THE PATCHOGUE OIL TERMINAL FIRE

. . . A 1987 Commentary

Original Article
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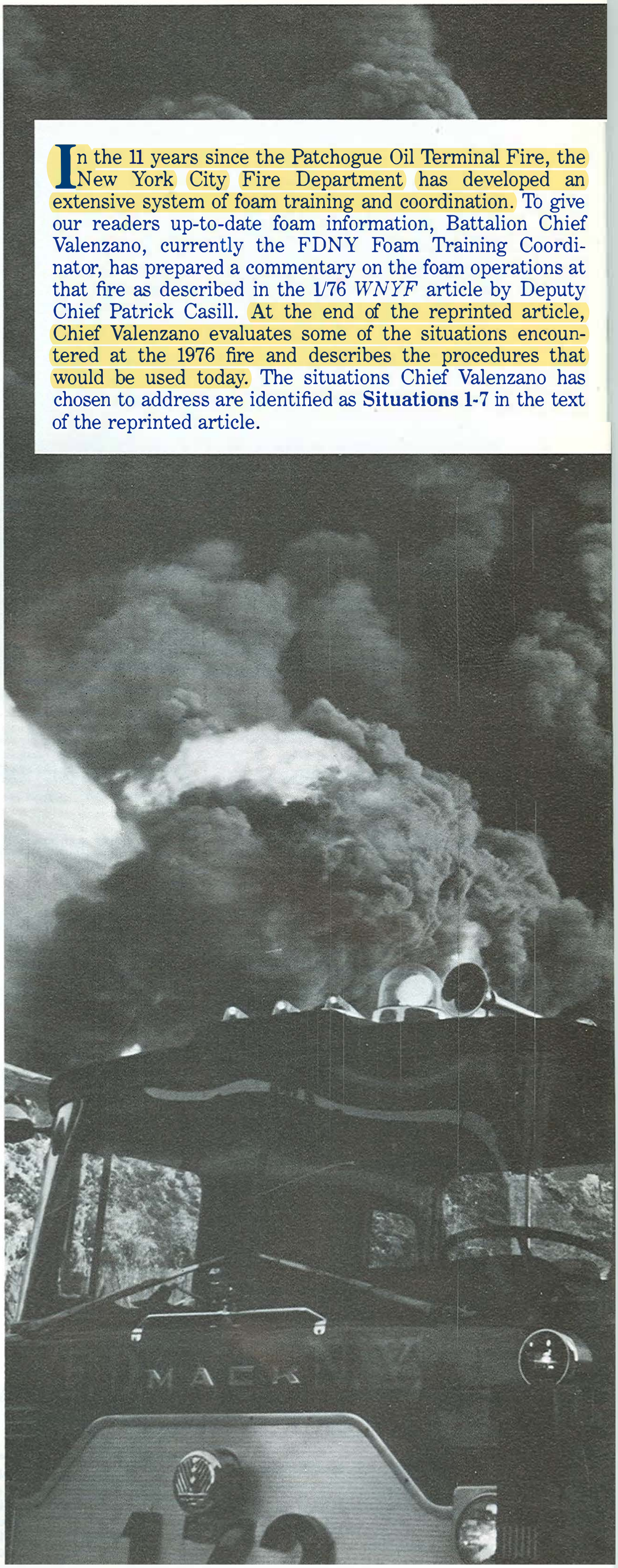

In the 11 years since the Patchogue Oil Terminal Fire, the New York City Fire Department has developed an extensive system of foam training and coordination. To give our readers up-to-date foam information, Battalion Chief Valenzano, currently the FDNY Foam Training Coordinator, has prepared a commentary on the foam operations at that fire as described in the 1/76 *WNYF* article by Deputy Chief Patrick Casill. At the end of the reprinted article, Chief Valenzano evaluates some of the situations encountered at the 1976 fire and describes the procedures that would be used today. The situations Chief Valenzano has chosen to address are identified as **Situations 1-7** in the text of the reprinted article.

"As I was speaking with Mr. Murphy, from the tugboat Ocean King, I heard an increasing roar, like a low flying jet plane. It grew constantly louder. As I stepped out of the guard house and looked toward the mounded fuel oil tanks, I saw black columns of smoke with bright orange streaks through them, coming out of the tanks. The roaring jet noise continued for about thirty seconds and then there was an explosion."

This was the description given by the security guard of conditions at the Patchogue Oil Terminal at 2000 hours on Sunday, January 4, 1976. This was the start of an oil tank fire that taxed the resources of the New York Fire Department for thirty-six hours before being brought under control.

