

# HAZARDOUS WASTE MANAGEMENT

*AN INTRODUCTION*

SECOND EDITION



INCLUDES DVD



CLIFF VANGUILDER

# HAZARDOUS WASTE MANAGEMENT

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*An Introduction*

Second Edition

Cliff VanGuilder



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# INTRODUCTION

The first edition of this book, *Hazardous Waste Management, An Introduction* was published in 2012, and the entire contents of this text are current but several portions will be out of date over the next few months.

This second edition is very timely, because in 2014 and 2015, the United States Environmental Protection Agency (USEPA) introduced three major revisions to the Solid and Hazardous Waste Regulations, those being the first major revisions since 1990. These revised standards are taking effect across all states (on schedules determined by states) authorized by the USEPA to administer their own programs.

These changes were implemented by the USEPA for a variety of reasons, with the majority of the solid waste regulations intended to tighten up the regulation of recycling facilities, including hazardous waste recycling. The bulk of the hazardous waste regulation changes were to simplify the regulation of the smallest facilities that generate hazardous waste and to recognize and help businesses that generate larger quantities of hazardous waste on a one time or infrequent (episodic) basis.

This text also includes a description and discussion of a separate regulatory change in the hazardous waste arena, promulgated by the USEPA on December 1, 2008. This action added a new Subpart K, which applies to colleges and universities, and teaching hospitals and nonprofit research institutes that are either owned by or formally affiliated with a college or university. It was not included in the 2012 version of this book because it had not yet been implemented in the individual states.



One very significant exception to these state-determined effective rule dates is the e-Manifest Rule, a separate rule that will take effect June 30, 2018. USEPA has indicated a desire for a national tracking system for all hazardous wastes since 2011, because all shipments are tracked by each state, and are therefore difficult to track nationally. A new law, called the Hazardous Waste Electronic Manifest Establishment Act, was signed into law October 5, 2012. The purpose of this law was to establish a national tracking system for all hazardous waste systems, and for the costs of the development and operation system to be recovered from fees charged to the users of the manifests. The implementation of this system took the USEPA seven years.

A more detailed description of the e-Manifest system and the user fees can be found at <https://www.epa.gov/e-manifest/learn-about-hazardous-waste-electronic-manifest-system-e-manifest> and <https://www.epa.gov/e-manifest/final-rule-user-fees-electronic-hazardous-waste-manifest-system-e-manifest-and-amendments> and are discussed in more detail in Chapter 3.

This book starts with a history of the solid waste and hazardous waste regulations in the United States, including some of my personal experiences in hazardous waste cleanups and development of some of the regulations. Although we have learned valuable lessons from past tragedies like Love Canal, the recent catastrophic earthquake and tsunami, followed by radioactive releases from the Daiichi nuclear power plant reactors in Fukushima, Japan show us that we need to continually improve our preparedness for hazardous waste and hazardous materials emergencies worldwide.

This text was written for four main purposes: the first being to introduce the reader to the technical field of hazardous waste management; the second to help the reader understand the myriad federal and state hazardous waste regulations; the third to offer some cost-saving measures for companies who do not completely understand the regulations; and the fourth to show how significant relief can be achieved by completely acceptable measures like neutralization of corrosive wastes under certain circumstances. It was impossible to separate these four subjects because in the United States (US), the regulations are frequently written with prescribed treatment standards and, in some cases, prescribed treatment technologies for various hazardous waste streams. This book will explain the history of the regulations and how the regulations became so prescriptive for certain wastes.

The hazardous waste regulations in the United States of America are often confusing, with a large number of references, cross-references, sections, subsections, and sub-subsections. With the assistance of some very patient and talented co-workers in the New York State Department of Environmental Conservation (NYSDEC), colleagues from other states, and friends at the United States Environmental Protection Agency (USEPA), along with untold hours of reading, I was able arrive at a level of understanding that allowed me to feel comfortable writing this book. That process took from 1983 - 1989, while I was in charge of the development of New York State's hazardous waste regulations and served on several committees to help the USEPA develop the federal hazardous waste regulations.

For the past 20 years, I was able to apply these regulations as a supervising hazardous waste inspector, certified by the USEPA and the NYSDEC. I conducted hundreds of hazardous waste inspections across New York State, and reviewed over one thousand inspections. I supervised several dedicated and talented inspectors, reviewing their completed work for accuracy and completeness. I trained several hazardous waste inspectors, prepared them for certification, and conducted certification exam, deciding whether or not they should be certified as hazardous waste inspectors.

