



**GASOLINE STORAGE TANK
EXPLOSION AND FIRE**

Newark, NJ
January 7, 1983



**FIRE
INVESTIGATIONS**

NATIONAL FIRE PROTECTION ASSOCIATION

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Summary Investigation Report

Gasoline Storage Tank Explosion and Fire
Newark, New Jersey
January 7, 1983
1 Fatality

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In Cooperation with

Federal Emergency Management Agency/
United States Fire Administration

and

National Bureau of Standards/
Center for Fire Research

This investigation was conducted by the National Fire Protection Association (NFPA) under an agreement with the Federal Emergency Management Agency/United States Fire Administration (FEMA/USFA) and the National Bureau of Standards/Center for Fire Research (NBS/CFR). It was jointly funded by these agencies and the NFPA.

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ABSTRACT

Ignition of vapors from overflowing gasoline at a storage facility in Newark, New Jersey, caused several minor initial explosions, followed by a devastating explosion that resulted in the death of one oil company employee, the destruction of 4 gasoline storage tanks, and the loss of some 3 million gallons of gasoline. In addition, 24 injuries were reported as a result of the incident. The cause of the fire, which occurred on January 7, 1983, at 12:16 AM, was determined by local investigators to be the failure to monitor the tank-filling operation properly, and the resulting spill was probably ignited by flashback from a nearby incinerator.

The principal factor contributing to the fatality and destruction in this fire was the failure to check closely the rising level of the gasoline being pumped into a storage tank. In addition, some error was probably made in calculating available space and pumping rates.

INTRODUCTION

The National Fire Protection Association (NFPA) investigated the Newark gasoline fire in order to document and analyze significant factors that resulted in the loss of life. This study was conducted under a Major Fires Investigation Agreement with the Federal Emergency Management Agency/United States Fire Administration (FEMA/USFA) and the National Bureau of Standards/Center for Fire Research (NBS/CFR).

The agreement, funded by all three organizations, provides for the investigation of technically significant fires by the NFPA Fire Investigations and Applied Research Division to document and analyze incident details and report lessons learned for loss prevention purposes.

The NFPA became aware of the Newark tank fire and explosion on January 8, 1983. John K. Bouchard, Fire Protection Specialist in the NFPA Quincy, Mass. office, traveled to Newark, New Jersey, to document the facts related to this fire. A one-day, on-site study and subsequent analysis were the basis for this report and NFPA's analysis of the event. An additional one-day visit was made to complete the report. Entry to the fire scene and data collection activities were made possible through the cooperation of the Newark Fire Department. Due to probable litigation, the Texaco Oil Company did not provide assistance. This report presents the findings of the NFPA data collection and analysis effort.

This report is another of NFPA's studies of fires having particularly important educational or technical interest. The information presented is based on the best data available shortly after the fire incident and that obtained during subsequent follow-up.

It is not NFPA's intention that this report pass judgment on, or fix liability for, the loss of life and property at the Newark gasoline storage facility.

The cooperation of John P. Caufield, Director, and Stanley J. Kossup, Chief of the Newark Fire Department, is acknowledged. The assistance and cooperation of Deputy Chief James Raymond, Battalion Chief Robert Fitzpatrick, and Captain Emil Nardone of the Division of Fire Investigation-Arson Squad are greatly appreciated.

BACKGROUND

In this predominantly industrial area just southeast of the Newark Airport on Newark Bay in Newark, New Jersey, the Texaco Oil Company maintained a flammable liquid storage tank farm off Doremus Avenue. The complex consisted of 26 storage tanks for various petroleum products, including gasoline. In addition, there were many flammable, pressurized gas storage tanks in the area, and other oil companies maintained storage facilities in the immediate area (see diagram).

Also within the complex were various structures in support of the fuel handling depot, such as truck stations and buildings housing supervisory personnel, gage equipment and pump controls.

Located apart from the concentrated storage areas were three large covered floating-roof type storage tanks constructed in the early 1960's, and numbered in the diagram as Nos. 67, 65, and 64. The dimensions and capacity of these tanks are shown below, and at the time of the fire contained various grades of gasoline.

<u>Tank No.</u>	<u>Diameter (feet)</u>	<u>Height (feet)</u>	<u>Capacity (gallons)</u>
67	80	50	1.76 MG
65	120	56	4.5
64	187	56	10.89

As shown in the diagram, the tanks were spaced apart, 50 feet between tanks Nos. 67 and 65, and 80 ft. between Nos. 65 and 64. This compares with the minimum spacing required in NFPA 30, "Flammable and Combustible Liquids Code", for these tanks of 34 feet and 77 feet respectively.