Engine 279 and Ladder 131, quartered approximately five blocks from the Patchogue Oil Terminal, heard the same loud jet roar and explosion as the security guard, and felt the vibrations of the explosion throughout the firehouse. They were preparing to respond before the dispatcher transmitted Box 1338 at 2004 hours. When they arrived at the scene, these units found a very heavy fire condition, with a large column of black smoke at 749 Court Street, an oil storage yard. The fire condition had already become so advanced, that Battalion Chief Gataroska, 32nd Batt., transmitted the second alarm while still several blocks from the fire.

PHYSICAL LAYOUT OF TERMINAL

The Patchogue Oil Terminal has a storage capacity of approximately 31,500,000 gallons of fuel oil in its thirteen storage tanks. The critical area of concern, Tanks #3, #4,

#5, #6, #7, and #8, are in one group described as mounded tanks that are twenty-five feet high. They are constructed of 3⁄16″ and 1⁄4″ steel plate, with welded seams, and have criss-crossed interior steel supporting members. Three quarters of the perimeter of these above ground tanks are protected by a ten foot wide span of earth fill, held in place by a twenty foot high concrete retaining wall. One quarter of the perimeter, Tank #8 and a small portion of Tank #6, (see diagram) is protected by a twenty-five foot concrete wall, and by an open space varying from three feet to ten feet. This space is protected by a foam system. The top of the tanks are covered by two feet of earth fill. A foam generating and delivery system, as per the Fire Prevention Code, was installed and was operative to all tanks for fire protection. While the diagram and numbered sections indicate that we are dealing with six tanks, according to the Fire Prevention Code there are only three tanks. Tanks numbered #3, #4, and #5 are actually one tank, partitioned into three compartments. Tanks numbered #6 and #7 are also one tank, but with two compartments. From a firefighting point of view, this is important because of the difference in fire protection afforded by a 3⁄16″ steel wall, as opposed to a double wall—each 3⁄16″ wall separated by an eighteen inch space, filled with an incombustible material. In this particular tank grouping, Tanks #3, #4, and #5 were separated from #6 and #7 by eighteen inches of concrete. Tanks #6 and #7 were separated from Tank #8 by eighteen inches of earth fill. However, the earth fill had eroded and was not replaced, so that between the walls of Tanks #6 and #7, and Tank #8 we had an eighteen inch void.

Oil Plant Operation 1/4/76, Before Incident.

As January 4th was a Sunday, there was very little activity at the oil plant. An oil tanker, the *Esso Roma*, was unloading No. 6 oil, topping off Tanks #3, #4, #5, and #8. Therefore, Tanks #3, #4, and #5 (4,822,000 gallons) and Tank #8 (2,000,000 gallons) were full. Tank #7 (1,425,000 gallons, No. 2 oil) was a little more than three quarters full, with a vapor space of about five feet.

Tank #6 was the only non-routine operation at the Patchogue Oil Terminal. This tank had been in service with No. 6 oil. For six weeks prior to December 30, 1975, Lara and Sons, Inc., a tank cleaning company, was in the process of cleaning this tank so that a changeover to No. 2 oil could be made. To accomplish this cleaning operation, men enter the tank and, using squeegees and suction-hose, discharge the sludge into tank trucks. Then the walls and interior bracing are washed with No. 2 oil, which is again squeegeed and vacuumed out. On December 30, 1975, with 90 per cent of the cleaning completed, approximately 300,000 gallons of No. 2 oil was introduced into Tank #6 for one final wash. This 300,000 gallons was to be left in the tank for a few days, heat applied to it, and Lara employees would again squeegee and suction out the remaining sludge. Three hundred thousand gallons of oil in this tank meant that this tank contained approximately two feet of liquid, and twenty-three feet of vapor space. This bomb erupted with a roar at 2000 hours on January 4, 1976.

