

# United States Fire Administration



**Technical Report Series**

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## **Swimming Pool Chemical Plant Fire Springfield, Massachusetts**



**Federal Emergency Management Agency**

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**United States Fire Administration  
National Fire Data Center**

## **U.S. Fire Administration Fire Investigations Program**

The U.S. Fire Administration develops reports on selected major fires throughout the country. The fires usually involve multiple deaths or a large loss of property. But the primary criterion for deciding to do a report is whether it will result in significant "lessons learned." In some cases these lessons bring to light new knowledge about fire -- the effect of building construction or contents, human behavior in fire, etc. In other cases, the lessons are not new but are serious enough to highlight once again, with yet another fire tragedy report.

The reports are sent to fire magazines and are distributed at national and regional fire meetings. The International Association of Fire Chiefs assists USFA in disseminating the findings throughout the fire service. On a continuing basis the reports are available on request from USFA.

This body of work provides detailed information on the nature of the fire problem for policymakers who must decide on allocations of resources between fire and other pressing problems, and within the fire service to improve codes and code enforcement, training, public fire education, building technology, and other related areas.

The Fire Administration, which has no regulatory authority, sends an experienced fire investigator into a community after a major incident only after having conferred with the local fire authorities to insure that USFA's assistance and presence would be supportive and in no way interfere with any review of the incident they are themselves conducting. The intent is not to arrive during the event or even immediately after, but rather after the dust settles, so that a complete and objective review of all the important aspects of the incident can be made. Local authorities review USFA's report while it is in draft. The USFA investigator or team is available to local authorities should they wish to request technical assistance for their own investigation.

This report and its recommendations were developed by USFA staff and by TriData Corporation, its staff and consultants, who are under contract to assist the Fire Administration in carrying out the Fire Reports program.

The U. S. Fire Administration appreciates the cooperation received from the Springfield, Massachusetts Fire Department and Civil Defense office for this report. Particular thanks go to Fire Chief Raymond Sullivan and Fire Lieutenant Robert Callahan of the Springfield Fire Department and James Controuich, Emergency Response Coordinator and Director of Civil Defense of Springfield.

# **Swimming Pool Chemical Plant Fire Springfield, Massachusetts (June 17, 1988)**

**Investigated by: Richard L. P. Custer**

**This is Report 027 of the Major Fires Investigation Project conducted by TriData Corporation under contract EMW-88-C-2649 to the United States Fire Administration, Federal Emergency Management Agency.**



**Federal Emergency Management Agency**

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**United States Fire Administration  
National Fire Data Center**



**Swimming Pool Chemical Plant Fire  
Springfield, Massachusetts**

**Investigated by:** Richard L. P. Custer

**Local Contacts:** Fire Chief Raymond Sullivan  
Fire Lieutenant Robert Callahan  
Springfield Fire Department  
605 Worthington Street  
Springfield, MA 01106  
(413) 787-6411

**OVERVIEW**

One of the most challenging problems facing the fire service today is the combined fire and hazardous/toxic chemical incident. Decisions have to be made regarding the timing of fire fighting activities with respect to evacuation priorities. In many cases, a decision must be made as to whether or not to fight the fire at all. Where the chemicals or products involved are water reactive, fighting the fire may make matters worse, endangering the firefighters or the general population.

Just such a situation presented itself to Chief Raymond Sullivan of the Springfield, Massachusetts Fire Department and the city's hazardous materials incident response team on Friday, June 17, 1988.

The incident occurred in that part of an 87-year-old industrial building housing a company that produced water treatment chemicals for swimming pools. Rain leakage wetted chemicals that released chlorine along with sufficient heat to cause ignition of ordinary combustibles. In the course of the incident, large amounts of chlorine gas were released, triggering several levels of evacuation involving more than 6,000 people.

The fire resulted in the collapse of a portion of the roof. The fire and corrosive action of the chlorine gas resulted in almost complete loss of the contents of both floors and caused significant structural damage prompting razing of the second floor. At the time this report was written it was not known whether the building would be reoccupied.

## SUMMARY OF KEY ISSUES

Issues	Comments
Cause of Fires	<p>First fire - Rain leaking in mixed with chlorine chemical compounds, releasing heat.</p> <p>Second fire - Lack of complete protection of the premises from weather after first fire allowed rainwater in, which started the second fire.</p>
Evacuations	<p>Gaseous chlorine generated by mixing chemicals with water and from products of combustion required several levels of evacuation as incident progressed. Approximately 6,000 people were evacuated.</p>
Firefighter Protective Equipment	<p>City found itself short of self-contained breathing apparatus for an incident of this magnitude, for both firefighters and police. Consideration is being given to providing cartridge-type masks for police and other emergency personnel.</p>
Sprinkler System	<p>Building was sprinklered, but part of the system had been disconnected because of the presence of water-reactive chemicals.</p> <p>The part of the sprinkler system remaining in service did operate, but was shut down by FD in attempt to reduce production of chlorine gas.</p>

**SUMMARY OF KEY ISSUES Cont'd**

<b>Issue</b>	<b>Comments</b>
Incident Command	<p>Dual problem: HazMat incident and fire with HazMat properties.</p> <p>Size of incident was large relative to forces available.</p> <p>In the second incident, mixed scientific advice was received on whether to flood the building or not apply water at all, causing delay in action. In retrospect, permitting the sprinkler system to continue operating supplemented with copious quantities of water is most likely the best option for such an incident.</p>
Duration of Incident	Lasted 4 days; FD remained on scene for cleanup operations for 27 days. Eleven of the city's 13 companies was involved.
Firefighting Agents	6 million gallons of water. 65 tons of neutralizing agents were required to treat the chemicals before removal.
Cost of Incident	<p>Soda ash used successfully in first fire.</p> <p>In second fire, due to presence of water, soda ash used but ineffective.</p>
Cost of Incident	\$2 million loss to building and contents; \$500,000 cost to fire department includes overtime and actual and anticipated damage to equipment from chlorine exposure; \$700,000 other costs to city.

During the incident, which lasted 31 days, 11 of the city's 13 engine companies were involved and over six million gallons of water used to extinguish the fire and to wet down the scene sufficiently for the chemicals to be removed and neutralized. It is estimated that 65 tons of neutralizing chemicals were employed.

Over 100 buses and 35 ambulances participated in the evacuation of the areas affected by the chlorine. Forty firefighters and approximately 275 civilians were treated for chlorine exposure at local hospitals and released. Principal means of exposure to firefighters was inhalation when changing breathing apparatus. Some firefighters received chemical burns on exposed skin and through turnout gear, especially when perspiring. Total dollar loss to the structure and contents was estimated to be over \$2 million. costs from overtime and chlorine damage to fire department equipment are expected to exceed \$500,000, and the cost to the city is estimated to approach an additional \$700,000.

## **THE BUILDING**

The two-story brick building at 1 Allen Street was built in two sections. The first section was built as an armory in 1858. A second section added in 1901 which paralleled Allen Street was the location of the incident. This "newer" section was constructed of brick and cast iron. Its floors were brick arches supported on cast iron beams, with a concrete cover on top overlaid with heavy wood plank. In the interior of the building, the floors were supported by cast iron columns. The slate roof was placed on wood purlins supported by cast iron truss work.

The occupant of the area in which the incident occurred was Advanced Laboratories, Inc., manufacturers of tablets for chlorination of swimming pools. They occupied the first and second floors of the newer section of the building.

The "chlorine" tablets were produced by mixing raw materials including trichloro-S-triazinetrione known as TCT (trichloroisocyanuric acid) in a mechanical blender and pressing the resulting mixture into tablets. When TCT is exposed to water, heat is released. In the presence of heat, TCT will



break down to form chlorine gas. An intermediate product of TCT breakdown is nitrogen chloride, which presents a severe explosion hazard when heated or exposed to shock.

Two types of tablets were produced by Advanced Laboratories -- a "quick" tab that was a blend of TCT and soda ash with other chemicals, and a "slow" tab that did not contain soda ash. TCT blended with alkaline materials such as soda ash is subject to more rapid decomposition in the presence of water than TCT alone and produces temperatures sufficiently high to ignite paper products or wood.

Mixing was accomplished on the second floor where the raw materials were stored. Three blenders were in use, two for the Quick Tab product and one for Slow Tab blend. The mixing area on the second floor was called the "Blending Room." The blended mixture was discharged into chutes leading down to the tablet presses (one for each blender) on the first floor in the "Tab Room." The general layout of the (south) end of the second floor is shown in Appendix A.

A pneumatic dust collection system was employed to recover products from the blender and discharge areas on the second floor. The dust was deposited in a collection bin on the second floor. Recovered dust and reground broken or defective tablets were saved to be added later, in small amounts, to new batches of raw ingredients in the blenders. This recycled material, called "remix," was stored in paper drums against the (east) wall (see Appendix B). In addition to the remix, approximately 1,000 polyethylene lined paper drums of pure TCT, each weighing 300 pounds, were stored two to three pallets high on the (east and west) sides of the second floor.

The building was equipped with a dry pipe automatic sprinkler system. On the second floor, however, the sprinkler piping had been disconnected by the occupants in the area where the chemicals were mixed. The first floor also had a partial sprinkler system.

## **THE INCIDENT**

The incident actually took place in two phases and, although very closely related, could actually be considered two separate fires. For ease of discussion, the incident will be treated in that way.

## **The First Fire**

At 0959, Springfield Fire Alarm was notified of a fire in the dust collection system at Advanced Laboratories. The Department had previously responded to small fires at this company involving floor sweepings in a dumpster.

Arriving firefighters went to the second floor and attacked a small fire in the dust collection duct with soda ash (sodium carbonate) as called for in the most recent Fire Department prefire plan (March 1987). The use of soda ash to quench the reaction was reported to be the employee practice at Advanced Laboratories. This procedure was effective so long as no moisture was present. (As noted earlier, soda ash speeds the decomposition reaction in the presence of water.) Flames were noted in the dust collector. In order to reduce the high level of chlorine fumes in the Blending Room area, doors were opened and windows opened or broken out.