These three tanks were contained in a single diked area in the western corner of the yard area, adjacent to several railroad track spurs. The earthen and crushed-rock dike was irregular in shape, but the long side was approximately 900 feet, and the height was approximately 6 feet. The impoundment area could hold approximately 12 million gallons which could contain the largest spill releasable from the largest tank (No. 64), as required by NFPA 30, "Flammable and Combustible Liquids Code".

Each tank was equipped with a vertical riser intended for use with a portable foam pump/generator reportedly stored on the premises of the storage facility. In addition, private hydrants were provided on the perimeter of the diked area.

Underground pipe lines served to load and unload these tanks. In addition, underground piping from a pipeline company at a remote location, Woodbridge Township, New Jersey, was used to supply gasoline to this storage area.

At the time of the incident, it is believed that tank No. 67 was full (1.76 million gallons), tank No. 65 contained 140,000 gallons, and tank No. 64 held about 1.38 million gallons. A total of 3.28 million gallons of gasoline in these three tanks was involved in the fire.

FIRE INCIDENT

Tank Transfer Operations and Explosion

At 6:50 PM, on Thursday, January 6, 1983, the filling of tank No. 67 began with super unleaded gasoline via the underground piping from the pipeline company. The scheduled delivery was approximately 1.6 million gallons (38,000 bbls.) to be completed at approximately 12:10 AM on Friday morning, January 7. This would require a flow rate of approximately 5000 GPM.

At 7:20 PM that same evening, simultaneous off-loading of tank No. 67 to a remote tank No. 5 (see diagram) began. The scheduled transfer amount was 1.09 million gallons (26,000 bbls.), and would provide adequate room for the incoming shipment according to oil company calculations.

Shortly before midnight on Thursday, January 6, two terminal operators visited the diked area in a pick-up truck as the expected fill time approached. Presumably, this visit was in order to secure the operation, including the valves at the pipeline company valve station, which was adjacent to the dike area.

At this time, the operators discovered tank No. 67 overflowing from the vent pipes at the top of the tank. The operators returned to the terminal control building by driving north from the diked area to Delancey Street, then east to the control building, a distance of approximately four-tenths of a mile. Upon reaching their destination, emergency shut-down procedures were implemented, and employees were advised to vacate the premises. It should be noted that the route taken by the employees bypassed the truck terminal building where some controls reportedly existed.

Initially, the emergency procedures called for shutting down the terminal area, which would halt the off-loading to tank No. 5. At the same time, the pipeline company was notified to shut down the supply operation.

At approximately 12:02 AM, January 7, 1983, Conrail employees on duty in the nearby railroad yards discovered the overflow and radioed that they were shutting down their diesel engines because of the strong smell of fuel. Conrail then dispatched a security officer to the scene.

Approximatey 1000 feet to the north, northwest of the overflow incident, there was a metal drum refinishing plant. Part of the drum refinishing operation utilized an incinerator to burn off residues in used barrels. This incinerator was not being utilized at the time, but the unit was fired continuously for efficiency purposes. At approximately 12:10 AM, two

employees on a loading platform were forced back inside as the smell of gasoline vapors was "too strong to breathe". One of the workers telephoned their supervisor to report the situation. Upon hanging up the telephone, several small explosions were heard, and then a tremendous blast occurred.

The weather did not appear to have had a great impact on the ignition scenario, inasmuch as winds were very light, and nearly still at the time of the incident. The drum refinishing operation was slightly below the level of the tank area; eventually the winds were from the SE at about 3 knots (3.5 MPH), which placed the incinerator of the refinishing operation in the path of any drifting vapor cloud.

Fire Department Response and Operations

At 12:16 AM, the Newark Fire Alarm Headquarters received a telephone call from the police relaying a radio communication that there had been a large explosion in the vicinity of the Doremus Avenue industrial plant. At about the same time, the fire alarm operators began to receive numerous reports - ranging from a supposed airplane crash to an exploding vehicle on the highway, and Box Alarm 5782 was struck. This first alarm response included four Engine Companies, two Ladder Companies, a Battalion Chief, a Deputy Chief, and a Rescue Unit. Before the incident was over, a total of four alarms were sounded with a response of 15 engines, four ladders, several rescue units and some 90 fire fighters.

At approximately 12:18 AM, the first arriving companies reported numerous spot fires, burning automobiles, and soon discovered the body of the single fatality. Approach was made down the access road to the diked area, where two of the three tanks involved were found in a collapsed condition, buckled inwards and burning. The third tank (No. 67 in the diagram) was still relatively intact and full of gasoline. The remaining contents of all three tanks was burning furiously.

Within 5 minutes of the initial alarm, a second alarm was sounded, bringing in four more additional engines, a ladder company and battalion chief. At 12:28 AM, the third alarm was sounded, calling for an additional three engine and one ladder companies.