CONDITIONS ON ARRIVAL

The first arriving units were met with a very large bulk oil fire, inherent with monumental problems of control, extinguishment, and life safety. A raging fire involved Tank #6, one of the several contiguous partial underground tanks that were contained by concrete and earthen bunkers. Above Tank #6, a massive body of flame, about fifty feet in diameter, disgorged huge volumes of black smoke. Fire balls and flames could be seen rising to a height of over seventy-five feet above the tank cover. The intensity of the fire

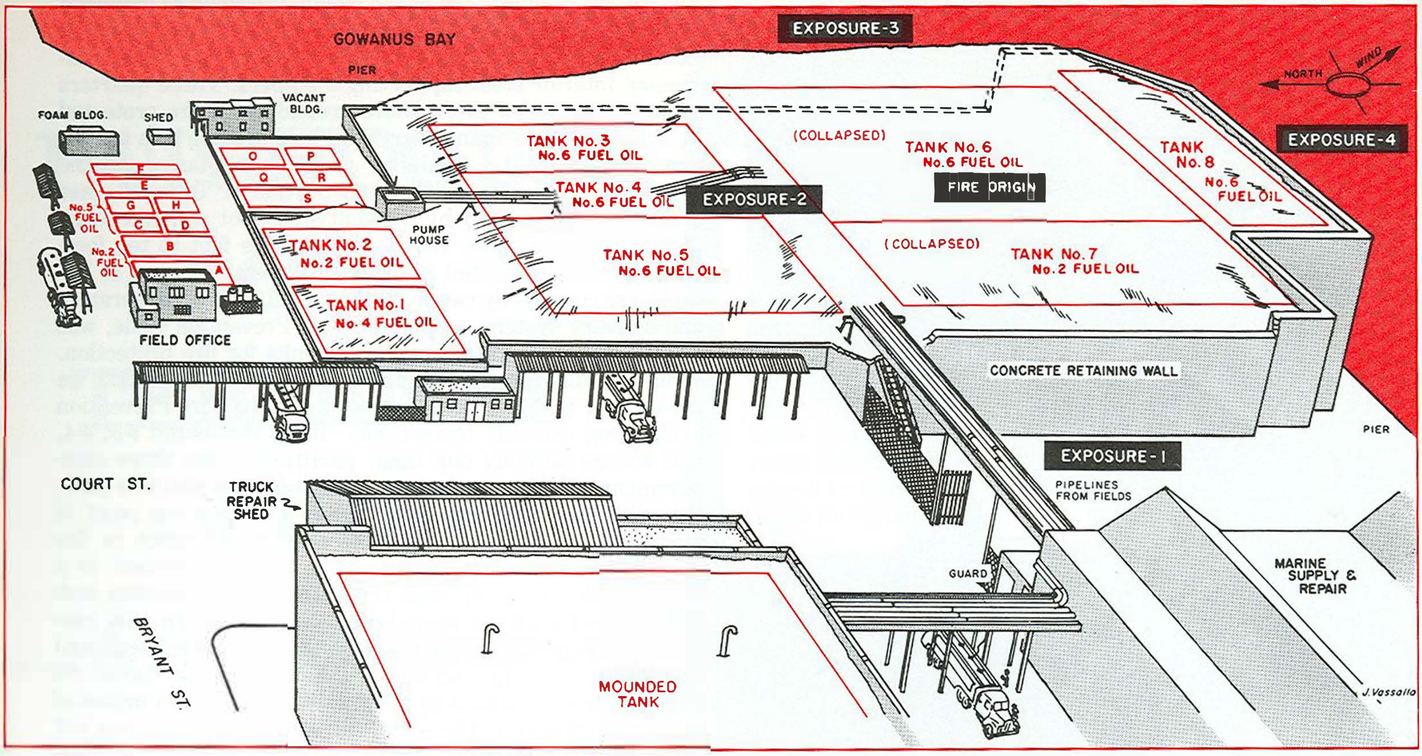

Illustration shows physical layout of Patchogue Oil Terminal.

indicated that it had an ample supply of fuel. What was not immediately known was that additional oil was also being supplied to the blaze by Tank #8, whose contiguous wall had ruptured during the initial explosion. Tank #8 was also leaking oil directly into the Gowanus Canal, endangering piers, ships, and the adjoining occupancies. This was a new dimension to an already serious fire problem. The cold and gusty thirty mile per hour wind compounded these problems; and our forces would have to contend with them this night.

INITIAL STRATEGY

Heavy streams from Tower Ladders, Fireboats, and Stang nozzles were used to cool down the area and protect the exposed tanks, while the plant's foam system was being employed to extinguish the fire. It soon became apparent, however, that the plant foam system had no effect on the fire. It was assumed that their foam distribution system was damaged by the initial explosion.

With supervisory plant personnel now on the scene, a reassessment of the situation had to be made. Using Court Street as Exposure One, Tanks #3, #4, and #5 became Exposure Two. These exposures were considered comparatively safe due to their separation from the fire by eighteen inches of concrete and a favorable north west wind. Stang nozzles were used to keep these tanks cool (**Situation 1**). Exposure Three was a pier. This pier was protected somewhat by the twenty foot concrete retaining wall, but with the wind blowing the heat and flames in its direction, it was subject to radiant heat. A Stang nozzle and fireboat streams were immediately set up to protect the pier.