At about 1015, the Command Post vehicle arrived and was set up. After surveying the conditions and the spread of chlorine gas odor, orders were given to evacuate the schools in the area. Residents were warned to stay inside with the windows closed and to leave if they smelled chlorine.

The school evacuation was initially carried out in the downwind direction for about half a mile. Schools on the perimeter were also evacuated and the students moved to other schools.

Fire fighting continued employing soda ash and at 1129 hours the fire was out. Hot dust had been removed from the ducts and the dust collector, mixed with soda ash, placed in drums and disposed of in the alley.

The fire and chlorine release were considered under control at 1148. At this time the evacuation order was rescinded. People were allowed to return home and the School Board was notified. The Fire Department remained on the scene until approximately 1515 to 1530. During this time period, the Advanced Laboratories foreman and the employees were engaged in cleaning up the debris and boarding over the windows that had been broken to ventilate the chlorine fumes.

The cause of this first fire was most likely rainwater blowing in under the sliding door at the south end of the building and entering the dust collection duct.

In post-fire interviews with employees, the Fire Department was told that the windows on the east wall in the vicinity of the remix and dust storage were not boarded over. This was reportedly due to the difficulty in reaching the windows over the pallets of TCT drums. It was also reported that in the past, a number of dust and remix drums had split or been broken discharging their contents into inaccessible areas under the pallets where the material could not be cleaned up.

The foreman was reported to have left the building at approximately 1615.

### **The Second Fire**

Weather records indicate that at approximately 1700 hours there was a light rainfall in the area driving rain against the east wall that contained the open windows.

At 2254, a police patrol reported "smoke" coming from the second floor of Advanced Laboratories in the area of the blending room. At 2256, the first arriving firefighters on the second floor reported seeing orange flames in the TCT drum storage area and applied soda ash with some success, reducing the fire to intermittent flareups. After approximately 10 minutes, the chlorine levels were so severe that the firefighters had to leave the building.

The Command Post had been activated at 2300 hours. At 2316, shortly after the firefighters were driven from the building, the second alarm was sounded.

The dry pipe automatic sprinkler system operated at 2317, most likely controlling the fire, but discharging water over the stored TCT and remix materials. After about 20 minutes of operation, water supply to the system was cut off in the street because of concern that the water would do more harm than good among the water reactive chemicals.

Evacuation of the area began for the second time that day at 2320, when local residents were again asked to leave.

Throughout Friday night, sounds were heard attributed to rupturing barrels on the second floor. Although no flaming was noted, chlorine gas and hydrochloric acid fumes continued to be released in large quantities from the building.

Early Saturday, June 18, conditions improved and the evacuation was called off at 0400 hours. At 0550, personnel from Clean Harbors, a contract hazardous waste disposal company retained by the State of Massachusetts, arrived on the scene. At this point, most areas of the city were reportedly clear of chlorine odor.

By 0900 hours, Fire Department and Clean Harbors personnel in HazMat entry suits were engaged in attempting to remove drums of reacting material from the second floor and releasing the blended mixture from two hoppers. At 0940, another local evacuation was initiated. By approximately 1000 hours, conditions began to worsen again and by 1100 hours orders were given to clear the building and the evacuation was expanded again.

The perimeter was established by roving police and Fire Department vehicles, and the decision to expand or contract the evacuation zone was based on the presence or absence of the chlorine odor (chlorine can be detected by smell at a level about one tenth of the danger level). At its greatest extent, the evacuation zone was approximately 6 to 7 miles long and 1-1/2 miles wide.

At 1220, one of the drums "blew," pushing a firefighter back, and all personnel left the building.

Around 1900 hours, the fire began developing on the second floor and flames appeared on the first floor. Water was discharged on the first floor fire at 1915. As the fire continued to grow, the City Solicitor gave the authority to forcibly evacuate the area and preparations were made to attack the fire and flood the building with as much water as possible in order to minimize heating of the TCT. This was the procedure recommended by the Material Safety Data Sheet (MSDS) and CHEMTREC.

A portion of the roof collapsed near the center of the building at 2200 hours, and the fire extinguishment and flooding operations continued throughout the night.

By shortly after 0500 hours on Sunday, June 19, the chlorine conditions were improving once more and the fire was nearly under control. Clean Harbors prepared a powder mixture of sodium sulfate and boric acid to be used in neutralizing the TCT, allowing its clean up and disposal. During Sunday, areas affected by the chlorine were checked and if found to be clear, people were allowed to return.

All hose lines were shut down at 0619 Monday morning. By 1230, Clean Harbors had spread the neutralizing powder throughout the building. Checks were made of schools and other facilities by the federal and state Environmental Protection Agencies during the day as removal of the chemical debris from the building was underway.

At 1840 Monday, after almost four days, "Recall" was sounded for the second fire and HazMat incident. Some Fire Department apparatus and personnel stood by at the scene during final clean up for an additional 27 days, until July 17, 1988.

The remaining chemical sludge was removed by Clean Harbors and placed in 10 above-ground swimming pools. After neutralization in the pools, the water, now chlorinated, was disposed of in the city storm sewer system.

The second fire was determined to have originated within the remix storage area. The cause was thought to most likely have been water from rain storms following the first fire entering through the open windows on the east wall.

#### **DECISION ON WHETHER OR NOT TO FIGHT THE FIRE**

In dealing with HazMat incidents, the incident commander must rely heavily on information from published sources and available experts. Many resources are available to assist command officers in making these tough decisions. Included are manuals, such as NFPA 49 Hazardous Chemicals Data, the United States Coast Guard's Chemical Hazard Response Information System Manual (CHRIS) Volume II and Sax's Dangerous Properties of Industrial Materials, industry "hot lines" such as CHEMTREC, and computerized hazmat information systems such as CAMEO. Frequently, "experts" from nearby industry

also will be available to assist. In some instances, however, the various sources will provide incomplete data or conflicting instructions, and the information provided may not fit exactly with the situation at hand.

Nevertheless, the command officer must sift through the available information, suggested procedures, expert advice, and past experience and develop a strategy to minimize the effects of both the fire and hazardous materials aspects of the incident. To further complicate matters, as the incident develops the initial strategies may have to be altered rapidly to react to changing conditions.

Chief Sullivan and the Springfield Hazardous Materials Response Team had literature available to them, including NFPA 49, Sax, CHRIS, and the Material Safety Data Sheet for TCT.

Additional guidance was obtained from the Chlorine Institute (prior to the fire), CHEM-NET, CHEMTREC, and even a phone call from a chemist who learned of the incident on cable television. In addition, the local Monsanto plant, a key participant in Springfield's HazMat response planning, had a representative on the scene to advise.

Based on all the information and advice reviewed, the following choices were available:

- Let the reaction run its course.
- Fight the fire using large volumes of water.

In the first choice, evacuation of the area would be carried out and attempts made to control the fire with soda ash, as had been done in the first fire incident. One advisor had suggested that the reaction might last two to three days if left alone.

In the second choice, the scope of the evacuation might to be quickly increased in the event that the fire streams released additional chlorine. Once the fire was out, the chlorine would be controlled chemically.

Many factors relating to the actual incident conditions need to be considered when selecting an option or seeking others in a situation such as this. These factors include:

- presence or absence of fire
- size and growth rate of the fire
- location of the fire
- need to minimize injury to public
- need to minimize fire loss
- fire control resources available
- present amount of chlorine being produced
- effect of fire fighting on chlorine
- wind direction and speed
- status of evacuation
- hazardous material control resources

Taking the above into consideration, Chief Sullivan first treated the incident as a minor fire in which soda ash was applied. The area was evacuated. During Friday night, the chlorine conditions varied. By early Saturday, conditions were clear, and the evacuation order was rescinded. By early Saturday evening, however, the Chief was faced with a significant fire. In addition, not only was more chlorine being generated, but the plume of hot gases from the fire could aid in the spread of the gases throughout the community. At this time, aggressive fire fighting with large amounts of water was initiated.

#### **LESSONS LEARNED**

1. Managing combined fire and HazMat incidents often requires access to in-depth technical expertise.

The chief needs the best possible technical information, but still may have to make a decision in the face of conflicting expert opinion. The incident commander needs to quickly gather all the relevant information regarding the chemicals involved, the properties of their decomposition products, the danger of explosion, and the danger of toxic by-products.

In addition to the literature and "hot lines," efforts should be made to contact industry experts directly. Do not expect strong positive recommendations from "hot lines." They usually can't and won't do more than offer options. And the technical experts and sources may disagree. The HazMat incident control options must be evaluated in light of the incident conditions before decisions are made. This remains a major problem for today's chiefs.

A recently released (1989) set of guidelines for handling chlorinated pool chemicals is now available. Produced by Monsanto, Olin, and PPG, manufacturers of the chlorine compounds used in these products, the guidelines address hazards, storage, processing, protective equipment, emergency procedures, and other safety related aspects. A list of emergency telephone numbers is also included. Copies may be obtained by contacting any of the following:

Monsanto - (314) 694-1519  
Olin - (203) 271-4161  
PPG - (412) 434-3556

The guidelines recommend that if "there are any signs of fire, the building should be evacuated and the fire department called immediately, even if the building has a sprinkler system. In extinguishing a fire, copious amounts of water should be used. Do not use dry powder extinguishers."

2. HazMat incident response planning makes a difference.

The value of a hazardous materials incident response organization was proven again. This incident had excellent interdepartmental cooperation. This was largely due to the fact that the major actors in dealing with Springfield's HazMat incidents had met regularly for planning sessions and table top incident exercises. In fact, 1 Allen Street was the subject of a chlorine leak exercise prior to the incident. Participants in this group included the Fire, Police, Health, and Public Works Departments; Emergency Medical Services; and a representative of the local Monsanto facility. Other groups were the Red Cross, the School Board, area hospitals, and the Springfield Civic Center.



