

F.D.N.Y. *HAZ-MAT*





F.D.N.Y. Haz-Mat



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Photo: Lt. Anthony Guerriera/FDNY Forensic Unit

Welcome to the 21st Century!

Two centuries ago the construction of large buildings full of flammable materials spelled the death of the bucket brigade and made the introduction of the pumper a necessity. But even as pumpers evolved into today's diesel-powered behemoths, and aerial trucks and tower ladders joined the firefighter's arsenal, the fuel feeding fires remained pretty much unchanged—wood, paper, and the like, although gasoline and other explosives started becoming a hazard with the dawn of the 20th century.

Today a new age of man-made hazardous materials is confronting the fire service at every level: low-level radiation resulting from medical and manufacturing processes—as well as liquid petroleum gas, anhydrous ammonia, flammable and combustible liquids, polyurethane, flammable solids, explosives, poisons, reactive and unstable chemicals with names that are as unpronounceable as their characteristics are unknown to anyone other than expert chemists. Increasingly these materials are replacing the wood, paper and cloth that have always posed a fire threat in our daily lives.

Each of these modern-day chemical formulations is designed to benefit humanity. They make our lives more convenient, more comfortable, even safer. Yet—just as with fire itself—there is a dark

side to them, and when they are out of control they can injure and kill with fury.

In the most dramatic cases we confront hazardous materials at railroad or truck accidents, at factories or refineries, but they are also hazards in your everyday life even if you are not near a railroad derailment: Just consider the plastics in your home and office—and then think about the trucks carrying chemicals that pass through your neighborhood.

The most fearsome ones, however, involve nuclear power out of control: Chernobyl, Three-Mile Island, and the 1975 Brown's Ferry, Alabama, nuclear plant fire which disabled the reactor's core cooling system. It was started by electricians using candle flames to search for air leaks and touching off polyurethane insulation. It was extinguished in 20 minutes, six hours after it erupted—and after both power units were near meltdown—when the emergency workers finally took the advice of the local fire chief . . . and applied water.

Fire service professionals know how to get things done and that is why the Fire Department of New York City has a Haz-Mat unit.

We are mobilized to deal decisively with the threats posed by technology's breakthroughs. And as new potions come bubbling out of the test tubes, the FDNY will be ready with the knowledge, the means and the skills to contain them.

Welcome to the benefits and the hazards of our chemical-dependent future—and to Haz-Mat, the newest frontier in firefighting.

JOSEPH F. BRUNO
Fire Commissioner

Hazardous Materials Defined

Hazardous materials are any liquid, gas, solid, dust, or vapor that can damage or destroy by explosion, fire, corrosion or toxic reaction. There are millions of shipments of hazardous materials in the United States every year. Some analysts estimate that one out of every three trains and one truck in every ten is carrying some type of hazardous material. In most cases, when they are properly contained or used, hazardous materials do not present a problem. But when the materials are not under control, e.g. during fires, accidents, spills or releases, they present significant problems. In many cases waste products from substances can cause more problems than the original product, particularly when wastes are illegally transported and dumped.

Protecting members and civilians at hazardous materials incidents is a complex problem. Humans can be exposed to toxic substances through inhalation, ingestion, and contact with, or absorption through, skin. The effects of exposure vary widely but they are classified in two major categories—acute and chronic. Acute exposure occurs over relatively short periods of time, from a few hours to one or two days. Chronic exposures are those occurring over longer periods of time, generally months or years. Acute exposure to hazardous materials in air is more typical in transportation accidents, fires, or releases from manufacturing or storage facilities. Acute exposure through inhalation and absorption can occur when firefighters come close to substances while controlling their release. Therefore, self-contained breathing apparatus (SCBA) and full firefighting equipment are the firefighter's greatest protection in an incident where contamination is suspected.

Regulations regarding labeling are designed to protect civilians transporting and handling hazardous materials but they are often of limited assistance to firefighters or other first responders. Fires and accidents can obscure or destroy labels and weaken or rupture containers. Heat can cause chemical and physical changes in materials, transforming them from harmless to dangerous and from dangerous to highly hazardous. These conditions complicate and add additional risks to the job of firefighters. Recognition of

potential hazards and informed action or calculated inaction at hazardous materials incidents can make the difference between a controlled operation and one of major proportions.