Exposure Four presented the biggest problem. The explosion and fire appeared to be centered in that portion of Tank #6 that sided on Exposures Three and Four. The wind (15 miles per hour, with gusts to 30 miles per hour) was blowing toward Exposure Four. It was determined that No. 6 oil was leaking into the Gowanus Bay at the east side of Tank #8. This indicated that Tank #8 was ruptured, and was feeding No. 6 oil to the fire and into the Gowanus Canal. The Coast Guard set up flotation collars to contain the oil leaking into the water and, after the fire was brought under control, they supervised the clean up of oil in the canal. But the oil feeding the fire in Tank #6 was probably the main obstacle to the control of this fire. Tank #8 was being cooled and protected by fireboat stream.

(Situation 2) With the exposures being protected by heavy streams, foam had to be applied to Tank #6. However, with a prevailing 30 mile per hour wind from the north west, the application of foam, from the fireboats, on Exposures Three and Four was ineffective. The stability of Tanks #4, #5, and #7 was ascertained, and the temperature of the oil in these tanks constantly monitored to ensure that any dangerous increase would be detected. The foam was then applied to the fire from these positions.

(Situation 3) Hi-Ex foam units were placed in operation, but the freezing temperature caused the fans to ice up and they became inoperative. Hand lines from the Foam Unit, with pick-up tubes, were placed into operation. Hand foam lines from Marine Company 1 and Marine Company 6 were also stretched and operated.

By Monday morning, January 5th, headway was being made in developing a foam blanket. The foam lines were lashed down, requiring a minimum number of men on the tanks at any one time, and then only when adjustments were necessary in directing the streams. All the black smoke and visible fire had dissipated except for that area where Tank #8 was leaking oil into Tank #6. With the oil flowing, it was proving difficult to blanket this area with foam.

SECOND EXPLOSION

At 1400 hours, with the fire almost under control, a pressure blast and explosion occurred in Tank #7, lifting the earth fill surface of the tank, throwing several of the operating firefighters to the ground. Happily, all escaped with only minor injuries.

To bring the fire problem at this point into proper perspective, it must be realized that initially we were dealing with a fire that involved 300,000 gallons of No. 2 oil, and an unknown quantity of No. 6 oil feeding that fire. All this was occurring in an area covering 20,000 square feet.

That condition required a dispatcher's 4th alarm to be transmitted in order to obtain sufficient manpower and equipment.

The explosion of Tank #7, on January 5th, changed the entire complexion of the operation. When Tank #7 exploded, 1,425,000 gallons of No. 2 oil was suddenly added to the fire, and the area involved was increased to 30,000 square feet. Immediately after this explosion, a dispatcher's 5th alarm was transmitted.

OPERATIONS REEVALUATED

(Situation 4) From the onset of operations, it was known that foam in large quantities would be needed to bring this fire under control. Special arrangements were made to collect and deliver all the available foam from Fire Department units throughout the city. Wholesale distributors, who normally supply the Fire Department, were called upon and requested to open their warehouses at midnight, Sunday, January 4th, to make emergency deliveries.

(Situation 5) The amount of foam gathered from Fire Department units totaled some 5,000 gallons of the 3 per cent low expansion proteinaceous type; the greatest amounts coming from the Marine Division and the Repairs and Transportation Unit. We also received approximately 9,000 gallons of the 3 per cent foam from various sources such as Con Edison, oil companies, and wholesalers. The Port Authority of N.Y. & N.J. and the Mount Vernon Fire Department delivered approximately 2,500 gallons of their 6 per cent low expansion proteinaceous foam, and the 3M Company made emergency deliveries in the form of 5,500 gallons of Aqueous Film Forming Foam. Some of the much needed foam was also "trucked" in from Philadelphia.

Before this fire would be brought under control, a total of more than 22,000 gallons of foam solution would be used by units of this department.

With the explosion of Tank #7, the entire operation had to be reevaluated. After consulting with all Assistant and Deputy Assistant Chiefs present, Fire Commissioner O'Hagan developed the following strategy: Create a holding action by covering all of the exposures with heavy streams, thereby preventing the spread of fire to any of the other tanks. Then, marshal all available means so as to apply the largest quantity of foam possible in the shortest period of time. This was accomplished by positioning Tower Ladders on Court Street and on the pier (Exposures One and Three). These ladders were set up with a foam pipe and proportioner, and an ample supply of foam. Additional support was given these units by placing a Port Authority airport crash unit on the Exposure One side, and a Mount Vernon foam truck on the Exposure Three side. Marine units were resupplied with foam and brought in as close as possible on the Exposure Four side.