During the time I was a supervising hazardous waste inspector, my very talented and dedicated staff developed a computerized hazardous waste inspection program that produced a finished copy of inspection reports, eliminating untold hours of paperwork and saved thousands of pages of printed paper. The program my staff developed in our office produced a finished report, and, based on any violations found in the inspection, also produced the correspondence to the facility inspected. This correspondence would range from a letter stating no violations were found, to a list of violations that needed to be resolved within a specific time frame (usually 30 days), to a complaint with proposed penalties.

The inspections were conducted at all categories and sizes of hazardous waste generators in New York State, along with hazardous waste treatment, storage and disposal facilities and hazardous waste transfer facilities. When I conducted inspections, the owner or environmental manager of the company would frequently ask "What do I need to do to pass hazardous waste inspections?" I would reply that they had to prove they were in compliance with all of the pertinent hazardous waste laws rules and regulations. This

was accomplished in two steps: 1. Determine the proper regulatory category(ies) of the facility and: 2. Make sure the facility complied with all the questions contained in the pertinent hazardous waste compliance checklists, which the inspector would supply at the end of the inspection.

Several text books have been written about hazardous waste management. Some of these books deal with cleanup of contamination from past practices. Others attempt to explain the hazardous waste regulations from an environmental perspective. This book is written as a practical guide for everyone; including professors, students, business owners, environmental professionals and lawyers, so they may understand the hazardous waste regulations from both a technical and regulatory compliance perspective.

The book includes a discussion of the hierarchy of hazardous waste management. This is followed by straightforward instructions on how to determine whether a facility generates or otherwise manages hazardous waste. After these instructions, the book describes several hazardous waste management methods and treatment technologies. The book then provides a list of requirements that must be met to comply with the pertinent regulatory citations. The book gives the regulatory citation from the federal Code of Federal Regulations (CFR), provides an explanation of the terms in the citation, and gives the appropriate compliance question(s) that would be asked by a compliance inspector. If the readers start with a thorough and accurate waste determination, and follow the instructions in the book and the supplement carefully, they should be able to develop a basic comprehensive understanding of hazardous waste management in the US. They should also develop a good understanding of the basic regulatory requirements for hazardous waste management, and know where to look for the appropriate US rules and regulations.

Please note this book is about the hazardous waste management rules and regulations in the US, and that the rules and regulations in other countries may be very different from US standards.

This book contains several case studies from actual inspections that provide questions designed to challenge readers on interpreting the regulations. The identities of the facilities and the employees in the case studies are kept anonymous unless the information was made public by the regulating agency.

For professors, I have provided instructional slides from each chapter in Microsoft Power Point. I have also included companion files that con-

tains the federal hazardous waste CFRs, along with a supplement on how to pass hazardous waste inspections.

Owners of businesses and environmental managers face a daunting task. They are expected to be familiar with a myriad of environmental regulations and to comply with them all. The hazardous waste regulatory program is arguably the most complicated environmental regulatory program, in terms of understanding the language and the requirements. This book is written to translate the language and intention of these complex hazardous waste regulatory requirements into terms the business owners and environmental regulators can understand.

The book also offers options for potential regulatory relief and cost savings in areas like neutralization of certain corrosive hazardous wastes, identification of certain hazardous wastes as universal wastes, and other areas.

Since my retirement with the NYSDEC in 2009, I have continued my work in the environmental engineering and compliance arena as the owner of two consulting firms; ARCH Environmental Compliance Service Associates, LLC, and VanGuilder Engineering, PLLC, both of which help clients deal with environmental compliance.

Both of my firms offer compliance training in the form of preliminary compliance audits to prepare for regulatory inspections, written plans for compliance, and environmental and civil/structural engineering design.

ARCH Environmental Compliance Service Associates, LLC and VanGuilder Engineering, PLLC are both located in upstate New York at 333 Kingsley Rd, Burnt Hills, NY, and any questions about these firms can be made at (518) 491-3287.