Two members of the Haz-Mat unit in protective clothing signal their readiness before descending into a manhole to fight a transformer fire at Park Avenue and 78th Street in Manhattan. Photo: Vic DeLucia/The New York Times

Why Haz-Mat is Essential

Prior to 1980, New York City had a very limited capability to handle a hazardous materials incident. The Fire Department, with its rescue companies and specialized equipment, was capable of handling most minor incidents with backup from within existing fire department resources. Two critical events propelled the FDNY into its present Haz-Mat capability.

The Bridge

The first incident had all the ingredients of a major catastrophe and is one which any community could face. It involved a severe propane gas leak from a tank truck stopped on the off-ramp of the George Washington Bridge, part of a major arterial network. The tank truck was carrying 9,000 gallons of liquefied propane and was venting propane in gaseous form from a malfunctioning relief valve located at its top.

The truck was stopped on an off-bound ramp adjacent to several large multiple dwellings, and an explosion could have engulfed these buildings and other structures in the immediate area. The flammable, gaseous vapors were venting at a pressure of 175 psi, and the introduction of an ignition source could have produced a tremendous fireball. Even though every precaution was taken to mitigate the effects of an explosion, it was several uneasy hours before a sanitary test plug was available to be placed in the valve opening so that the gas flow was reduced and successful off-loading could take place. This task was performed by the members of Rescue Company 4, which became the FDNY's first Haz-Mat unit in addition to performing its regular operations of rescue and firefighting.

The Rules Change

The other event was an anticipated change in the federal Department of Transportation rules and regulations. While these rules and regulations pertained mainly to the labeling and packaging of hazardous materials, they also removed some of the restrictions regarding local shipping requirements and traffic routes. At the

same time it was felt that under the new regulations, some laboratories which had been warehousing radioactive waste materials would now be able to ship these materials through New York City.

The Birth of the FDNY's Haz-Mat Company

Utilizing these two events as background, the New York City Fire Department was able to present a proposal to and convince the City's Office of Management and Budget that an increased Haz-Mat capability was required. Initially, this capability was established in Rescue Company 4. This dual function concept enabled an increase in capability without additional expenditure and was a further selling point.

The foresight in this methodology was rewarded in February 1982 when the Mayor mandated the FDNY to be the lead agency in hazardous material mitigation. However, it wasn't until October 1984 that Haz-Mat 1 was established, a unit solely dedicated to the problem of mitigating the effects of hazardous material incidents.



Haz-Mat's first vehicle, a 1983 American LaFrance with a Saulsbury box, was retrofitted to fit their needs.



Another Haz-Mat vehicle sharing quarters with Engine 288 in Maspeth, Queens, and responding citywide is a 1979 Mack pumper.



FDNY Mobile Decontamination Truck, right, housed at Ladder Company 15 in Manhattan. The unit contains four hot-water showers, a facility to catch the run-off water, and dressing rooms for final decontamination. The support vehicle carries tarps, coveralls, plastic bags, hoses, recovery drums and other items necessary to putting the Decontamination Truck into operation.

How Haz-Mat Works

From a centralized location on 68th Street in Queens, the quarters of Engine 288, Haz-Mat 1 responds citywide to any fire emergency involving hazardous materials. In addition, six firehouses have been designated as hazardous materials equipment locations, where both recovery drums and absorbent materials are stored. They are: Engines 4 and 67 in Manhattan, Engine 42 in the Bronx, Engine 248 in Brooklyn, and Engines 159 and 167 in Staten Island. The supplies kept in these quarters are intended for use at Haz-Mat incidents. When needed at a scene, they are delivered by Department apparatus.

With a roster of 4 officers and 35 firefighters, the company has an on-duty strength of 1 officer and 7 firefighters. All of the



Chemical data, as well as training schedules, statistical reports and inventories, are stored in a computer.



In addition to books, the Haz-Mat reference library contains videotapes and slide programs.



Some of the tools and equipment used by Haz-Mat displayed on the floor of quarters in front of the five-borough map board. Photo: Joel Shanus/FDNY Forensic Unit.