The Command Post vehicle was a project that evolved from this HazMat response group. The truck was donated by Coca Cola, and Monsanto split the cost of equipment for the Command Post with the city of Springfield.

3. There may be "hidden" costs to the fire department associated with a HazMat incident involving corrosives such as chlorine.

After the Allen Street incident, the Springfield Fire Department rebuilt and tested all regulators on their breathing apparatus as a precaution. In addition to thorough steam cleaning, the oil and oil filter were changed on all exposed vehicles. Even with washing and treatment, the life of fire hose and turnout gear is expected to be reduced. All exposed fire hose had to be tested. Electrical and electronic equipment needed cleaning and overhauling. The Department already has replaced two generators that failed after being used at Allen Street. Overtime was paid as well as "stand-by" time for mutual aid companies. It has been estimated that cost to the Springfield Fire Department will exceed \$500,000.

4. Evacuation plans should incorporate clearly defined zone boundaries.

Although the evacuations went well, they would have been easier and less complicated if evacuation zones had been established citywide prior to the incident. It was suggested that street maps showing the boundaries of the zones should be placed in police patrol cars. Planned use of public transportation buses for the evacuation proved to be highly successful.

5. Multiple channel radio communications are essential in an evacuation situation.

The greatest communications problem in the incident was the limitation of fire department radio channels. The current system has only one channel. The city had previously addressed this problem but new equipment had not yet been installed. Cellular phones proved to be extremely helpful as did the services of amateur radio operators. The Command Post was also equipped with radios on the bus frequency. Having direct communication with the buses not only helped coordinate the evacuations but provided an additional means for obtaining chlorine condition reports.

6. It was useful to have the City Attorney on the HazMat team and available at the incident.

The city attorney can provide valuable advice in such matters as evacuation authority, issuing of evacuation orders, arrests, and city liability.

In summary, the Allen Street incident points out the problems of dealing with hazardous material information as well as the importance of planning and inter-departmental cooperation before the incident. The value of communications and the need for legal assistance were also pointed out. It is hoped that the lessons described above can be applied by others in order to learn from Springfield's experience.

**POSTSCRIPT - CHLORINE PLANT FIRE IN GLENDALE, ARIZONA**

Following the Springfield fire, a fire in a Glendale, Arizona warehouse storing similar swimming pool chemicals totally destroyed the building on August 21, 1988. Rainstorms had moved through the area shortly before the fire. On arrival, the building was well involved in fire. Heavy red-brown smoke, probably due to nitrogen-trichloride, was issuing from the building, and explosions could be heard inside the structure.

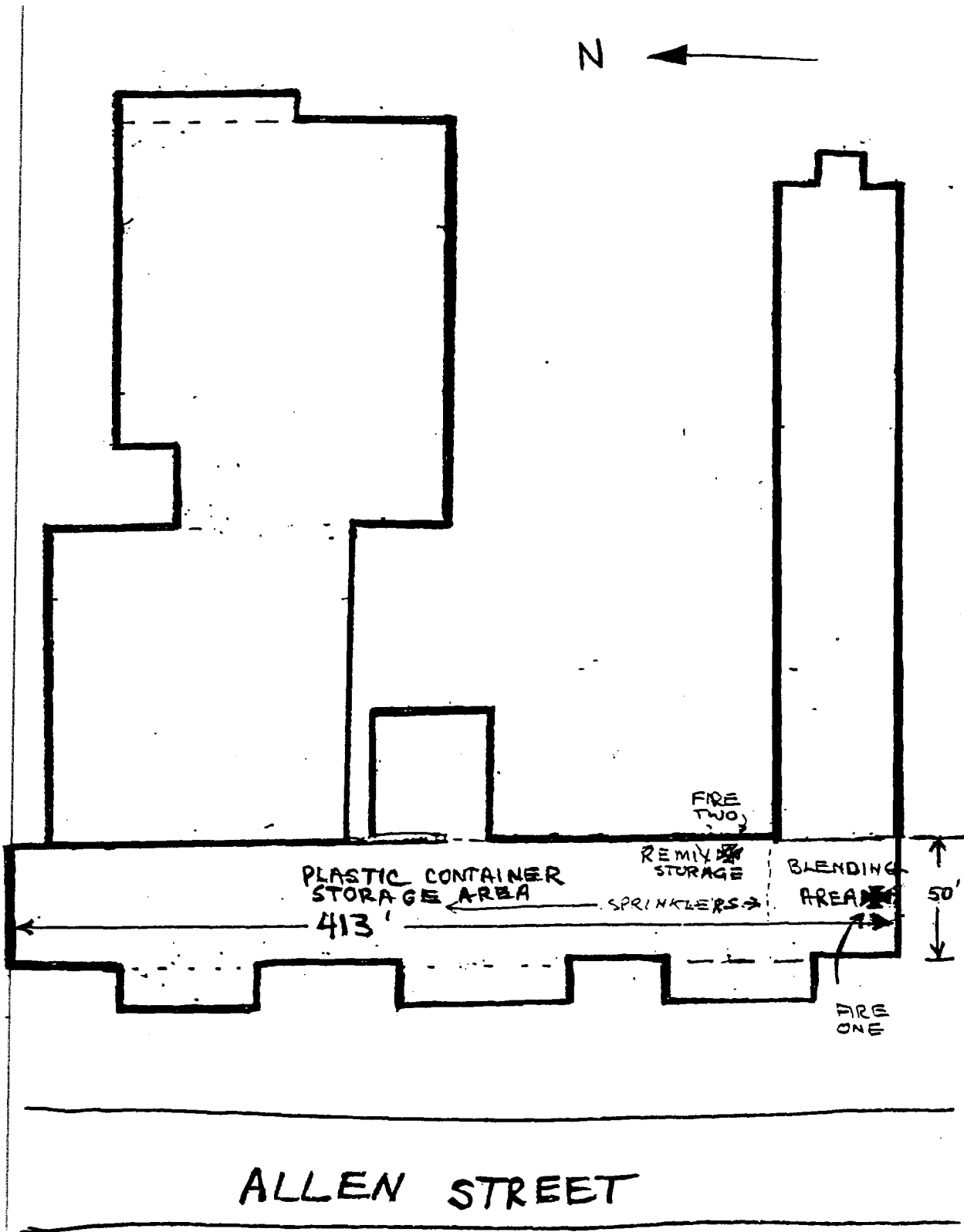
The warehouse was fully sprinklered, but it is possible that the sprinkler piping may have been damaged, since only a slight amount of water was coming from the water motor gong. Eventually, the roof collapsed. Extinguishment was accomplished through an external attack. Approximately 200-300 people were evacuated from the area. (For more information, contact Lt. Greg Victor, Glendale Fire Department, 7505 North 55th Avenue, Glendale, AZ 85301, (602) 931-5614.)

Even though the cause is officially listed as undetermined, review of the circumstances of the Springfield fires suggested rain leakage as a possible cause scenario for the Glendale fire. The most likely explanation of the red-brown smoke was the presence of nitrogen oxides that were released along with chlorine when trichloroisocyanuric acid breaks down in reaction to heat.

## Appendices

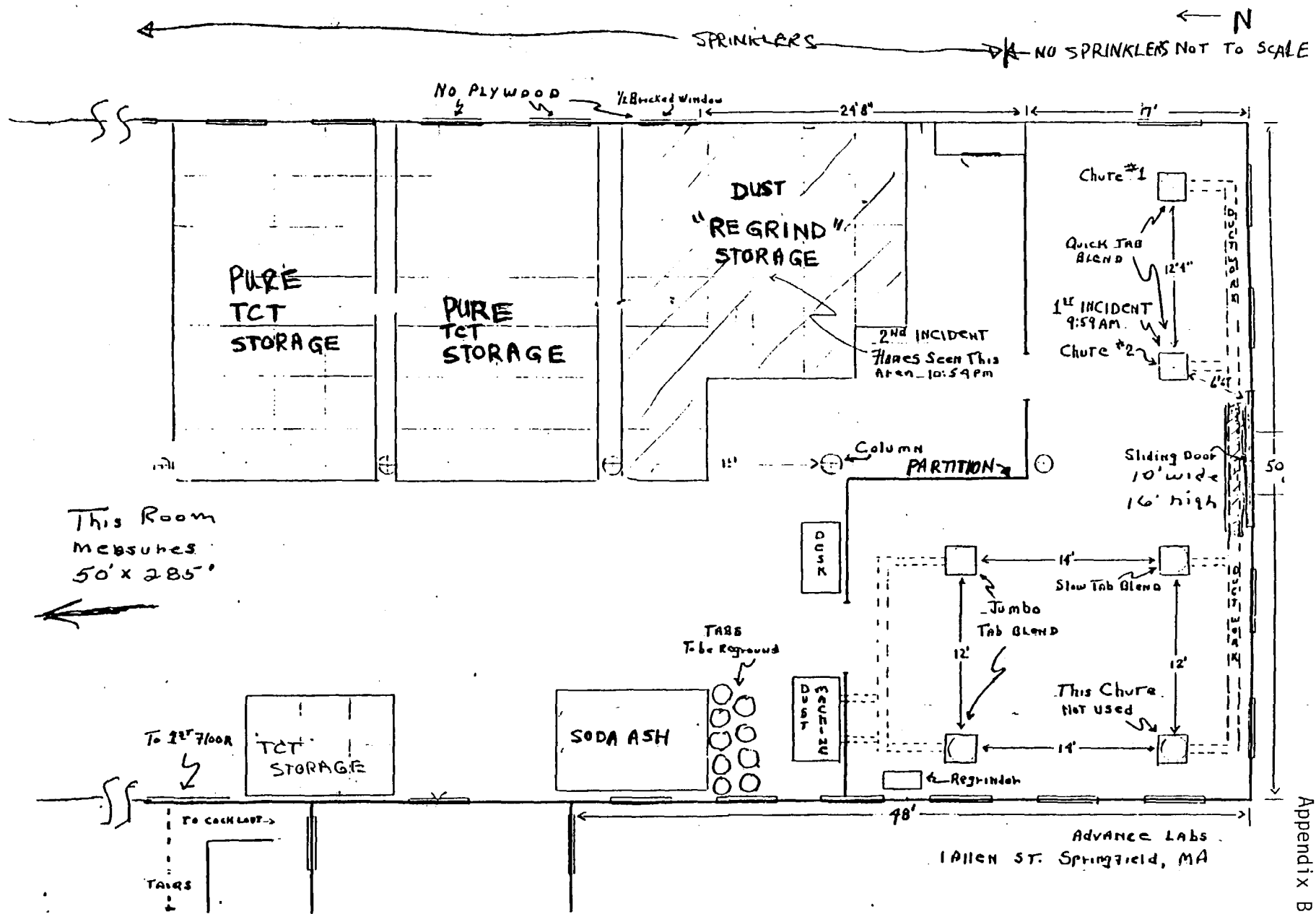
- A. General Layout of the Second Floor of Advanced Laboratories
- B. Second Floor Storage Area and Blending Room
- C. List of Slides, Selected Photographs
- D. A Material Safety Data Sheet (MSDS) for Trichloroisocyanuric Acid; Courtesy of Monsanto Chemical Company
- E. "Guidelines for Safe Handling and Storage of Calcium Hypochlorite and Chlorinated Isocyanurate Pool Chemicals," Monsanto, Olin, and PPG; Reproduced with Permission of Monsanto Chemical Company, 800 North Lindbergh Boulevard, St. Louis, MO 63167.