Cliff VanGuilder, P.E.  
Malta, New York  
March 2018



# *A BRIEF HISTORY OF HAZARDOUS WASTE*

## **In This Chapter**

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- Introduction to and definitions of solid waste and hazardous waste
- The history of solid and hazardous waste management
- The first U.S. solid waste law
- The first U.S. hazardous waste laws
- The fundamental principles of hazardous waste management
- Examination of Fukushima Disaster

## **1.1 INTRODUCTION TO HAZARDOUS WASTE**

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This chapter introduces readers to hazardous waste management in the United States; more precisely, the history of solid and hazardous waste, the identification of solid and hazardous waste, and U.S. hazardous waste policy and regulations. Although technical discussions of solid waste, hazardous waste, wastewater, and air pollution control are included in this text, a substantial portion of this book is dedicated to outlining and explaining the hazardous waste regulations in the United States and helping the reader to understand the steps required to comply with them.

### **Definitions of Solid Waste and Hazardous Waste**

A discussion of the history of the solid waste and hazardous waste laws, rules, and regulations will begin with definitions of the terms.

### Solid Waste Definition

The United States Congress defined *solid waste* as “...any garbage, refuse, sludge from a wastewater treatment plant, water supply treatment plant, or air pollution control facility, and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, agricultural operations, and community activities...” [SWDA 65]. The Solid Waste Disposal Act became law on October 20, 1965.

As discussed in the Introduction and described in more detail later in this chapter, the USEPA promulgated changes to the Solid Waste Regulations on December 10, 2014, primarily to tighten the requirements on recyclers of solid and hazardous waste. These changes are currently being promulgated in most authorized states at this time.

---

**NOTE**


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*This definition is confusing from a scientific perspective; these wastes are not necessarily in a solid phase—they can be solid, liquid, or a contained gas.*

<h1 style="margin: 0;">Hazardous waste</h1> <h2 style="margin: 0;">FEDERAL LAW PROHIBITS IMPROPER DISPOSAL</h2> <p style="margin: 0;">If found, contact the nearest police or public safety authority, and the Washington State Department of Ecology or the Environmental Protection Agency</p>	
<p>Accumulation Start Date:</p> <p>Reportable Quantities (RQ):                          lbs <i>40 CFR Subchapter J. Part 302, Table 302.4</i></p> <p>Manifest Document #:</p> <p>Emergency Response Guide #:</p> <p>EPA Waste Code(s) and/or Characteristic(s)</p> <p>EPA/DOT Shipping Name:</p> <p style="padding-left: 20px;">Hazard Class:</p> <p style="padding-left: 20px;">UN/NA #:</p> <p style="padding-left: 20px;">Packing Group (PG):</p>	<p>Generator Name:</p> <p>Address:</p> <p>City:</p> <p>State:</p> <p>Zip:</p> <p>EPA ID #:</p>
<p>In the event of a spill or release of this hazardous waste, contact the US Coast Guard National Response Center at 1-800-424-8802 for information and assistance.</p>	

**FIGURE 1.1** Hazardous waste label. (Washington State Department of Ecology at [http://www.ecy.wa.gov/programs/hwtr/hw\\_labels/index.html](http://www.ecy.wa.gov/programs/hwtr/hw_labels/index.html).)

### Hazardous Waste Definition

*Hazardous waste* is a solid waste that poses substantial or potential threats to public health or the environment. Figure 1.1 displays an example of a hazardous waste label.

Hazardous wastes fall into two major categories: characteristic wastes and listed wastes.

- *Characteristic hazardous wastes* are solid wastes that are known or tested to exhibit a hazardous trait such as:
  - Ignitability (i.e., flammable)
  - Reactivity (reacts vigorously when exposed to water, heat, or pressure)
  - Corrosivity (strong acids or bases)
  - Toxicity (fails test for toxicity)
- *Listed hazardous wastes* are materials specifically listed by the EPA (Environmental Protection Agency) or State as a hazardous waste. Hazardous wastes listed by EPA fall into two major categories:
  - Process wastes from general activities (F-listed) and from specific industrial processes (K-list)
  - Unused or off-specification chemicals, container residues and spill cleanup residues of acute hazardous waste chemicals (P-listed) and other chemicals (U-list)

The complex official USEPA (United States Environmental Protection Agency) regulatory definitions of solid waste and hazardous waste are discussed later in this chapter, together with plain-language interpretations.

## 1.2 HISTORY OF SOLID AND HAZARDOUS WASTE MANAGEMENT

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The hazardous waste laws, rules, and regulations were generated in reaction to a series of adverse environmental circumstances that occurred over several years, dating as far back as the early 20th century. Before we look at the hazardous waste problem, we should first examine the history of solid waste management.



### **The Waste Management Problem**

As long as humans have inhabited the Earth, there have been problems with waste disposal. The first documented garbage problems in a populated area were in Rome, Italy.