Some of the chemical protective suits worn by members of Haz-Mat. Left: Level "B" protection is achieved with a one-piece vinyl splash suit and outer chemical resistant gloves and boots. The firefighter is also wearing a one-hour positive pressure self-contained breathing apparatus. Second from left: A one-piece Tyel splash suit with hood provides Level "B" protection. Completing the outfit are chemical protective gloves. Center: Vitron, fully encapsulated Level "A" chemical protective suit. Second from right: Fully encapsulated flash-protection suit, which can be used with a Level "A" protective suit worn underneath. Right: This 100% Nomex jumpsuit provides Level "D" protection. All Haz-Mat members have two of these jumpsuits and a Nomex hood. Photo: FF. Joel Shanus/FDNY Forensic Unit

members of Haz-Mat are seasoned firefighters and have received specialized training at the National Fire Academy, at federal, state and local seminars, and at on-the-job training and site-visit programs. The formal portion of this training averages about 300 hours per firefighter or more than 12,000 hours of training.

At the scene of an incident the 7 firefighters are assigned to operate in teams for maximum safety and protection. Aggressive actions are seldom taken and a cautious, controlled approach is the primary operating mode.

One firefighter—the resource man—is responsible for obtaining all available information. This takes place before, during and after the Haz-Mat operation. This is accomplished via an on-board computer, telephone lines, a comprehensive collection of material safety data sheets in microfiche format and a small library.

The computer terminal is hooked up to two on-line interactive computer data bases, containing over 78,000 important industrial chemicals. The data bases provide operational rather than



Research, development and testing of tools and equipment is an ongoing process. Chemical protective suits are inflated to be tested before being returned to service.



An Ecolyzer carbon monoxide (CO) monitor, giving a digital readout in parts per million. The presence of CO cannot be detected through normal senses.

bibliographic information, covering approximately 90% (by volume) of the known potentially hazardous compounds used in interstate commerce.

Information in the data bases can be accessed using the chemical name of the substance, a synonym, the key word, the chemical formula, the Chemical Abstracts Service number, the Registry of Toxic Effects number, or a description of the symptoms caused by exposure.

The officer establishes communications, receives information, establishes a plan of mitigation and attack, keeps the incident commander advised and supervises the mitigation procedures.

The decontamination team, wearing proper protection, sets up and maintains three separate zones. The first zone is the exclusion zone, or hot zone, where contamination is or may be occurring. The second zone is the reduction zone transition between the hot and cold zones. The third zone is the support or cold zone. This team also provides initial decontamination of the entry and safety teams.



A manual, pump-operated oxygen indicator measuring in percent determines oxygen displacement or enrichment.



Radiological equipment includes: left, a Victoreen Geiger counter, model CDC-700; rear, two Victoreen survey meters, model CDV-715; right, a Ludlum detection meter, model 14C, with a pancake probe; center, a dosimeter charger and assorted dosimeters.



The Wahl Heatspy infrared thermometer gives a digital readout in Fahrenheit and centigrade.



A large selection of colormetric chemical tubes to detect the presence of nearly every chemical from A (anhydrous ammonia) to Z (zinc), and the pumps necessary to utilize them, are kept aboard Haz-Mat's first rig.

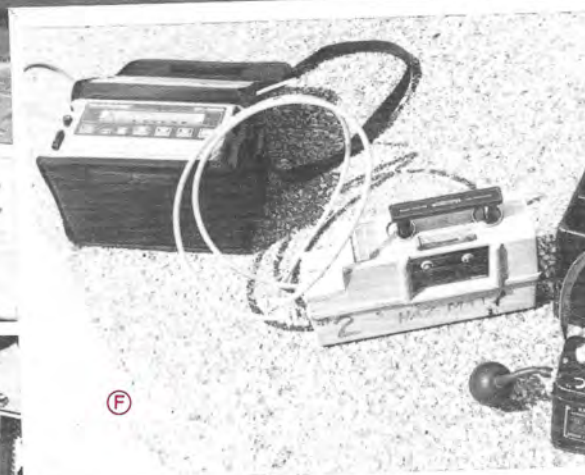
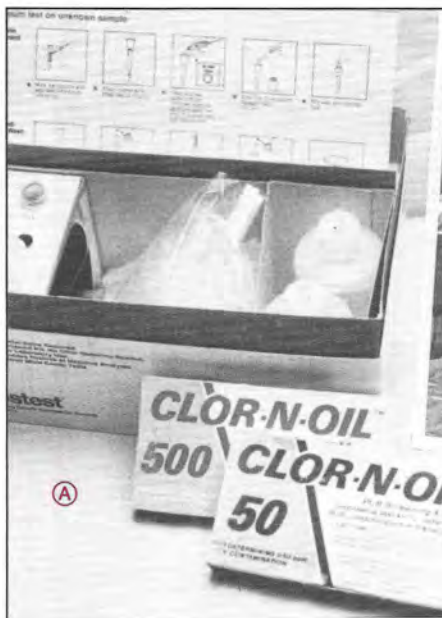
The two-member entry team, wearing completely encapsulated clothing and equipment, conducts a size-up, performs necessary rescues, monitoring and sampling, and determines and carries out the appropriate mitigation procedures.