GENERAL LAYOUT OF THE SECOND FLOOR OF ADVANCED LABORATORIES

NOT TO SCALE



SECOND FLOOR STORAGE AREA & BLENDING ROOM

Appendix B

## Appendix C

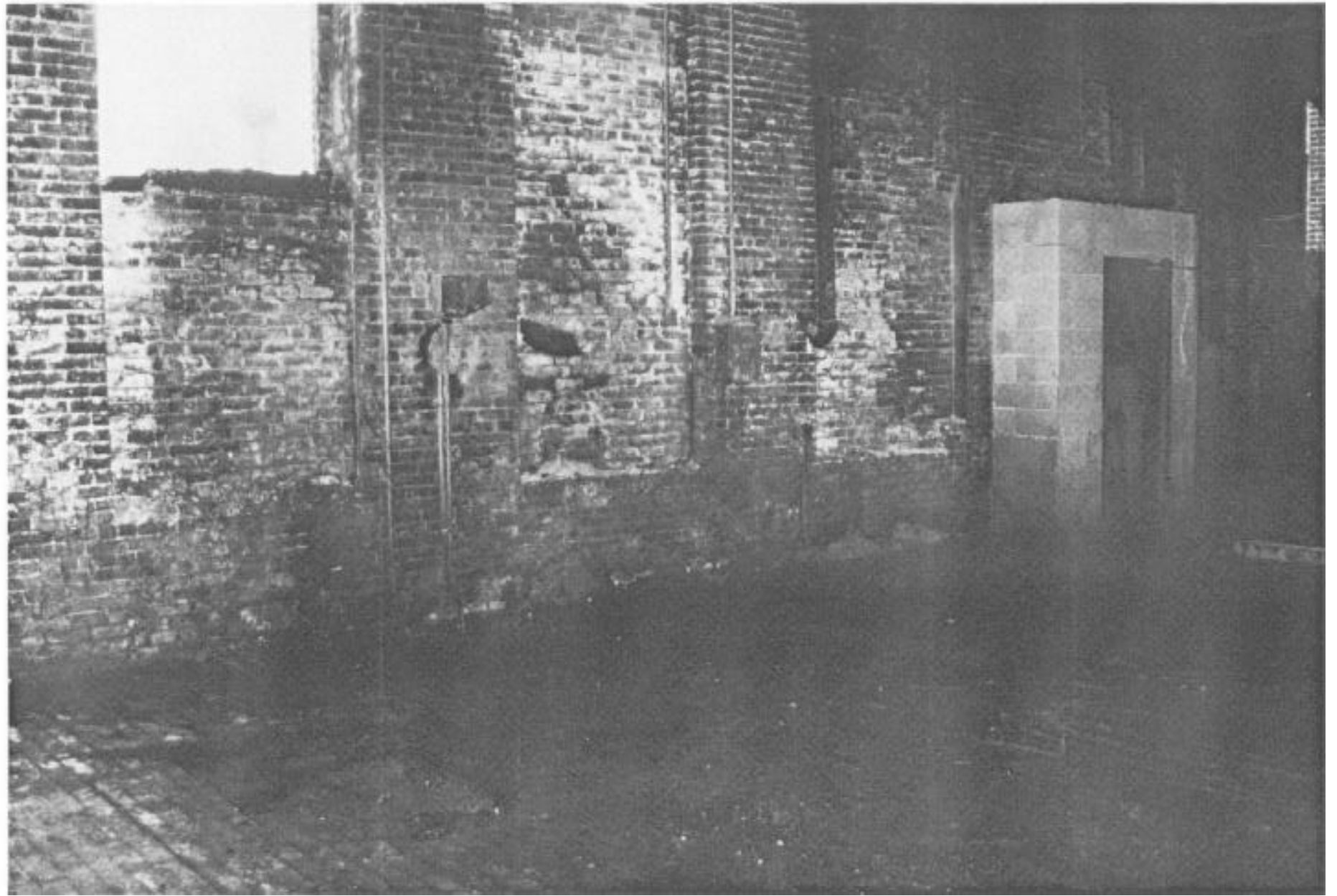
### List of Slides, Selected Photographs

The slides with an asterisk have been made into photos and are reproduced following this list.

1. Interior view of the Command Post showing the communications position. The wall-mounted status board can be seen as well as the cellular telephone and radios for the police, fire, and public transit busses. The status board is covered with plastic and notes can be made using wax pencils.
2. Same as number 1 but with a wider view showing a map of the city. The map is also covered with plastic and was used to plot areas of evacuation.
3. Outside view of the Command Post.
4. Springfield Fire Department Hazardous Materials Team vehicle. View of the driver's side showing open compartments and their contents.
5. Close-up of the communications compartment-containing the hazardous materials reference library.
6. Springfield Fire Department Hazardous Materials Team vehicle. Right side compartments opened to show SCBA equipment and HazMat suits.
- \*7. Interior view of the second floor looking at the east wall in the area of the "remix" storage. This is believed to be the area of origin. Deep burning of the wood floor can be seen as well as the window reportedly left open following the first fire.
- \*8. Interior view of the second floor looking south. One of the blending machines can be seen as can the door opening in the south wall. Rain that reportedly resulted in the first fire was blown in under the door that was in this opening.
9. View of the second floor ceiling over the "remix" storage area. The disconnected and capped sprinkler branch line can be seen in the center of the shot.
10. View of the "remix" storage area looking south. Burning of the floor through to the concrete subfloor is shown in the foreground.
11. View of the second floor looking north into the container storage area showing collapsed structural members.
12. Same view as number 18 showing a close-up of the structural collapse.

13. Outside view of the west side of the building showing the damage to the south end of the building on the second floor.
14. Outside view of the west side of the building showing the portable swimming pools used to dilute the chemicals removed by Clean Harbors during the clean-up.
- \*15. Long shot of the west side of the building including the swimming pools and showing damage to the second floor.
- \*16. Close-up of the swimming pools. The area of roof collapse can also be seen.
17. Overview of the west side of the building from the north end showing the swimming pools and damage to the storage area at the north end.











# Monsanto MATERIAL SAFETY DATA

MONSANTO PRODUCT NAME  
**ACL<sup>®</sup> 90 PLUS CHLORINATING  
 COMPOSITION**

**MONSANTO COMPANY  
 800 N. LINDBERGH BLVD.  
 ST. LOUIS, MO 63167**

**Emergency Phone No.  
 (Call Collect)  
 314-694-1000**

## PRODUCT IDENTIFICATION

<b>Synonym(s):</b>	1,3,5-Trichloro-s-triazine-2,4,6(1H,3H,5H)-trione; Trichloroisocyanurate acid; Trichloro-s-triazinetrione
<b>Chemical Name:</b>	1,3,5-Triazine-2,4,6(1H,3H,5H)-trione, 1,3,5-trichloro-,
<b>Chemical Formula:</b>	C <sub>3</sub> N <sub>3</sub> O <sub>3</sub> CL <sub>3</sub>
<b>Chemical Family:</b>	Chlorinated isocyanurates
<b>CAS No.:</b>	87-90-1
<b>EPA Reg. No.:</b>	524-107
<b>TSCA Inventory:</b>	1,3,5-Triazine-2,4,6,(1H,3H,5H)-trione, 1,3,5-trichloro- appears on the Inventory of Chemical Substances published by the U.S. Environmental Protection Agency (EPA) under authority of the Toxic Substances Control Act (TSCA).
<b>DOT Proper Shipping Name:</b>	Trichloroisocyanuric Acid, dry
<b>DOT Hazard Class/ I.D. No.:</b>	Oxidizer/UN2468
<b>DOT Label(s):</b>	Oxidizer
<b>U.S. Surface Freight Classification:</b>	Trichloroisocyanuric Acid (Bleach Assistant Compound, NOIBN, dry)
<b>Reportable Quantify (RQ) Under U.S. EPA CERCLA Regulations:</b>	Not Listed
<b>Hazardous Chemical(s) Under OSHA Hazard Communication Standard:</b>	This substance is identified as a hazardous chemical under the criteria of the OSHA Hazard Communication Standard (29 CFR 1910.1200):  Trichloroisocyanuric acid, CAS Reg. No. 87-90-1

**Monsanto MATERIAL SAFETY DATA****WARNING STATEMENTS**

Keep out of reach of children.