At about 1800 hours, January 5th, when all apparatus and Marine companies were in position, foam was applied from all units simultaneously. It was soon observed that this method of attack was meeting with success. A blanket of foam was building up, and the area and intensity of the fire was diminishing.

During the balance of the night foam was applied to maintain the foam blanket, and to prevent reignition of the oil fumes while the steel tanks cooled down. At 0802 hours, January 6, 1976, thirty-six hours after the initial explosion, the fire was declared under control.

CONCLUSION

Possible Cause. At the time of this writing, the cause of this blaze has not been determined and is still under investigation. The areas of investigation include:

1. Extension wires were used by plant personnel for temporary lighting in Tank #6. In this instance, there

Photo by F. Murphy

Land units and Fireboat *Archer* combine their forces to press home the attack from Gowanus Bay, the Exposure #3 side of the fire.

Photo by C. Justice

Above: Members applied thousands of gallons of foam to this fire. Foam was obtained from all available sources in and around the City. *Below:* Fireboat McKeon trains its heavy guns on the fire. Note floatation collar *(foreground)* placed by U.S. Coast Guard units to control oil spilling into the Gowanus Bay from ruptured Tank #8.

Photo by F. Murphy

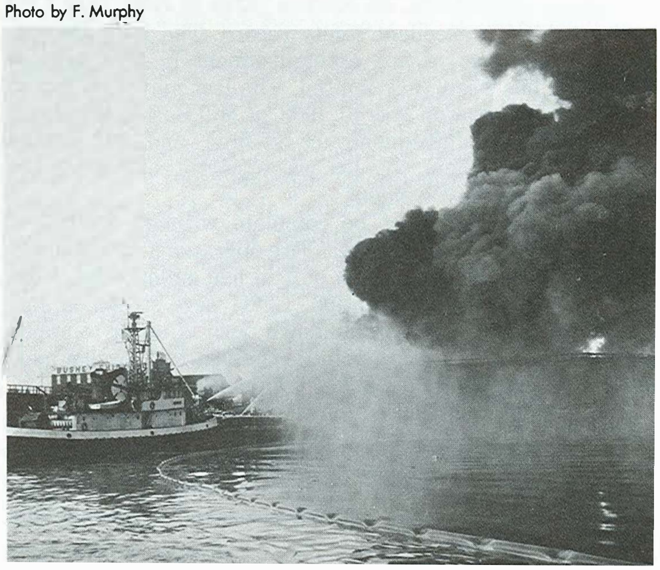

Photo by F. Murphy

Fire Dept. units prepare to attack fire raging from Tank #6. Condition shown here is what units were met with upon their arrival.

is the possibility that either the breaking of a light bulb, or the shorting out of a wire, could have caused a spark in the vapor space.

2. The heating of a relatively small amount of oil in a large tank (large vapor space) over a period of several days. This condition could have raised the temperature of the vapors in the tank to the point of autoignition.

It will be some time before investigations are completed and the cause properly defined.

Due to the high standards of construction and rigid fire prevention inspections, oil storage yards in New York City have enjoyed an excellent safety record. The Fire Department's experience of fire extinguishment in this type of occupancy has been very limited. The last major oil fire in New York City was on May 10, 1962, at Mill Basin, Brooklyn. And despite the infrequency of oil fires, and our limited experience with them, this fire was expertly confined to the tanks of original involvement.

This article would not be complete without a word of praise for New York's "valiant." Fire operations required the moving of tons of foam, much of it in five gallon cans, from trucks to the point of operation. Lines were stretched and operated from positions of unknown peril in order to apply foam to the fire. A case in point is the fact that twelve men were operating on top of Tank #7 when it exploded.

And, we would indeed be remiss if we did not express our gratitude and appreciation to all those outside agencies that came to our assistance. Our thanks to the U.S. Coast Guard, The Port Authority of N.Y. & N.J., Con Edison, the Mount Vernon Fire Department, and the various oil companies and wholesale foam distributors.