The safety team, also consisting of two members, wears the same clothing and equipment as the entry team and stands by at the point of entry.

Procedures

There are three levels of incidents. Level A, the worst, requires full encapsulation in butyl rubber, Teflon or Vitron suits. A compatibility chart determines the type of suit required. The suit contains an internal self-contained breathing apparatus (SCBA) and has a 300-foot air line for pressurizing it. This provides positive pressure to keep its wearer safe from contamination should the suit

(Continued on Page 20)





A: Field test kit with instructions for detecting the presence of asbestos.

B: This field ID test kit is used in conjunction with the mini-lab on board the apparatus. Haz-Mat thus has the ability to determine the chemical and physical properties of most of the unknown materials that are encountered in the field.

C: The pH meter in this kit has a digital readout and comes with probe and buffer solution.

D: This ultrasonic hearing device is capable of picking up minuscule leaks in cylinders or drums, as well as picking up sounds at building collapses.

E: An infrared thermal-imaging camera, connected by 800 feet of coaxial cable to a 5-inch black-and-white television monitor, can be used as a heat-seeking device to measure the temperature of drums containing chemicals or to search for victims at building collapses.

F: An array of measuring devices. Left, the Gastech 4000 model digital quad meter, measuring carbon monoxide (CO) and hydrogen sulfide in parts per million (ppm), percentage of oxygen (O₂) and the lower explosive limits (LEL) of combustible gases in percent.

Middle, a Gastech II model digital trimeter, which measures CO in ppm, percentage of O₂, and LEL in percent.

Right, an explosimeter, measuring in percent, indicates if a combustible gas is within its explosive range.

(Continued from Page 17)

develop a pinhole leak. Level B requires a chemical resistant suit with an external SCBA. Level C is full firefighting gear, which includes a jumpsuit made of Nomex material and an SCBA.

Other Agencies

The handling of a hazardous materials incident almost always requires the expertise and cooperation of many other agencies. The Police Department of New York City has been designated the on-scene coordinator for these incidents by mayoral directive. It is their responsibility to establish an interagency command center to maintain communications, restrict accessibility to the area and evacuate adjoining areas if conditions warrant. The Department of Environmental Protection provides information and trained chemists with a 24-hour response capability. The Emergency Medical Service provides monitoring, medical, health and decontamination services. The Health Department provides advice and information on various health hazards.

Many other federal, state and local agencies provide advice, information and sometimes personnel and equipment at these extremely critical, sometimes unknown, hazardous materials incidents.

The Busiest and Best of the Bravest

Operating with an annual budget of \$2 million, Haz-Mat 1 responded to 916 incidents in 1988. The total operational time is in excess of 1,000 hours. This figures out to be an average of 1¼ work hours per incident—62% of Haz-Mat's *runs* are *workers*. Considering the training required, the maintenance of equipment and inventory, on-site visits and orientation presentations, Haz-Mat 1 is the busiest unit in the New York City Fire Department. Their officers and members are highly regarded and are constantly in touch with other teams throughout the country and the world. On one occasion, April 23, 1987, Haz-Mat was even special-called to travel 61 miles to Bridgeport, CT to aid in the rescue of construction workers trapped in a building collapse in which 28 men perished. Haz-Mat maintains an open-door policy and is eager to exchange information with any agency that is interested.

Tools



Haz-Mat has a full line of foam capabilities. Shown are a high-expanding foam generator, fluoro polydol (fluoroprotein) foam and Cold Clean 500, a biodegradable foam solution for diesel fuel and gasoline spills. AFFF (aqueous-film-forming foam) and alcohol resistant foam are also used.



