Engineering
Dave Peyton	Secretary	Jacobs Engineering Group Inc.
James Combs		Fluor Daniel, Inc.
John Falcon		Jacobs Engineering Group Inc.
Dwight Hollingsworth		Albermarle Corporation
Frank Hsiu		Chevron Research & Technology
Curt Stroup		Raytheon Engineering & Const.
Harold Thayne		Brown & Root, Inc.
Christopher Ziu		Herzog-Hart Corporation

CONTENTS

Chapter 1: Introduction 1-1

1.1 Background 1-1
1.2 Purpose and Scope 1-2

Chapter 2: Storage Tanks 2-1

2.1 Introduction 2-1
2.2 General 2-1
2.3 Requirements and Recommendations 2-2
2.4 Special Considerations 2-27

Chapter 3: Loading & Unloading Tank Trucks & Railcars 3-1

3.1 Introduction 3-1
3.2 General 3-1
3.3 Requirements & Recommendations 3-1

Chapter 4: Transformers and Electrical Equipment 4-1

4.1 Introduction 4-1
4.2 General 4-1
4.3 Requirements & Recommendations 4-2
4.4 Special Considerations 4-3

Chapter 5: Sumps and Trenches 5-1

5.1 Introduction 5-1
5.2 General 5-1
5.3 Requirements and Recommendations 5-1
5.4 Special Considerations 5-7

Chapter 6: Plant Drainage 6-1

6.1 Introduction 6-1
6.2 General 6-1
6.3 Requirements and Recommendations 6-1

Chapter 7: Double Containment Piping Systems 7-1

7.1 Introduction 7-1
7.2 General 7-1
7.3 Requirements and Recommendations 7-2

Chapter 8: Leak Detection and Monitoring Systems 8-1

8.1 Introduction 8-1
8.2 General 8-1
8.3 Types of Leak Detection Systems 8-2
8.4 Requirements and Recommendations 8-12

Glossary A-1

References B-1

CHAPTER 1
INTRODUCTION

This document was prepared to provide guidance to civil engineers in the design of secondary containment for petrochemical facilities.

The guidelines provided are based on the current practice for petrochemical facilities and are in compliance with the latest governing regulations.

This document covers several areas in petrochemical facilities that may require secondary containment. It is the responsibility of the design civil engineer, with input from the environmental engineer and others in the regulatory agencies, to determine if secondary containment is required for each area in the petrochemical facility.

In preparing this document, the objective was to provide guidelines for the major areas in the petrochemical facility such as storage tanks, sumps, piping, and loading and unloading areas. It is recognized that there will be some areas not fully covered. However, the design engineer will be able to adopt the guidelines discussed in this document to design secondary containment systems for those areas not covered herein.

1.1 BACKGROUND

New governing environmental regulations require the petrochemical industry to provide secondary containment with a leak detection system. The design engineer is faced with new requirements to incorporate into the design of petrochemical plants and has to rely on personal interpretation of the regulations to determine the required design.

A partial list of these regulations is as follows:

29 CFR, Part 110	*Occupational Safety and Health Act*
40 CFR, Part 60	*Standards for Performance of New Stationary Sources*
40 CFR, Part 61	*National Emission Standards for hazardous Air Pollutants*
40 CFR, Part 112	*Regulation of Oil Pollution Prevention*
40 CFR, Part 125	*Criteria and Standards for Best Management Practices*
40 CFR, Part 260	*Hazardous Waste Management System*
40 CFR, Part 261	*Identification and Listing of hazardous Wastes*
40 CFR, Part 262	*Standards Applicable to Generators of Hazardous Wastes*
40 CFR, Part 263	*Standards Applicable to Transporters of Hazardous Waste*
40 CFR, Part 264	*Standards Applicable to Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities*
40 CFR, Part 265	*Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities - RCRA*
40 CFR, Part 270	*EPA Administered Permit Programs: The Hazardous Waste Permit Program - RCRA*
40 CFR, Part 280	*Underground Storage Tanks*

In addition, a new industry was created and new products have been introduced to provide secondary containment and leak detection systems in an attempt to comply with all these new regulations.

1.2 PURPOSE AND SCOPE

The purpose of this document is to provide guidance to the design engineer in designing secondary containment and leak detection systems for petrochemical facilities, to provide some uniformity, and to establish a common state of practice for the industry.