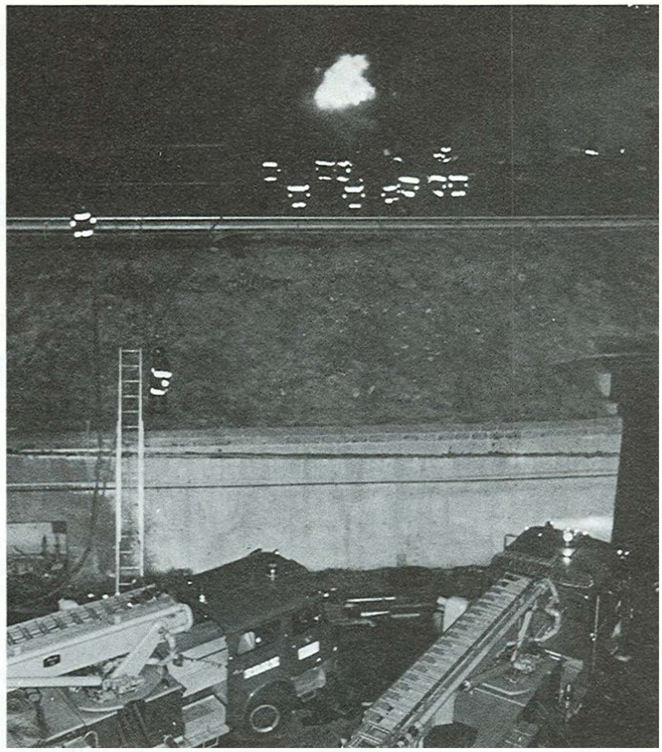

Photo by C. Justice

Firefighters operate from atop earth fill surface of oil storage tank. Several firefighters were injured (none seriously) when an explosion lifted the earth fill and threw them to the ground.

LESSONS LEARNED

- While the foam distribution systems at oil storage yards are designed to control most fires, there is the distinct possibility of these systems being rendered inoperative. Fire Department training to control fires in these instances must be reinforced.
- Foam supplies on hand (in units and our storage depot) may, once again in the future, prove inadequate. Backup supplies for emergencies should be catalogued, with the means for obtaining and transporting them during non-business hours.
- The efficiency of Hi-Ex foam on fires of this magnitude is doubtful. The light weight and small water content of Hi-Ex foam appeared to be unable to overcome the thermal updraft and high heat developed at this fire. Further testing must be conducted.
- Protein foam applied in small quantities also proved ineffective. Only when applied faster than its breakdown by heat was it capable of developing an efficient blanket.
- **(Situations 6 and 7)** Protein foam and Aqueous Film Forming Foam were compatible when applied simultaneously. Further testing with Aqueous Film Forming Foam, using our fog nozzles, is necessary.
- Whenever other than normal conditions exist at oil storage yards, such as the cleaning of oil tanks, extreme caution must be exercised by plant personnel. While bunkered and mounded tanks are considered to be extremely safe storage, carelessness can have catastrophic results.

COMMENTARY

Situation 1—USE OF WATER ON EXPOSED TANKS

The primary use of water at an oil terminal fire should be to make foam to extinguish the fire. Of course, water should be used when fire is impinging on an exposed tank and on pressure vessels exposed to the fire. If doubt exists, a

FOAM APPLICATION (At .16 G.P.M. per sq. ft.)				
TANK DIAMETER (FEET)	SQUARE FEET OF BURNING SURFACE AREA	MINIMUM FOAM SOLUTION (G.P.M.)	FOAM CONCENTRATE REQUIRED (G.P.M.)	STOCKPILE OF FOAM CONCENTRATE AT FIRE SITE (GALS)*
30	706	113	4	24
50	1962	314	10	600
70	3846	616	19	1140
80	5024	804	25	1500
100	7850	1256	38	2280
115	10381	1661	50	3000
135	14306	2280	69	4140
150	17663	2826	85	5100
200	31400	5024	151	9060

*1 hr. supply

stream can be applied to the exposed tank. If a large volume of steam is generated as a result, then water should be applied until cooling is achieved.

Judicious use of water is necessary because not all diked areas have the capability of pumping out water. The overuse of water on exposures can cause the flooding of these diked areas leading to an overflow and hampering firefighting operations.

Tanks with floating roofs usually are not candidates for cooling because they do not permit vapor to form; consequently, there is nothing to ignite. If cooling is called for on a tank with a floating roof, caution must be observed in not allowing water to enter the tank. In a floating roof tank this is important because water can sink the roof. (Fires in these tanks usually involve the seal area around the floating roof; placing foam into the seal area is usually all that is required to extinguish these fires.)