**DANGER!**

HIGHLY CORROSIVE.

CAUSES IRREVERSIBLE EYE DAMAGE.

CAUSES BURNS TO SKIN.

IRRITATING TO NOSE AND THROAT.

MAY BE FATAL IF SWALLOWED.

WILL BURN WITH THE EVOLUTION OF CHLORINE AND EQUALLY TOXIC GASES.

STRONG OXIDIZING AGENT.

CONTACT WITH WATER SLOWLY LIBERATES IRRITATING AND HAZARDOUS CHLORINE-CONTAINING GASES,

DECOMPOSES AT 460°F TO 460°F WITH LIBERATION OF HARMFUL GASES.

Mix only with water. Use clean dry utensils. Do not add this product to any dispensing device containing remnants of any other product. Such use may cause a violent reaction leading to fire or explosion. Contamination with moisture, organic matter, or other chemicals may start a chemical reaction with generation of heat, liberation of hazardous gases, and possible generation of fire and explosion.

**Directions for Use:**

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling.

FOR INDUSTRIAL USE ONLY. FOR REPACKAGING OR FORMULATING AS A DISINFECTANT, SANITIZER, BACTERICIDE, FUNGICIDE OR ALGICIDE. Repackagers or formulators must obtain their own EPA Registration Number to legally market this product for these uses.

**Note:** Drum contains absorbent packets. Remove packets before using contents. Discard packets with reuse.

**PRECAUTIONARY MEASURES**

Do not get in eyes, on skin, or on clothing.

Wear goggles or face shield and rubber gloves when handling.

Avoid breathing dust or fumes.

Wash thoroughly with soap and water after handling.

Remove and wash contaminated clothing before reuse.

**EMERGENCY AND FIRST AID PROCEDURES**

IF SWALLOWED, drink promptly a large quantity of milk, egg whites, gelatin solution, or, if these are not available, drink large quantities of water. Avoid alcohol.

IF ON SKIN, immediately brush off excess chemical and flush with plenty of water. Remove contaminated clothing. Wash clothing before reuse. If irritation persists, call a physician.

IF IN EYES, flush with plenty of water. Get medical attention.

IF INHALED, remove person to fresh air. Call a physician.

**Note To Physician:** Probable mucosal damage may contraindicate the use of gastric lavage.

IN CASE OF: FIRE, if possible, isolate container in open air or well ventilated area. Flood with large volume of water.

IN CASE OF: CONTAMINATION OR DECOMPOSITION, do not reseal container.

**Monsanto MATERIAL SAFETY DATA****OCCUPATIONAL CONTROL PROCEDURES**

**Eye Protection:** Wear chemical splash goggles and have eye baths immediately available where there is potential for eye contact.

**Skin Protection:** Wear appropriate protective gloves and protective clothing that provide a barrier to prevent skin contact. Consult glove manufacturer to determine appropriate type glove for given application. Wash immediately if skin is contaminated. Launder contaminated clothing and clean protective equipment before reuse. Provide a safety shower at any location where skin contact can occur. Wash thoroughly after handling.

**Respiratory Protection:** Avoid breathing dust or vapor. Use NIOSH/MSHA approved equipment when airborne exposure limits are exceeded. Full facepiece equipment is recommended and, if used, replaces need for face shield and/or chemical splash goggles. Consult respirator manufacturer to determine appropriate type equipment for given application. The respirator use limitations specified by NIOSH/MSHA or the manufacturer must be observed. High airborne concentrations may require use of self-contained breathing apparatus or supplied air respirator. Respiratory protection programs must be in compliance with 29 CFR 1910.134.

**Ventilation:** Provide ventilation to control exposure levels below airborne exposure limits. Use local mechanical exhaust ventilation at sources of air contamination such as open process equipment.

**Airborne Exposure Limits:** Typical Product Composition:

Active Ingredient:	Trichloro-s-triazinetrione	99%
Inert Ingredients		1%
Available Chlorine		90%

OSHA PEL: None Established  
ACGIH TLV<sup>®</sup> None Established

Monsanto has adopted an internal limit of 0.5 mg/m<sup>3</sup> TWA, 1.5 mg/m<sup>3</sup> STEL for ACL 90 PLUS chlorinating composition.

Chlorine

OSHA PEL/C: 1 ppm (3 mg/m<sup>3</sup>)  
ACGIH TLV<sup>®</sup>/TWA: 1 ppm (3 mg/m<sup>3</sup>)  
TLV<sup>®</sup>STEL: 3 ppm (9 mg/m<sup>3</sup>)

**FIRE PROTECTION INFORMATION**

ACL<sup>®</sup> 90 PLUS chlorinating composition is not flammable, but if heated by an outside source to a temperature of 460-480°F, this material will undergo self-sustaining decomposition with evolution of heat and dense noxious gases.

**Extinguishing Media:** A thermal decomposition can be extinguished by flooding with copious quantities of water or by isolating the decomposing material and allowing it to be consumed.

**Special Firefighting Procedures:** Firefighters and others subjected to products of decomposition should wear full protective clothing and self-contained breathing apparatus. Chlorine containing gases with traces of phosgene can be liberated at temperatures in excess of 400°F.

(Fire Protection Information Continued On The Next Page)

**Monsanto MATERIAL SAFETY DATA****FIRE PROTECTION INFORMATION (Continued)****Unusual Fire and**

**Explosion Hazards:** Small quantities of water react with ACL 90 PLUS to form hazardous quantities of nitrogen trichloride which is violently explosive. See Technical Bulletin IC/WT-104 for further information.

**REACTIVITY DATA**

**Materials to Avoid:** Avoid contact with water on concentrated ACL 90 PLUS in the container. Concentrated ACL 90 PLUS in the container reacts with water to form hypochlorous acid and cyanuric acid. Also avoid contact with easily oxidizable organic material; ammonia, urea, or similar nitrogen-containing compounds; inorganic reducing compounds; calcium hypochlorite; alkalis.

**Hazardous Decomposition**

**Products:** Chlorine-containing gases can be produced. Traces of phosgene can be liberated at high temperatures 400°F.

**Hazardous Polymerization:** Does not occur.

**HEALTH EFFECTS SUMMARY**

The following information presents both human experience and the results of scientific experiments used by qualified experts to assess the effects of ACL 90 PLUS on the health of industrially exposed individuals and to support the Precautionary Statements and Occupational Control Procedures recommended in this document. To avoid misunderstanding, the data provided in this section should be interpreted by individuals trained in evaluation of this type of information.

**Human Experience**

Dermal contact and inhalation are expected to be the primary routes of occupational exposure to ACL 90 PLUS. ACL 90 PLUS is considered to be corrosive to the eyes and skin. Exposure to ACL 90 PLUS dust or fumes has been reported to produce eye, nose, throat and respiratory tract irritation.

On contact with moisture ACL 90 PLUS readily decomposes to chlorine, hypochlorous acid and cyanuric acid. The tissue damage resulting from contact with ACL 90 PLUS is considered to result, in part, from its chlorine and hypochlorous acid decomposition products. Exposure to chlorine gas has been reported to cause burning of the eyes with lacrimation; burning of the nose and mouth with minorrhea; and irritation of the linings of the entire respiratory tract with coughing, a choking sensation, substernal pain, vomiting, nausea, headache, dizziness and syncope. The onset of severe respiratory symptoms following exposure to chlorine, including pulmonary edema and pneumonitis, may be delayed.

**Toxicological Data**

Data from Monsanto studies and from the scientific literature indicate the following:

**ACL 90 PLUS**

Oral LD <sub>50</sub> (Rat):	600 mg/kg, Slightly Toxic
Dermal LD <sub>50</sub> (Rabbit):	7,600 mg/kg, Practically Nontoxic
Eye Irritation (Rabbit, 24-hr):	Corrosive
Skin Irritation (Rabbit, 24-hr):	Corrosive
DOT Skin Irritation (Rabbit, 4-hr):	Not Corrosive

Rats were exposed by inhalation to dust of ACL 90 PLUS at exposure levels of 3.2, 10.1 and 31 mgm<sup>3</sup> for 6 hours/day, 5 days/week for 4 weeks. Signs of irritation including lacrimation, salivation and labored breathing were observed at the mid- and high-exposure levels. Increased adrenal weights and blood chemistry parameter alterations were also noted in the mid- and high-exposure groups. No adverse histopathological effects were observed. The no-effect level is considered to be 3.2 mg/m<sup>3</sup>.

(Health Effects Summary Continued On The Next Page)



**Monsanto MATERIAL SAFETY DATA****HEALTH EFFECTS SUMMARY (Continued)****Additional information**

Contact of ACL 90 PLUS with moisture will produce cyanuric acid and hazardous chlorine gas and hypochlorous acid. A Threshold Limit Value (TLV<sup>®</sup>) has been established by the American Conference of Governmental Industrial Hygienists-for chlorine. For further information on chlorine, please refer to the current edition of the *Documentation of Threshold Limit Values*. For information on cyanuric acid, please refer to the Cyanuric Acid Dry Material Safety Data Sheet.

**PHYSICAL DATA**

**Appearance and Odor:** White crystalline solid; slight chlorine odor

**Melting Point:** 225-230°C (decomposes)

**Loose Bulk Density (lbs./cu. ft.):** 56 (regular)  
57 (granular and extra granular)

**pH (1% solution @ 25°C):** 3.0

**Solubility @ 25°C:** 1.2 g/100 g H<sub>2</sub>O

Note: These physical data are typical values based on material tested but may vary from sample to sample. Typical values should not be construed as a guaranteed analysis of any specific lot or as specification items.