Extinguishers carried on board the apparatus to fight various types of fires include: halon, dry chemical, carbon dioxide, aqueous-film-forming foam, and water.



Non-sparking beryllium hand tools are used in flammable and explosive atmospheres.



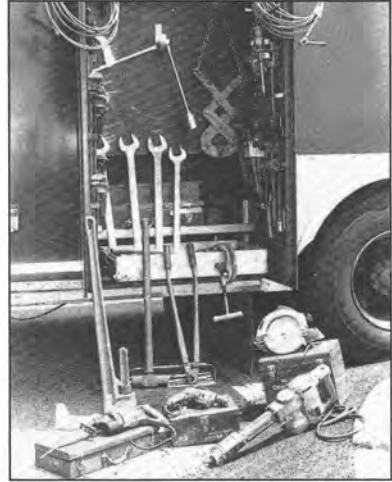
Leak-seal kits include plugs, clamps, epoxy, magnetic-patch kits, gaskets, duct tape, and much more.



A propane leak-seal field test kit includes an electronic gas leak detector (top center) and assorted fittings and tools.



On-board and portable generators and lighting equipment.



Various hand and power tools carried by Haz-Mat.



Vetter low-pressure leak seal kit with various sizes and shapes of patches and plug bags which can be pressurized either pneumatically or with water.



The plumbing compartment.

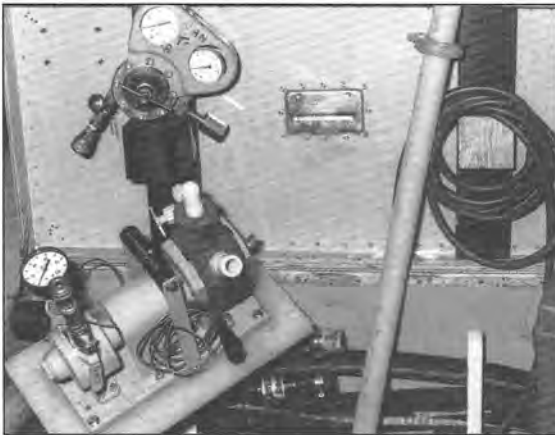
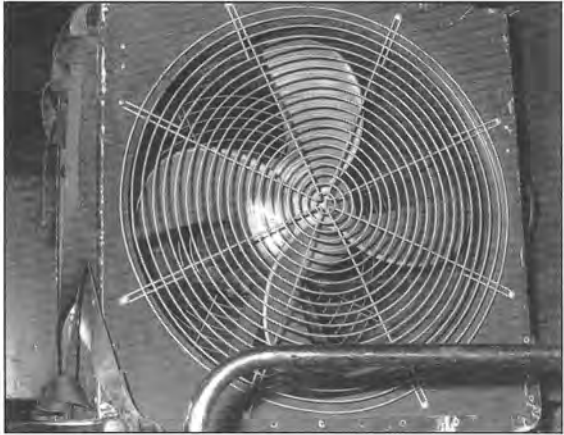


Maxi-force air bags, providing low lift but able to endure high pressure.



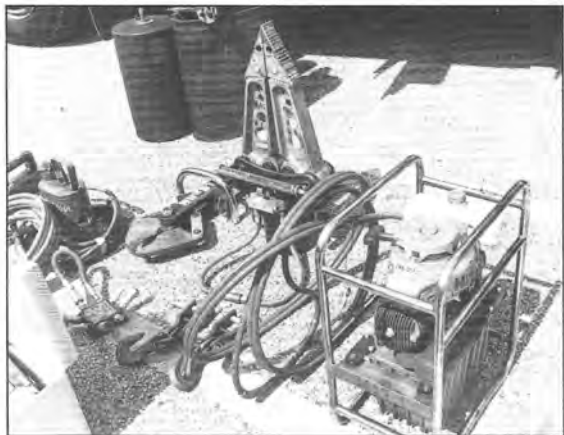
Paratech leak-seal kit with low-pressure pneumatic patch bags, adjustable Velcro and ratchet belts, regulators, hoses, fittings and a foot pump.