An immediate request was made for the assistance of a foam/crash truck from the New Jersey Port Authority (Newark Airport). Two units were dispatched; however, the unit attempting an approach from the south of the railroad tracks became stuck on the unfinished access road. The other foam unit dispensed its agent load on and into tank No. 67; however, little effect was noted. The attempt was made from a foam monitor nozzle some distance from the tank, and it is uncertain how much of the AFFF solution was successfully directed into the tank. The rate of burning and distance involved were factors preventing an adequate layer of foam solution to extinguish the blaze.

There were hydrants surrounding the diked area of the fire, but their proximity to the burning tanks necessitated relaying water with two 3 inch supply lines from hydrants on Delancey Street down the access road for firefighting efforts at the tanks, the truck terminal, the drum refinishing plant, and the numerous spot fires throughout the general area.

The Newark Fire Department Fireboat was called at 12:40 AM to operate on the bay side of the fire area. This was more of a precautionary move, and the fireboat did not actually become involved in the firefighting operation.

A command post was established at the corner of Delancey Street and Doremus Avenue. At 1:00 AM, a fourth alarm was issued, which brought in three additional engine companies.

Approaches from the south were attempted, and access was eventually gained by crossing the many railroad tracks adjacent to the fire scene, which allowed efforts to be directed at protection of the small "transmix" tank (No. 66 in the diagram) near the pipeline valve and meter station. This small tank,

which suffered some damage to the upper portion of the tank, was alternately reported as being empty and then full during the incident. Subsequently, some 86,500 gallons were reported to be actually in the tank. The contents of the tank did not become involved, due largely to fire department efforts to keep the tank cool with hose streams.

The incident was declared under control at 4:28 PM on Saturday afternoon, January 8. However, the gasoline in tank No. 67 continued to burn for over 24 additional hours, reportedly burning itself out late Sunday night, January 9, 1983.

Explosion Damage and Casualties

The blasts, especially the last (and largest) one, appeared to have had a great deal of force, in that a remote and empty storage tank No. 9 some 1,200 feet away was flattened by the impact, and tank No. 4 some 1,500 feet away was also damaged.

Other reported damage included flattened railroad freight cars and destruction and fires at the drum refinishing plant. At the truck terminal building, large tank trucks were tossed about, several automobiles were incinerated, and numerous fires ignited in the general area. In addition, the impact of the blast damaged several structures of surrounding industrial concerns. Losses have been estimated in the millions.

While apparently leaving the premises because of the emergency, one employee was caught in the open at the moment of the blast and killed. The burned body was found near the charred automobiles at the truck terminal area (see diagram and photo No. 4). Eventually, 24 persons were treated for various injuries resulting from the incident. Those injured included railroad, tank storage facility, and drum refinishing company employees. There were no firefighter or police injuries. It is speculated that the large blast was the ignition of the vapor and large spill at the diked area of tanks Nos. 67, 65 and 64.

ANALYSIS

It appears a tank overflow precipitated this incident. A tank overflow is one of the most serious accidents that can happen to a volatile flammable liquid storage tank.

NFPA 30, "Flammable and Combustible Liquids Code", requires that tanks receiving transfer of Class I liquids (eg. gasoline) shall be either (1) gaged at frequent intervals during the transfer, (2) equipped with high level alarms to signal on-duty personnel, or (3) equipped with high level alarm system to automatically shut down or divert the flow.