**SPILL, LEAK & DISPOSAL INFORMATION**

THIS SPILL, LEAK AND DISPOSAL INFORMATION IS APPLICABLE FOR CONCENTRATED ACL.

**Emergency Spill and Leak Information:**

Contain spilled material. Any spillage of ACL should be cleaned up as soon as possible to prevent contamination with foreign material with which it may react. See "Reactivity Data" section of this document.

KEEP SPILLED MATERIAL DRY. If allowed to stand in damp or wet areas, tear-producing vapors may result.

Sweep, scoop, or vacuum up all spilled material, contaminated soil, and other contaminated material and place in clean, dry containers for disposal. Complete cleanup on a dry basis if possible. Floor sweeping compounds should not be used in the removal of ACL as fuming, fire or explosion may result. Follow all protective measures indicated in the "Occupational Control Procedures" section of this document.

As currently defined, unneutralized ACL is a *hazardous substance* under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). If 100 pounds or more are released into the environment, it must be reported to the National Response Center (800-424-8802 or 202-426-2675). Since local, state and federal laws may vary, consult your attorney or appropriate regulatory officials for information relating to spill reporting.

Keep unneutralized ACL out of sewers, watersheds and water systems.

(Spill Leak & Disposal Information Continued On The Next Page)

# Monsanto MATERIAL SAFETY DATA

## SPILL, LEAK & DISPOSAL INFORMATION (Continued)

### Disposal Information:

**Waste Disposal:** Dispose of in accordance with all local, state and federal regulations.

As currently defined in Federal Resource Conservation and Recovery Act (RCRA) regulations, ACL 90 PLUS, when discarded, is a *hazardous waste* exhibiting the characteristics of ignitability (D-001) and reactivity (D-003). See 40 CFR 261.23. Its disposal, therefore, is regulated by Federal RCRA regulations. Consult your attorney or appropriate regulatory officials for information regarding additional state and local waste disposal requirements.

Do not dispose of filled or partially filled containers in a common waste compactor. Contaminants in the compactor such as oil, sawdust, floor-sweeping compound, etc. could cause spontaneous decomposition and fusion of the material at ambient temperatures resulting in rupture of the drum.

If material is *dry*, disposal by incineration is recommended.

Do not transport wet material. An alternate method for disposal is by neutralization to a non-oxidizing residue which can then be discarded safely. This procedure should be undertaken only after reviewing the details of the method in Monsanto Technical Bulletin IC/WT-104 on storage and handling of ACL.

Wastes of this pesticide may cause irreversible eye damage and burns to skin and may be dangerous. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional office for guidance.

**Container Disposal:** Completely empty liner by shaking and tapping sides and bottom to loosen clinging particles. Empty residue into application equipment. Then dispose of liner in a sanitary landfill or by incineration if allowed by State and local authorities. Rinse empty container with water, and dispose of in the same manner.

## ADDITIONAL COMMENTS

The preparation of concentrated solutions or slurries of ACL<sup>®</sup> 90 PLUS chlorinating composition is not recommended. Also, ACL 90 PLUS is not recommended for formulated bleaches containing strong alkali, surfactants or hydrated chemicals.

### Environmental Toxicity Information:

48-hr LC <sub>50</sub> <i>Daphnia magna</i> :	0.21 ppm, Highly Toxic
96-hr LC <sub>50</sub> Bluegill Sunfish:	0.30 ppm, Highly Toxic
96-hr LC <sub>50</sub> Rainbow Trout:	0.32 ppm, Highly Toxic
Oral LD <sub>50</sub> Mallard Duck:	1,021 mg/kg, Slightly Toxic
8-Day Dietary LC <sub>50</sub> Mallard Duck:	Greater than 10,000 ppm, Practically Nontoxic
8-Day Dietary LC <sub>50</sub> Bobwhite Quail:	Greater than 7,422 ppm, Practically Nontoxic

This product is toxic to fish. Do not discharge into lakes, streams, ponds, or public waters unless in accordance with NPDES Permit. For guidance contact the regional office of EPA.

**Storage:** Retie polyethylene liner after each use and keep container tightly closed. Store in a cool dry place. Do not allow water to get into container. Keep containers off wet floors. Do not contaminate water, food, or feed by storage or disposal.

Refer to Monsanto Technical Bulletin IC/WT-104 for detailed information on handling and storage.

# Monsanto MATERIAL SAFETY DATA

**DATE:** 11/25/85

**SUPERSEDES:** 11/25/84

MSDS NO.: S00010524

FOR ADDITIONAL NON-EMERGENCY INFORMATION, CONTACT:

MSDS Coordinator  
Specialty Chemicals  
Monsanto Chemical Company  
314-694-1000  
(A Unit of Monsanto Co.)

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MATERIAL SAFETY DATA  
ACL® 90 Plus Chlorinating Composition

# Monsanto MATERIAL SAFETY DATA

~~ACL® 90 Plus Chlorinating Composition~~

~~MATERIAL SAFETY DATA~~

Guidelines for  
**SAFE HANDLING  
& STORAGE  
OF CALCIUM  
HYPOCHLORITE  
AND CHLORINATED  
ISOCYANURATE  
POOL CHEMICALS**



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# Table of Contents

Introduction	2
Trademarks	3
Product Nomenclature	4
Incompatibilities and Hazards	6
Storage	7
Processing Guidelines	16
Transportation Guidelines	17
Personal Protective Equipment	18
First Aid	18
Emergency Procedures	18
Handling Minor Spills	19
Do's and Don'ts	21
Emergency Telephone Numbers	22

# Introduction

Two types of chemicals used to disinfect swimming pool water are calcium hypochlorite and chlorinated isocyanurates (chlorinated-s-triazinetri-ones). These pool chlorinating chemicals are sold by the manufacturers in various forms, under a number of different trademarks (see page 3).

Calcium hypochlorite and chlorinated isocyanurates are incompatible with each other. And they are incompatible with most other chemicals used in pool water treatment, such as algicides, clarifiers, pool conditioners and tile cleaners. Therefore, it is important to follow proper storage and handling procedures in order to prevent conditions which might cause emergencies.

This publication was prepared by representatives of Monsanto Chemical Company, Olin Corporation and PPG Industries. The objective is to provide a reference on the safe handling and storage of calcium hypochlorite and chlorinated isocyanurate pool chemicals. It is not intended to supersede, or be used in place of, information provided by the supplier of the pool chemical being used. Such information provided by the pool chemical supplier should always be followed.

It is for use by processors and repackers of these chemicals, as well as for distributors, wholesalers and retailers. It is also intended for fire chiefs and building inspectors.

This publication includes guidelines, definitions and storage arrangements, many of which are excerpted from the National Fire Protection Association (NFPA) Standard 43A, *Storage of Liquid and Solid Oxidizing Materials*, 1980. It provides data on the properties of pool chlorinating chemicals and their NFPA ratings and it contains information on personal protection and first aid.

It also covers the containment of small spills (less than 100 lbs.). In the event of a larger spill, you should call your pool chemical supplier for information on how to deal with it. (See back cover for emergency phone numbers.)

In the event of any fire, you should immediately call your local fire department-even if the building has a sprinkler system. In extinguishing a fire, copious amounts of water should be used. Do not use dry chemical fire extinguishers. After the fire department has been summoned, call your pool chemical supplier for additional assistance.



# Trademarks

## Calcium Hypochlorite

Olin trademarks for calcium hypochlorite products include:

*CCH*<sup>®</sup>  
*Constant Chlor*<sup>®</sup>  
*HTH*<sup>®</sup>  
*Pace*<sup>®</sup>  
*Prochlor*<sup>®</sup>  
*Pulsar*<sup>®</sup>  
*Sock It*<sup>®</sup>  
*Sun Burn*<sup>®</sup>  
*Sun Burst*<sup>®</sup>

PPG trademarks for calcium hypochlorite include:

*Induclor*<sup>®</sup>  
*Pittabs*<sup>®</sup>  
*Pittclor*<sup>®</sup>  
*Repak*<sup>®</sup>  
*Sustain*<sup>®</sup>  
*Zappit*<sup>®</sup>

## Chlorinated Isocyanurates

Olin trademarks for chlorinated isocyanurates include:

*CDB*<sup>®</sup>  
*CDB Clearon*<sup>®</sup>  
*Constant Chlor*<sup>®</sup>  
*HTH*<sup>®</sup>  
*Pace*<sup>®</sup>  
*Prochlor*<sup>®</sup>  
*Sun*<sup>®</sup>

Monsanto trademark for chlorinated isocyanurates is:

*ACL*<sup>®</sup>

*Note:* Many of these pool chemicals are sold to processors and repackers who resell under various brand names. Such packages will always identify the product inside by its chemical name.

# Product Nomenclature

Calcium hypochlorite is sometimes called "cal hypo" for short. It is available in two forms: hydrated (more than 5.5% water, but not more than 10% water) and anhydrous (less than 5.5% water). The properties are similar, although the anhydrous material is more susceptible to the initiation of a self-sustained decomposition due to contamination, heat or fire.

