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Hazardous substances releases associated with Hurricanes Katrina and Rita in industrial settings, Louisiana and Texas☆

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Abstract

The scientific literature concerning the public health response to the unprecedented hurricanes striking the Gulf Coast in August and September 2005 has focused mainly on assessing health-related needs and surveillance of injuries, infectious diseases, and other illnesses. However, the hurricanes also resulted in unintended hazardous substances releases in the affected states. Data from two states (Louisiana and Texas) participating in the Hazardous Substances Emergency Events Surveillance (HSEES) system were analyzed to describe the characteristics of hazardous substances releases in industrial settings associated with Hurricanes Katrina and Rita. HSEES is an active multi-state Web-based surveillance system maintained by the Agency for Toxic Substances and Disease Registry (ATSDR). In 2005, 166 hurricane-related hazardous substances events in industrial settings in Louisiana and Texas were reported. Most (72.3%) releases were due to emergency shut downs in preparation for the hurricanes and start-ups after the hurricanes. Emphasis is given to the contributing causal factors, hazardous substances released, and event scenarios. Recommendations are made to prevent or minimize acute releases of hazardous substances during future hurricanes, including installing backup power generation, securing equipment and piping to withstand high winds, establishing procedures to shutdown process operations safely, following established and up-to-date start-up procedures and checklists, and carefully performing pre-start-up safety reviews.

Keywords: Hurricanes; Hazardous substances; Chemical release; Industrial release; Startup; Shutdown

1. Introduction

After crossing southern Florida and entering the Gulf of Mexico, Hurricane Katrina strengthened and struck southeastern Louisiana on August 29, 2005, as a Category 3 hurricane [1]. Hurricane Katrina, one of the worst natural disasters to ever strike the United States, resulted in an estimated 1336 deaths, numerous illnesses and injuries, and extensive damage [1–3]. Hurricane Rita was also classified as a Category 3 hurricane when it struck the Louisiana–Texas border on September 24, 2005 [4]. Although the impact from Hurricane Rita was not as severe as that from Hurricane Katrina, the approach of Hurricane Rita generated one of the largest evacuations in US history; estimates exceed 2 million evacuees in Texas [4].

The scientific literature concerning the public health response to these unprecedented hurricanes has focused mainly on assessing health-related needs and surveillance of injuries, infectious diseases, and other illnesses [5–10]. However, the hurricanes also resulted in unintended hazardous substances releases in the affected states. Data from two states (Louisiana and Texas) participating in the Hazardous Substances Emergency Events Surveillance (HSEES) system were analyzed to describe the characteristics of hazardous substances releases in industrial settings associated with Hurricanes Katrina and Rita. Recommendations are made to prevent or minimize acute releases of hazardous substances during future hurricanes

2. Methods

HSEES is maintained by the Agency for Toxic Substances and Disease Registry (ATSDR). Since 1990, HSEES has col-

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lected data on acute releases of hazardous substances and their associated injuries and evacuations. HSEES is an active, state-based surveillance system that enables identification of factors related to the public health impact of these acute events and promotion of activities to lessen the impact. A HSEES event is an uncontrolled or illegal acute release of any hazardous substance in any amount for substances listed on the HSEES Mandatory Chemical Reporting List. For substances not on the list, events are included if the amount released is ≥10 lbs or 1 gallon. Threatened releases of qualifying amounts are included if the threat led to an action (e.g., evacuation) to protect the public health. Events involving only petroleum are excluded. The Petroleum Exclusion clause of the CERCLA legislation excludes any forms of petroleum that have not been refined to the point of becoming single-chemical products such as pure xylene [11]. However, HSEES does record information about petroleum if it is released with a qualifying substance.

State health department personnel used a variety of sources (e.g., records and oral reports of state environmental agencies, police and fire departments, and hospitals) to collect information about the acute hazardous substances events. Data were entered into a Web-based application that enabled ATSDR to instantly access the data. Information collected for each event included the location and industry involved in the event, hazardous substances released, number of victims, evacuations, and contributing causal factors for the event. Information on contributing causal factors was either reported by the notification source or determined by the state HSEES coordinator using various reports.