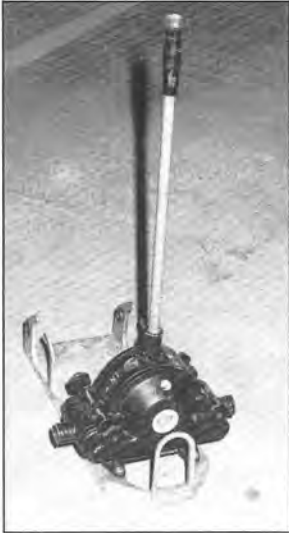
Explosion proof, non-sparking, 36-inch smoke ejector which operates at 1,725 rpms.



A Vanton, pneumatic-operated sump pump for use in small, off-loading operations.

Electric and gasoline-powered generators for the Hurst tool: rams, jaws spreaders, chains and other accessories.





Manually operated Patay pump can be used in small, off-loading operations in explosive or flammable atmospheres.



Dome-cover clamps used to secure the hatch covers on overturned gasoline or oil trucks.



Various sizes of boiler plugs add to Haz-Mat's leak-stopping capability.

Drills



The Haz-Mat apparatus carries four low-pressure pneumatically operated air bags with a circular shape that, when filled, provide four-and-a-half feet of lift.



Entry team taking part in an interagency drill. Both wear Level "A" fully encapsulated chemical protective suit. Umbilical cord supplies air to maintain positive pressure.

Photo: FF. Richard Smiouskas/FDNY Forensic Unit



Member of Haz-Mat performs a diking operation around a sewer opening using a containment boom.



Using the infrared thermal imaging camera to get a read on a drum "leaking" poison during a drill.



Entry team at a drill "stabilizing" an unknown chemical in a recovery drum while a safety team waits in the background. Photo: FF. Joel Shanus/FDNY Forensic Unit



Haz-Mat members in Level "A" chemical protective suits practice an overpacking operation, placing a 55-gallon drum into an 85-gallon one.



In this training exercise, Haz-Mat members demonstrate how overpacking operations are conducted with a rope to avoid contamination.



At this drill, a Haz-Mat member in Level "C" protective gear (turnout coat, boots, gloves, helmet and Nomex hood) positions a dome cover clamp on an overturned gasoline tank truck.



The start of off-loading of an overturned tank truck using a pneumatic pump. Haz-Mat member in center uses a quad meter to measure as the atmosphere reaches an explosive potential while member at right is ready with a foam extinguisher should anything go wrong with the operation.



Haz-Mat team positions a leak-seal bag on an overturned tank truck . . .



. . . as part of a patching, metering, grounding, off-loading and foam back-up operation.



Safety team, wearing Level "B" splash protective chemical suits, washes down and decontaminates the entry team, dressed in Level "A" chemical protective suits.

Photo: FF. Charles Benson/FDNY Forensic Unit



After the entry team steps out of their suits, the suits are placed in recovery drums for decontamination.

Photo: FF. Charles Benson/FDNY Forensic Unit

Operations



Several bags of asbestos toppled from a truck on the upper level of the Verrazano Bridge in January 1988 and were struck by cars, spreading chunks of the cancer-causing material over a quarter-mile section of the roadway. The FDNY and Haz-Mat were immediately notified and began clean-up. Photo: Steve Zaffarano/Staten Island Advance



Haz-Mat members putting on level "A" suits and preparing to enter a garment manufacturing plant in the Sunset Park section of Brooklyn in November, 1986. Over 30 people were felled by CO₂ and toluene fumes.

Photo: Todd Maisel/Maisel Media



The low-pressure, high lift wedge-shaped bag is capable of lifting up to 17 tons. The shape is designed to assist in lifting railroad cars, tanker trucks, etc. The bag can be filled in a three-stage operation by air compressor or air cylinder to a size of 6' high by 5' wide by 10' long.



Two Haz-Mat members wearing level "B" protective suits placing containers of acid in 12-gallon recovery drums. The containers are packed in oil and grease absorbent to protect them and to soak up any leakage. The acid was spilled by contractors cleaning the exterior of a house in Brooklyn.

Photo: Todd Maisel/Maisel Media



An explosion of unknown origin started this fire on June 14, 1988, in the transformers of a Con Edison Electrical generating plant in Brooklyn. Members of Haz-Mat took air samples to determine if PCB's or other toxins were emitted.

Photo: Mel Finkelstein/New York Post

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MATERIALS