## Calcium Hypochlorite

---

	Anhydrous	Hydrate
CAS Number:	7778-54-3	7778-54-3
Formula:	Ca(OCl) <sub>2</sub>	Ca(OCl) <sub>2</sub> • H <sub>2</sub> O
NFPA Oxidizer Class	3	3
Manufacturer and brands:	Olin <i>HTH</i>	Olin <i>CCH</i> <i>Constant Chlor</i> <i>HTH</i> <i>Pace</i> <i>Prochlor</i> <i>Pulsar</i> <i>Sock It</i> <i>Sun Burn</i> <i>Sun Burst</i> PPG <i>Induclor</i> <i>Pittabs</i> <i>Pittclor</i> <i>Repak</i> <i>Sustain</i> <i>Zappit</i>

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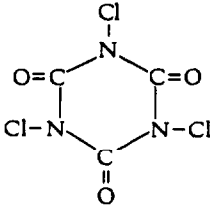
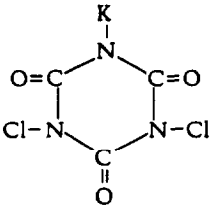
Chlorinated isocyanurates are also known as chloroisocyanurates or chlorinated-s-triazinetri-ones. They are sometimes called "isos" for short. These names describe four chemically related products

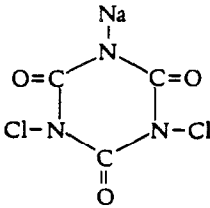
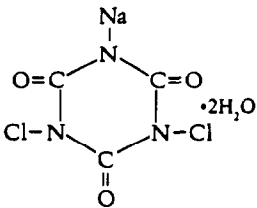
One of them is the acid form: trichloroisocyanuric acid, also known familiarly as "trichlor."

The other three are salts. One of these is the potassium salt: potassium dichloroisocyanurate. The other two are sodium salts: sodium dichloroisocyanurates. One of these sodium salts is anhydrous; the other is a dihydrate (two molecules of bound water). Any of these may be known by the nickname "dichlor."

For any of the chlorinated isocyanurates, if there is a number following the trademark (e.g. *CDB 90* or *ACL 90*), it indicates the approximate percent available chlorine for the product. If there is no number following the trademark, read the package or the label on the container; the percent available chlorine will be displayed there.

## Chlorinated Isocyanurates

	<b>Acid</b>	<b>Potassium Salt</b>
Chemical Name:	Trichloro-s-triazinetriene  Trichloroisocyanuric acid	Potassium dichloro-s-triazinetriene  Potassium dichloroisocyanurate
CAS Number:	87-90-1	2244-2 1-5
Chemical Structure:		
NFPA Oxidizer Class:	2	3
Manufacturer and Brands:	Monsanto <i>ACL 90</i> Olin <i>CDB 90</i> <i>Constant Chlor</i> <i>Pace</i> <i>Prochlor</i> <i>Sun</i>	Monsanto <i>ACL 59</i>

	<b>Sodium salt-anhydrous</b>	<b>Sodium salt-dihydrate</b>
Chemical Name:	Sodium dichloro-s-triazinetriene  Sodium dichloroisocyanurate	Sodium dichloro-s-triazinetriene dihydrate  Sodium dichloroisocyanurate dihydrate
CAS Number:	2893-78-9	51580-86-0
Chemical Structure:		
NFPA Oxidizer Class:	3	1
Manufacturer and Brands:	Monsanto <i>ACL 60</i>  Olin <i>CDB 63</i> <i>Constant Chlor</i> <i>Pace</i> <i>Prochlor</i> <i>Sun</i>	Monsanto <i>ACL 56</i>  Olin <i>CDB Clearon</i> <i>Constant Chlor</i> <i>Pace</i> <i>Prochlor</i> <i>Sun</i>

# Incompatibilities and Hazards

Calcium hypochlorite and chlorinated isocyanurates are dry solids with strong oxidizing properties. They are stable when stored in a cool, dry, ventilated area...and not contaminated by other chemicals such as acids, alkalis or easily oxidizable materials.

However, if these pool chemicals are mishandled, improperly stored or contaminated, they can become unstable and dangerous.

## Incompatibility

Calcium hypochlorite and chlorinated isocyanurates are chlorinating agents. They are also highly reactive oxidizing agents and are classed as "oxidizers" by the NFPA and the Department of Transportation (DOT). Because of their composition and properties, special precautions should be taken to prevent their contact and reaction with other chemicals during storage, handling, processing or shipment.

Each of these pool chlorinating chemicals is incompatible with each of the others. Therefore, special care should be taken to separate these chemicals in storage by using a buffer zone, wall or appropriate distance. They should also be separated from liquids since they will react when wet.

Some of the chemicals that are incompatible with calcium hypochlorite and chlorinated isocyanurates are:

- Acetic acid
- Paint, oils and greases
- Glycerin
- Petroleum products (gasoline, kerosene, etc.)
- Ethers
- Amines
- Ammonia and ammonium salts
- Quaternary ammonium compounds ("quats" such as algicides)
- Solvents (toluene, xylene, turpentine, etc.)
- Alcohols (methyl, ethyl, propyl and higher alcohols)
- Phenols
- Aliphatic and aromatic unsaturated compounds
- Peroxides (hydrogen, sodium, calcium, etc.)
- Reducing agents (sulfides, sulfites, bisulfites, thiosulfates, nitrates, etc.)
- Floor sweeping compounds

For more detailed information on the incompatibilities between pool chemicals and other chemicals, please contact the appropriate pool chemical manufacturer (see inside front cover).

## Fire and Fume Hazards

Calcium hypochlorite and chlorinated isocyanurates are not combustible. However, they do have thermal decomposition points. Calcium hypochlorite decomposes above 350°F (177°C). Isos decompose in the range of 428°-482°F (220°-250°C). For trichlor, decomposition requires heat. However for dichlor, the decomposition itself generates heat...enough heat to ignite paper and wood and cause a fire. There will also be a dense white cloud of gases characteristic of any thermal decomposition of pool chemicals. This smoke is toxic and very difficult to see through.

Examples of heat sources capable of raising product temperatures above their decomposition points include:

- Lighted cigarette or match
- Hot welding rod or molten particles from a welding operation
- Hot bearing on a conveyor
- Hot spot on conveying equipment caused by friction from metal-to-metal contact

The spark from static electricity may have a temperature considerably higher than the decomposition point of cal hypo or isos. However, a spark cannot transfer enough heat to cause thermal decomposition

On the other hand, if the pool chemicals are contaminated with easily-oxidized materials (e.g. gasoline, oil, sawdust, or floor sweepings) a reaction can start, even at temperatures well below their decomposition points. In fact, contamination can cause spontaneous combustion at room temperature.

Each of the pool chemicals has different thermal characteristics,

*Calcium hypochlorite:* Temperatures above 350°F (177°C) cause rapid decomposition which generates oxygen and heat. A fire of great intensity may result. Direct exposure to an external fire will cause decomposition, eruption of the container and greatly increased intensity of the fire. Decomposition results in an inert white residue consisting mainly of calcium chloride.

*Dichloroisocyanurates:* After the loss of any hydrate water, both the potassium and the sodium products will sustain thermal decomposition above 428°F (220°C), even in the absence of oxygen. Decomposition results in a yellow or brown porous inert residue.

*Trichloroisocyanuric acid:* Once the heat source is removed, trichlor will not continue to decompose. Partial decomposition leaves a yellow or brown residue. Complete decomposition leaves very little residue.

# Storage

Proper storage of calcium hypochlorite and chlorinated isocyanurates is essential in order to minimize the possibility of an emergency. For added protection against that possibility, a site-specific emergency plan should be drawn up and checked with local fire and hazardous materials officials. The plan should be reviewed with them annually (or sooner, if changes are made). An emergency drill involving facility staff and public response agencies should be held at least once per year.

The storage facility should be cool, dry and well-ventilated. Stock should be rotated on a "first-in, first-out" basis (FIFO). In addition, stock should be properly arranged. The following sections are included to help you in determining your storage requirements. They include:

- Definitions (classes of oxidizers and types of storage)
- Identification (of fire hazards of materials being stored)
- Storage arrangements (for buildings and retail shelves, based on NFPA Guidelines and Bulletin NFPA 43A-1980)
- Other storage considerations (general guidelines, based on NFPA Bulletin 43A-1980)

## Definitions

**Oxidizing material:** Any solid or liquid that readily yields oxygen or other oxidizing gases or readily reacts to oxidize combustible materials. Oxidizers are divided into four classes (1 to 4), based primarily on their effect on the burning rate of materials with which they come in contact. Class 1 has the least effect on burning rate; Class 4 the most. None of the pool chlorinating chemicals falls into Class 4 (see Box).

**Class 1 Oxidizer:** An oxidizing material whose primary hazard is that it may increase the burning rate of the combustible material with which it comes in contact.

**Class 2 Oxidizer:** An oxidizing material that will moderately increase the burning rate or may cause spontaneous ignition of the combustible material with which it comes in contact.

**Class 3 Oxidizer:** An oxidizing material that will cause a severe increase in the burning rate of combustible material with which it comes in contact or which will undergo vigorous self-sustained decomposition when catalyzed or exposed to heat.

## NFPA Oxidizer Class of Pool Chlorinating Chemicals

Class 1	Sodium dichloroisocyanurate, dihydrate
Class 2	Trichloroisocyanuric acid
Class 3	Calcium hypochlorite, anhydrous, greater than 39% by weight Potassium dichloroisocyanurate, anhydrous Sodium dichloroisocyanurate, anhydrous

**Incompatible materials:** Those materials that, when mixed with oxidizing materials, can cause hazardous reactions or can catalyze decomposition of the oxidizer. See page 6 for typical examples.

**Storage type:** The type of separation between different kinds of oxidizing materials required when they are in storage. Storage type is determined by the nature of the material and various conditions of the room in which the materials are being stored. There are three types of storage:

**Segregated:** Storage in the same room, but physically separated by space from incompatible materials, using sills or curbs to maintain spacing, or by using intervening storage of nonhazardous, compatible materials.

**Cutoff:** Storage in the same building or area, but physically separated from incompatible materials by partitions or walls.

**Detached:** Storage either in the open or in a separate building, located well away from all structures, except those housing operations related directly to the production of the stored materials.

**Warehouse:** Those facilities where oxidizing materials are received and stored, and from which they are subsequently shipped.