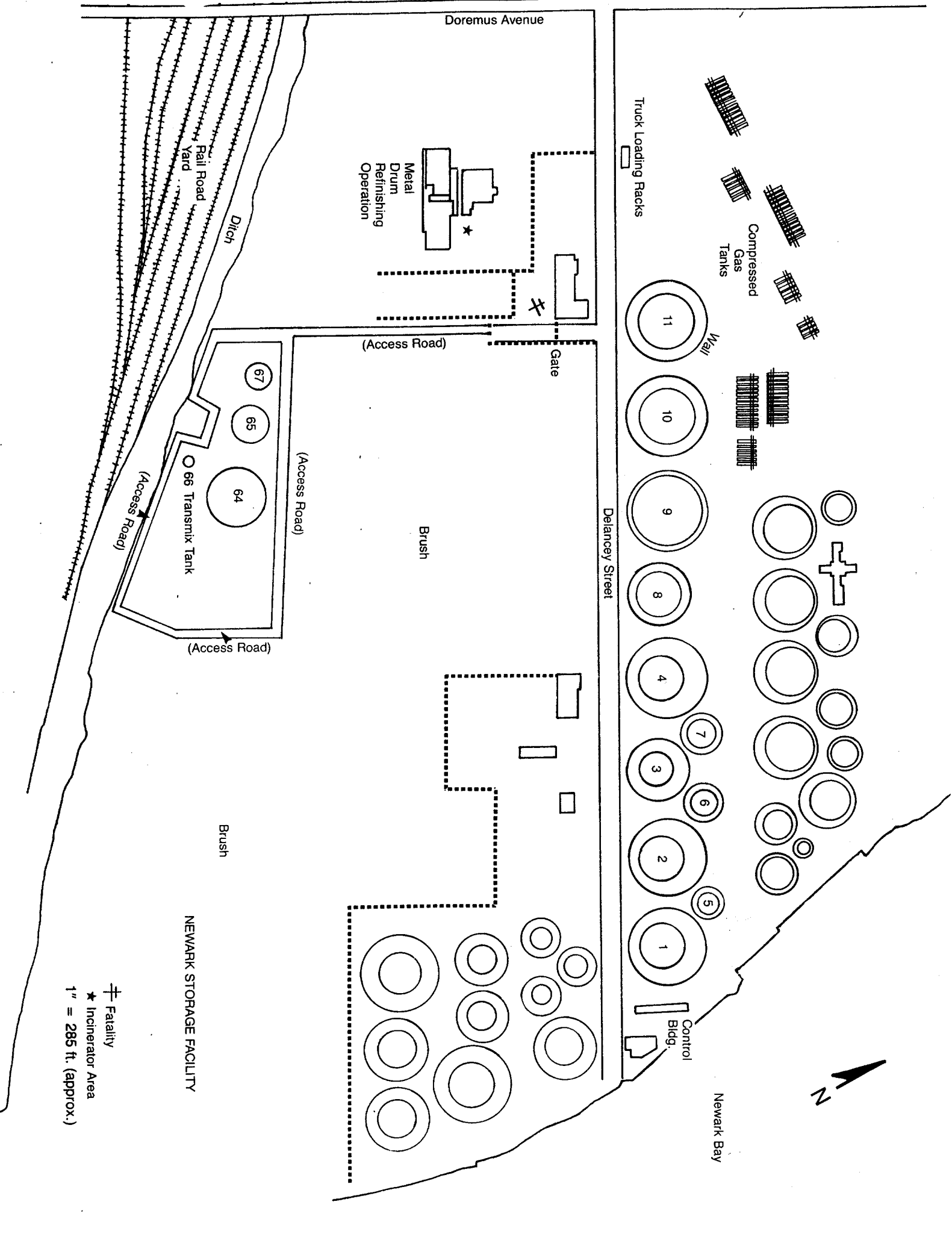
The system for monitoring the level in tank No. 67 was a completely manual one in consideration of option (1) above. Although the standard operating procedures of the tank storage facility stipulated this kind of gaging, no data was available documenting gaging activities prior to the incident. A "check" of the transfer operation was to occur at approximately 12:00 AM, Friday, January 7, as tank storage facility personnel prepared to secure the valves following completion of the transfer. It is unknown exactly when the overflow level of the tank was reached and the spill commenced.

The configuration of the area and an apparent shift in the wind direction brought the vapors from the spill into contact with the suspected ignition source - the incinerator at the metal drum refinishing plant. However, the eventual ignition of the vapors could have occurred regardless of the wind direction by other ignition sources, such as automobile or truck engines, smoking materials, or perhaps the railroad diesel engines operating adjacent to the tanks.

Although notification of the Newark Fire Department is part of the tank storage facility's standard emergency operating procedures, it appears that during the initial emergency operations at the storage facility, the Fire Department was not notified. It is doubtful that immediate notification of

the fire service would have prevented the eventual ignition and explosions. However, it is quite possible that had the Fire Department arrived earlier, fire service personnel may have been caught by the blast, thus increasing loss of life from the incident.

The responding fire service officers and fire fighters handled the situation in a professional and calm manner. A decision to let the fires in the tanks burn themselves out was made after early attempts with the Port Authority foam truck proved unsuccessful, and an evaluation was made of the condition of the tanks and exposure factors. Considerable damage to transfer piping was suspected, and the burning tanks were located in a relatively remote area, properly and adequately diked. Attempts to extinguish the blaze may have resulted in further injury. Salvaging the remaining contents was doubtful, and the loss of the fuel weighed against possible loss of life was insignificant.



Doremus Avenue

Truck Loading Racks

Compressed Gas Tanks

Metal Drum Refinishing Operation

(Access Road)

Gate

Delancey Street

Brush

(Access Road)

(Access Road)

66 Transmix Tank

Brush

NEWARK STORAGE FACILITY

Newark Bay

Control Bldg.



✚ Fatality

★ Incinerator Area

1" = 285 ft. (approx.)