Covered tanks with vents are usually of the pressure-vacuum type. They are set to operate at from three to 12 ounces of pressure and will close when the pressure is diminished. These tanks have to be monitored but not cooled indiscriminately.

Mounded-over tanks cannot be cooled effectively because the entire surface of the tank is not exposed.

Tanks which are filled with product will require less extensive cooling because the product absorbs the heat of the exposing fire. However, it is important to monitor these tanks also.

In all operations of this nature, the expertise of plant personnel should be utilized immediately in the use of fire protection systems, types of tanks, types of product and whether the tanks are full or empty.

Situation 2—FOAM DELIVERY SYSTEMS

The efficiency of finished foam streams is affected by the wind. Fighting an oil terminal fire today, heavy caliber foam streams operating with the wind would be used. Tower ladders allow better placement of finished foam on the fire.

All tower ladders, with the exception of the 100-foot Sutphen, can be equipped with a modified Angus Foam Cannon which can deliver in excess of 1000 GPM of solution to the fire. The necessary equipment to mount the Angus Cannon is carried by all satellite units.

All 2000 GPM pumpers assigned to the satellite system are equipped with a foam module which regulates the amount of foam concentrate to be placed in a foam stream. When these modules are used, eductors are not required.

Back-up engine companies for the satellite 2000 GPM pumpers are equipped with portable foam injection modules. These are supplied by bulk foam or foam carrier units whose booster tanks are filled with 500 gallons of bulk 3% fluoroprotein concentrate. The foam system now in use allows foam concentrate to be pumped from remote locations to the area of operations.

Situation 3—USE OF HI-EX FOAM

Although manufacturers recommend using Hi-Ex Foam on Class B fires, its use must be very selective and conditions must be within its limited capabilities. The disadvantages of its use on hydrocarbon fires far outweigh its advantages. Due to the high heat of hydrocarbon fires and Hi-Ex Foam's fast drainage rate (loss of water from the finished foam blanket), Hi-Ex Foam blankets tend to break down rapidly. Even if the density and the application rate of Hi-Ex Foam were increased dramatically, its blanket stability would still not stand up to the thermal updraft created by these fires.

In addition, wind in excess of 10 M.P.H. disturbs a Hi-Ex blanket and rain has a tendency to break it down. Because of these properties, it is necessary to place generators and foam chutes so close to the fire that it endangers personnel.

It is important to note here that under no circumstances should personnel be positioned on tanks. The integrity of the tank may already be compromised by the normal corrosive action of the product on the metal roof suports. The addition of heat from the fire further increases the possibility of a roof collapse.

Situation 4—INSURING ADEQUATE SUPPLIES OF FOAM CONCENTRATE BEFORE START OF FOAM OPERATIONS

Before starting foam operations, it is necessary to have on hand a minimum of one hour of foam concentrate coupled with nozzles of adequate size to apply the required solution at the proper rate.

The tank involved in the Patchogue Oil Terminal fire was approximately 160 feet in diameter. In order to compute the amount of solution necessary to apply to this size tank, refer to the Foam Application Table above. (A Table similar to this is carried by all Battalion Foam Coordinators).

Reading across the Table, using the 150′ diameter row, the last column shows that well over 5100 gallons of foam concentrate (a one hour supply) is required at the site prior to the start of fire extinguishment. The third column is the Minimum Foam Solution Application Rate for fluoroprotein foam. At .16 GPM of solution per square foot of area, this shows that almost 3000 gallons of foam solution per minute are required for the 150′ diameter tank. This would require three 1000 GPM nozzles. The Angus Foam Cannon can exceed its rated capacity of 1000 GPM of solution depending on the water source and pumping capacity of the supplying pumper.

(Continued on page 22.)

written decision is returned to the respondent and the Fire Department within a short period of time.

NOV PILOT PROGRAM

The Bureau of Fire Prevention—which has 180 inspectors working in 24 inspectional units—began using the NOV in March 1986. The initial, six-month pilot program introduced this new method of issuing violations in seven inspectional units, all staffed by uniformed members. During this period modifications were made in certain forms and procedures. Substantial experience was gained in training NOV users.

In October 1986 the Bureau's remaining nine uniformed inspectional units and three of its civilian inspectional units began using the NOV. By March 1987, NOVs were being issued at an annual rate of approximately 36,000. The use of the NOV seems to be an effective tool in getting the public to comply with the Fire Code. A high percentage of NOVs are resulting in cures, although penalties are often imposed.