### **Side Note**

---

“Roman rubbish was often left to collect in alleys between buildings in the poorer districts of the city. It sometimes became so thick that stepping stones were needed. ‘Unfortunately its functions did not include house-to-house garbage collection, and this led to indiscriminate refuse dumping, even to the heedless tossing of trash from windows’ (Casson, Lionel. *Everyday Life in Ancient Rome*, revised and expanded edition. Baltimore: The Johns Hopkins University Press, 1998. p 40.) As a consequence the street level in the city rose, as new buildings were constructed on top of rubble and rubbish” [WIKI 11a].

---

As time progressed and people became aware of the hazards, human waste was disposed in locations away from populated areas, usually in low areas, and, where possible, away from populated areas. These “garbage dumps” were health nuisances because they generated odors and attracted vermin that could spread diseases.

### **Health Hazards**

These early dumps generally were not contained by any liners, leachate collection systems, or groundwater barriers. Some of the contaminated leachate from the dumps eventually leaked out and polluted groundwater and surface water, creating health problems, but the source was not always immediately obvious. Most dumps did not receive any kind of regular cover material, such as soil, so numerous birds, insects, rodents, and other vermin would go to the dumps to eat. These vermin became vectors of diseases when they left the dumps and migrated to populated areas. Fires were a problem at many of these dumps, sometimes purposely set by humans to reduce the volume of the waste, at other times to drive off the vermin, and sometimes from spontaneous combustion of materials in the landfills. The odors from these dumps were a nuisance, and the smoke and fumes from fires created air pollution that was annoying and unhealthy for the people living or working downwind. An additional problem occurred when moderate



**FIGURE 1.2** Landfill photo. (From town of Colonie, New York.)

or heavy winds blew waste papers, grocery bags, and other light materials from uncovered dumps into cities, villages, suburbs, towns, or onto water bodies. The image in Figure 1.2 is representative of these dump sites.

### **1.3 FIRST U.S. SOLID WASTE LAW**

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When the Industrial Revolution began in the 18th century, the waste management practices adopted by manufacturing facilities were similar to those of early dump sites; sometimes industrial wastes were dumped in the same places where human wastes were disposed, and sometimes individual industrial waste disposal areas were created. In the meantime, while laws were being written to better manage solid waste, industrial waste dumps were creating problems of greater proportions and potential hazards.

In 1965, in reaction to the public outcry concerning these poor solid-waste management practices in the United States, Congress passed The Solid Waste Disposal Act (SWDA). This law outlined environmentally

responsible methods for getting rid of trash at household, municipal, commercial, and industrial levels. Wastes described in the Solid Waste Disposal Act were both hazardous and nonhazardous.

In its original form, the SWDA was an attempt to address the solid waste problems confronting the nation through a series of research projects, investigations, experiments, training, demonstrations, surveys, and studies. Congress indicated two reasons for the necessity of the SWDA:

Advancements in technology resulted in the creation of vastly increased amounts and types of wastes than there had been in the past.

Rapid growth in the nation's metropolitan areas had caused these areas to experience significant financial, managerial, and technical problems associated with waste disposal.

Over the next ten years, it became evident that the SWDA was not effective in resolving the solid and hazardous waste disposal issues facing the country.

One very good aspect of the passage of the SWDA was that it marked the beginning of a series of laws and regulations that emphasized clean air and resource management. It focused on researching the pollution and waste management problems during that era and caused the training of experts in improved environmental waste management and disposal. Waste management was improved through research among states, and was recognized and targeted as an issue for local governments [Ledford].

### **The Love Canal Tragedy**

One of the first industrial dumps to make national news that resulted in further legislation was the Love Canal hazardous waste site in Niagara Falls, New York. The Love Canal was an abandoned water power supply canal built as part of a "model city" that was proposed to be built at the eastern edge of Niagara Falls, a project envisioned by Colonel William Love early in the 20th century. In the 1920s, after Colonel Love's dream failed to materialize, the canal became a dump site for the City of Niagara Falls, and the city regularly unloaded its municipal refuse into the canal. In the 1940s, the U.S. Army began using the site to dump wastes from the World War II war effort, including wastes from the Manhattan Project.