The 2002 North American Industry Classification System (NAICS) was used to categorize the industries [12]. A victim is defined as a person experiencing at least one documented adverse health effect (such as respiratory irritation or chemical burns) that was likely associated with the event and occurred within 24 h after the release.

For the analyses, the hazardous substances released were grouped into 13 categories: acids, ammonia, bases, chlorine, hetero-organics, hydrocarbons, mixture across categories, oxy-organics, pesticides, polymers, volatile organic compounds (VOCs), other inorganic substances, and other substances. Mixture across categories consisted of hazardous substances that were mixed before release, including hazardous substances from more than one of the other 12 categories used. The category "other inorganic substances" comprised all inorganic substances—except for acids, bases, ammonia, and chlorine—and includes hazardous substances such as nitrogen oxide and hydrogen sulfide. The "other" category consisted of hazardous substances, such as asbestos, that could not be classified into any of the other 12 categories.

Fifteen states participated in HSEES in 2005: Colorado, Florida, Iowa, Louisiana, Michigan, Minnesota, Missouri, New Jersey, New York, North Carolina, Oregon, Texas, Utah, Washington, and Wisconsin. Data from two states (Louisiana and Texas) were analyzed to describe the characteristics of hazardous substances releases associated with Hurricanes Katrina and Rita. Events were identified as hurricane-related based on state reports. Events were restricted to the following NAICS codes because the focus of this analysis was releases in industrial settings: 21 Mining, 22 Utilities, 23 Construction, and 31–33 Manufacturing. Descriptive statistics are presented including contributing causal factors, hazardous substances and industries involved in the releases, release type, amount of hazardous substance released, and event scenarios.

3. Results

A total of 166 hurricane-related events occurred in industrial settings in Louisiana and Texas in 2005; 131 (78.9%) events occurred in Texas and 35 (21.1%) occurred in Louisiana. These events represented 5.2% of all HSEES events in Louisiana and Texas in 2005. Most (74.7%) of the events occurred in September; 13.3% were in October and 12.0% were in August. Twenty-five (15.1%) events were related to Hurricane Katrina and 140 (84.3%) events were related to Hurricane Rita. One (0.6%) event was related to both hurricanes and occurred when a third-party clean-up contractor caused a release while cleaning up after both hurricanes. All of the Hurricane Katrina-related events occurred in Louisiana, and 93.6% of the Hurricane Rita-related events occurred in Texas.

Hurricane-related events in industrial settings involved the manufacturing (151 [91.0%]), mining (11 [6.6%]), utilities (3 [1.8%]), and construction (1 [0.6%]) industries. Chemical manufacturing (115 [76.2%]) and petroleum and coal manufacturing (34 [22.5%]) accounted for most of the manufacturing events.

3.1. Contributing causal factors

The most common immediate contributing causal factor was system start-up or shutdown (120 [72.3%]) (Table 1). Of the 120 events where system start-up or shutdown was an immediate contributing causal factor, 6 (5.0%) were shutdowns in preparation for Hurricane Katrina, 59 (49.2%) were shutdowns in preparation for Hurricane Rita, and 55 (45.8%) were start-ups after Hurricane Rita.

Table 1
Immediate contributing causal factors in events related to Hurricanes Katrina and Rita in Louisiana and Texas, Hazardous Substances Emergency Events Surveillance (HSEES) System, 2005

Immediate causal factors	No.	%
Equipment failure	17	10.2
Fire	2	1.2
Human error	1	0.6
Improper filling, loading, or packing	2	1.2
None	10	6.2
Other	1	0.6
Power failure	6	3.6
System/process upset	7	4.2
System start-up/shut down	120	72.3
Total[a]	166	100.1

[a] Percentages do not total 100% due to rounding.