THE ENFORCEMENT UNIT

The Bureau of Fire Prevention's Enforcement Unit serves as the liaison between the Department and the ECB. All NOVs served by inspectors are returned to the Enforcement Unit which processes them and sends Department representatives to ECB to argue the Department's cases. Processing includes handling all required data entry (NOVs are tracked on both the ECB's and the Bureau of Fire Prevention's computer systems) and filing of materials.

The Enforcement Unit consists of a director and a small staff of attorneys who resolve legal issues pertaining to the new process and handle cases returned to the ECB on appeal. Also under the director are a number of sections that play a crucial role in processing NOVs and Criminal Court summonses. Both types of cases require substantial preparation before being brought before the appropriate adjudicatory body.

FUTURE PLANS

The NOV is now being used by all inspectional units of the Bureau of Fire Prevention which can make good use of it. The Department will expand its use to field forces through a Pilot Program during the fall of 1987. The advantages are expected to be similar to those found by inspectional units of the Bureau of Fire Prevention. Among these are fewer reinspections and more significant penalties for noncompliance. ▲

(The Patchogue Oil Terminal Fire cont. from page 7.)

Situation 5—USES AND TYPES OF FOAM

Our Department now uses 3% fluoroprotein concentrate in both cans and in bulk. Fluoroprotein foam is better suited for use from large caliber and hand line foam streams because of its "fuel shedding" property. Fluorprotein foam plunged into the product will shed fuel, rise to the surface, and extinguish the fire.

Protein foam doesn't have this "fuel shedding" property. It is necessary to bank it off a vertical surface so it can flow onto the fire gently. If protein foam is plunged into the fuel, it will break down and burn.

Situation 6—MIXING DIFFERENT TYPES OF FOAM CONCENTRATES

Mixing different types of foam concentrates is not recommended. When a synthetic material such as Aqueous Film Forming Foam (AFFF) is mixed with a fluoroprotein concentrate (protein base material), a breakdown of the protein material occurs since the AFFF acts as a defoamer.

When AFFF and fluoroprotein foams are applied simultaneously to a fire, the AFFF blanket will displace the fluoroprotein blanket. Since an AFFF blanket's drainage time (the rate at which 25% of the water in a blanket drains off) is faster than that of a fluoroprotein blanket, the blanket stability and burnback resistance of the AFFF is short-lived. Its inability to adhere to hot metal, such as heated tank walls, prevents it from forming the complete seal necessary to extinguish the fire. All of the above drawbacks are directly influenced by pre-burn time (the time from the start of fire to the first application of extinguishing agent).

Situation 7—USE OF AFFF THROUGH FOG NOZZLES

As a result of tests conducted at the Division of Training since 1976, the FDNY has decided to use fluoroprotein foam with aerated nozzles and equipment for most of its foam operations. The only exception is AFFF which is used in portable extinguishers.

CONCLUSION

Since 1976 FDNY has acquired new equipment and developed training and coordination plans to improve its response to foam operations. The following is a listing of some of the major developments in the Department's foam capabilities.

BATTALION FOAM COORDINATORS—Seven battalions throughout the City have been designated Foam Coordinator Battalions. Battalion Chiefs assigned to these battalions have received special training in foam operations. Their function is to assist the chief in charge at any fire requiring foam operations.

RADIO SIGNAL 10-86—Signal 10-86 with its associated codes has been established to provide specific responses to fires or emergencies requiring any type of foam concentrate in addition to that carried by units on the scene.

FOAM AVAILABILITY The Department now has seven foam carrier units assigned as second units. Each carries 500 gallons of concentrate in its booster tank at all times, a total of 3500 gallons of concentrate immediately available. In addition, these units carry Hi-Ex, fluoroprotein, and alcohol resistant fluoroprotein concentrate in five-gallon cans. An additional 6000 gallons of concentrate is available from the 12 engine companies designated as bulk foam units, each of which has 500 gallons of bulk concentrate stored in separate tanks in quarters. (These units must first empty water from their booster tanks prior to filling up with concentrate.) An additional 500 gallons of bulk concentrate is stored at the Repairs and Transportation Unit.

The following units, Engine Companies 207, 72, 9, 330, 152 and 324, are all equipped with 2000 GPM pumpers and satellites which can provide necessary tools for foam operations.

Eleven years after the Patchogue Oil Terminal fire the Fire Department has greatly improved its ability to deliver and apply large amounts of foam concentrate. In fact, within approximately 90 minutes, the Department's foam-carrying vehicles can provide 10,000 gallons of bulk foam concentrate to almost any part of the City. ▲