By the 1940s, Hooker Electrochemical Company (later known as Hooker Chemical Company), founded by Elon Hooker, began searching for a place to dump the chemical waste it was producing. In 1942, Hooker

was granted permission by the Niagara Power and Development Company to dump wastes into the canal. The canal was drained and lined with thick clay. Into this site, Hooker began dumping industrial waste in various containers. The City of Niagara Falls and the U.S. Army continued the dumping of refuse, along with Hooker, for about six years.

In 1948, after World War II had ended and the City of Niagara Falls had ended self-sufficient disposal of refuse, Hooker became the sole user and owner of the site. This dump site was in operation until 1953 [WIKI 11b].

The dump site must have seemed to be a better-than-average location for a landfill, from an engineering and geological perspective, because it was located in deep clay soils, and its bottom and sides were lined with clay. The dump was also covered with clay soils after it was closed. Humans were not exposed to this dump until the site was purchased by the Niagara Falls School Board in 1953 in order to build the 99th Street School. The school was built, and eventually the remaining land was developed for housing, which was when the problems started to come to light.

Love Canal was not as large as many other industrial dumps across the nation, or even in New York State. It was, however, the first industrial dump site where houses were built in close proximity to an industrial landfill, and the occupants of these houses were likely exposed to high levels of toxic chemicals. Figure 1.3 shows houses that were built close to the Love Canal dump site.

The Hooker Chemical Company was not entirely to blame for the Love Canal tragedy. As mentioned earlier, the dump site was also used by the City of Niagara Falls and the U.S. Army.

## Side Note

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The residents who bought houses near the Love Canal dump site in the 1950s and 1960s had no idea that they were going to be living next to an inactive hazardous waste cleanup site, or that they would be potentially exposed to the 30,000 + chemicals that had been dumped there. After the New York State Health Department discovered the extent of the contamination, the State of New York offered to buy the affected houses at a fraction of their assessed values. Some (about 900) homeowners accepted the offers and moved out, but some residents (about 90 homes) decided to stay, some houses within a few feet of the highly

contaminated dump. A few of these houses are still occupied today. They were allowed to stay because it was their property and the houses were supplied with public drinking water.

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A great deal has been written about the history of the Love Canal dump site. Although many of the books point to Hooker Chemical alone as the villain in this tragedy, there is evidence to suggest Hooker Chemical acted responsibly and a different culprit caused the Love Canal area to be developed into residential housing. A February 1981 article in *Reason* magazine thoroughly chronicles the true Love Canal story [Zeusse 81].

Another informative article was written on the 30th anniversary of the discovery of the problems at the Love Canal dumpsite [Engelhaupt 08].



**FIGURE 1.3** Love Canal homes. (From EPA Website <http://www.epa.gov/region2/superfund/npl/lovecanal/images.html>.)

## 1.4 FIRST U.S. HAZARDOUS WASTE LAWS

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The Solid Waste Disposal Act was written in 1965 to deal primarily with solid waste from municipal sources. Although the SWDA mentioned industrial wastes, the problems associated with Love Canal and other industrial waste sites near residences had not yet become evident. The outcry from the affected citizens at these sites made national news in the 1970s, and Congress acted.

The Environmental Protection Agency was formed in 1970.

### **Ramification of Love Canal: The Resource, Conservation and Recovery Act (RCRA)**

As a result of the political fallout of Love Canal and other industrial dump sites, Congress passed the Resource Conservation and Recovery Act in 1976 (RCRA). This law was written to better regulate hazardous waste under RCRA Subtitle C and solid waste under RCRA Subtitle D. The hazardous waste portion of the law (Subtitle C) created a national “cradle to grave” hazardous waste management tracking (manifest) program to deal with the nation’s annual production and shipping of hazardous waste. Among many other restrictions and obligations, it also required generators of hazardous waste to file biennial reports.

The solid waste part of the law (Subtitle D) dealt with municipal waste disposal.

### **Authorization of States**

One important provision of the law was the ability for states to obtain authorization to develop and run their own hazardous waste programs, with federal funding support and oversight by the USEPA. To obtain authorization, each state had to pass its own separate law(s) to regulate the management of waste, and promulgate regulations that were at least as stringent as the federal laws, rules, and regulations.

Currently, all 50 states have authorization to manage at least a portion of the RCRA program. One feature of the authorization process is interesting, in that changes to the federal regulations do not apply in authorized states until the authorized state changes its laws, rules, and regulations. See:

*<https://www.epa.gov/rcra/state-authorization-under-resource-conservation-and-recovery-act-rcra>*

for the current status of RCRA Authorization Nationwide.