\*Excerpted with permission from NFPA 43A-1980, *Code for the Storage of Liquid and Solid Oxidizing Materials*. Copyright©, 1980, National Fire Protection Association, Quincy, MA 02269. This reprinted material is not the complete and official position of the NFPA on the referenced subject which is represented only by the standard in its entirety.

**Identification of Materials in Storage**

All storage areas should be conspicuously identified with the words

Class [number] Oxidizer

They should also be identified by their hazard identification in accordance with NFPA 704, *Standard System for the Identification of Fire Hazards of Materials*.

When materials having different hazard identifications are stored in the same area, the area should be marked to indicate the most severe of the health, flammability and reactivity hazards present in the area. 1

All packages should be individually marked with the chemical name of the oxidizer, or with other information which adequately permits accurate area identification.

**Storage Arrangements for Buildings**

In general, oxidizers should be stored to avoid contact with incompatible materials such as ordinary combustibles, flammable liquids, greases and those materials-including other oxidizers-that could react with the oxidizer or catalyze its decomposition.

Approval of the storage arrangement should also take into consideration the potential evolution of large quantities of toxic fumes resulting from decomposition which are severely hazardous to surrounding communities.

The arrangement and quantity of oxidizers in storage depends on a number of factors:

Class of oxidizer (1, 2 or 3)

Storage type (segregated, cutoff or detached)

Building usage (manufacturing or processing, warehouse or retail store]

Building fire protection (sprinklered or non-sprinklered)

Note: For oxidizers, if the storage is to be considered sprinklered the sprinkler protection must be installed in accordance with NFPA 231, *Standard for Indoor General Storage*, or NFPA 231 C, *Standard for Rack Storage of Materials*, whichever is applicable. Such a system should be able to provide a minimum water density of 0.2 gallons/minute per square foot (8.2 liters/minute per square meter) over an area not exceeding 5000 square feet (465 square meters).

To determine the storage arrangement for your building, first use Chart 1 as a key to the tables on pages 10 to 13 which contain:

1 Permissible size of the pile (length, width and height)

1 Minimum separation distance (to next pile and to walls)

1 Maximum quantity limit (per pile or per building, in tons).

...for pool chlorinating chemicals stored in sprinklered and non-sprinklered buildings.

Simply select the column which corresponds to the oxidizer class (1, 2 or 3) being stored and the row which corresponds to the type of storage (*segregated, cutoff or detached*) to be used.

At the intersection of the selected column and row is the number of the table which contains the storage arrangement information.

Note that for Class 1 oxidizers, Table 1 covers all types of storage arrangements. However, for Class 2 and Class 3 oxidizers, selection of the proper table depends on storage type.

Chart 1. Key to Tables			
Storage Type	Oxidizer Class		
	1	2	3
Segregated	Table 1	Table 2	Table 5
Detached		Table 3	Table 6
Cutoff		Table 4	Table 7

Associated with each of the tables is a diagram in which is shown the location of the various dimensions referred to in the table.

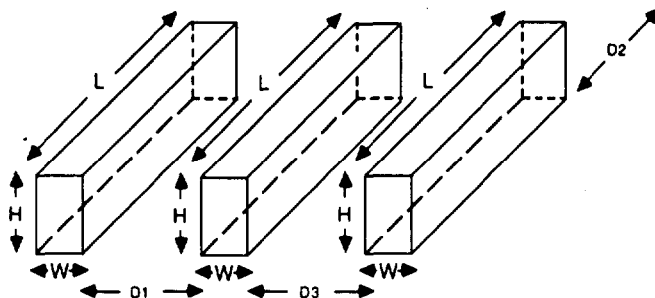
For Class 1 oxidizers and Class 2 or Class 3 segregated storage, use Diagram 1.

For Class 2 or Class 3 detached storage, use Diagram 2.

For Class 2 or Class 3 cutoff storage, use Diagram 3.

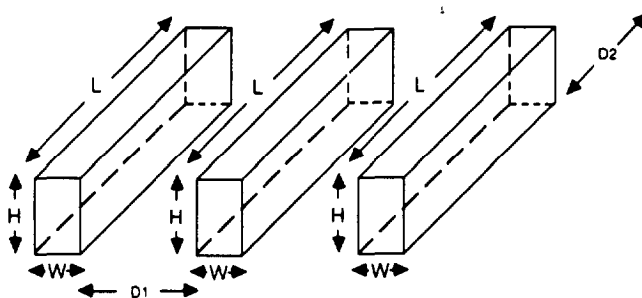
\*Hazard identifications for many oxidizing materials will be found in NFPA 49, *Hazardous Chemicals Data*, and in NFPA 491M, *Manual of Hazardous Chemical Reactions*.

Diagram 1. General Arrangement for Class 1 Oxidizers or Segregated Storage for Class 2 and Class 3 Oxidizers (All distances in feet)



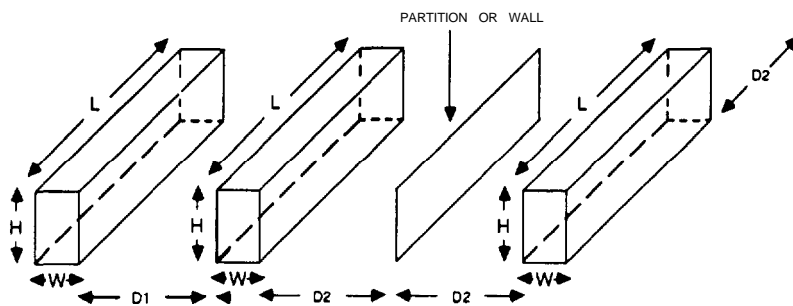
L = Length of individual pile      D1 = Distance between compatible piles  
 W = Width of individual pile      D2 = Distance from pile to wall  
 H = Height of individual pile      D3 = Distance between incompatible piles

Diagram 2. Detached Storage for Class 2 and Class 3 Oxidizers (All distances in feet)



L = Length of individual pile      D1 = Distance between compatible piles  
 W = Width of individual pile      D2 = Distance from pile to wall or  
 H = Height of individual pile      partition

Diagram 3. Cutoff Storage for Class 2 and Class 3 Oxidizers (All distances in feet)



L = Length of individual pile      D1 = Distance between compatible piles  
 W = Width of individual pile      D2 = Distance from pile to wall  
 H = Height of individual pile

Table 1. Class 1 Oxidizers-Segregated, Cutoff or Detached Storage  
Refer to Diagram 1 for location of dimensions

	Dim.	Unit	Sprinklered Building	Non-Sprinklered Building
Pile Dimensions:				
Length	L	Feet	No Limit	50
Width	W	Feet	50	50
Height	H	Feet	20	15
Pile Distance:				
To Next Pile	D1	Feet	3	6
To Walls	D2	Feet	2	4
Maximum quantity:				
Individual Pile		Tons	No Limit	No Limit
Total Building		Tons	No Limit	No Limit

Table 2. Class 2 Oxidizers-Segregated Storage  
Refer to Diagram 1 for location of dimensions

	Dim.	Unit	Sprinklered Building	Non-Sprinklered Building
Pile Dimensions:				
Length	L	Feet	No Limit	No Limit
Width	W	Feet	No Limit	No Limit
Height	H	Feet	10	8
Pile Distance to:				
Next Pile	D1	Feet	10 <sup>a</sup>	8 <sup>a</sup>
Walls	D2	Feet	2	4
Incompatible Storage	D3	Feet	12	10
Maximum quantity:				
Individual Pile		Tons	20	5
Total Building		Tons	200	100

<sup>a</sup> Aisle width must be equal to or greater than pile height.



Table 3. Class 2 Oxidizers-Detached Storage  
Refer to Diagram 2 for location of dimensions

	Dim.	Unit	Sprinklered Building	Non-Sprinklered Type 1 <sup>a</sup>	Building Type 2 <sup>b</sup>
Pile Dimensions:					
Length	L	Feet	No Limit	No Limit	No Limit
Width	W	Feet	No Limit	No Limit	No Limit
Height	H	Feet	12	8	No Limit
Pile Distance to:					
Next Pile	D1	Feet	12 <sup>c</sup>	8 <sup>c</sup>	No Limit
Wall	D2	Feet	2 <sup>d</sup>	2	2
Maximum quantity:					
Individual Pile		Tons	200	100	500
Total Building		Tons	No Limit	No Limit	500

- <sup>a</sup> Type 1 Detached Storage is designed to limit a fire to a single block of material with reasonable manual fire fighting.
- <sup>b</sup> Type 2 Detached Storage limits the total quantity in a single building because the possibility of successfully limiting damage with manual fire fighting is questionable.
- <sup>c</sup> Aisle width must be equal to or greater than pile height.
- <sup>d</sup> Required for combustible buildings only.

Table 4. Class 2 Oxidizers-Cutoff Storage  
Refer to Diagram 3 for location of dimensions

	Dim.	Unit	Sprinklered Building	Non-Sprinklered Building
Pile Dimensions:				
Length	L	Feet	No Limit	No Limit
Width	W	Feet	No Limit	No Limit
Height	H	Feet	12	8
Pile Distance to:				
Next Pile	D1	Feet	12 <sup>a</sup>	8 <sup>a</sup>
Wall or Partition	D2	Feet	2	4
Maximum quantity:				
Individual Pile		Tons	100	25
Total Building		Tons	2000	500

Aisle width must be equal to or greater than pile height.

Table 5. Class 3 Oxidizers-Segregated Storage  
Refer to Diagram 1 for location of dimensions

	Dim.	Unit	Manufacturing Plant or Warehouse		Processing Plant or Retail Store	
			Sprink.	Non-Sprink.	Sprink.	Non-Sprink.
Pile Dimensions:						
Length	L	Feet	No Limit	No Limit	No Limit	No Limit
Width	W	Feet	No Limit	No Limit	No Limit	No Limit
Height	H	Feet	8	6	8	6
Pile Distance to:						
Next Pile	D1	Feet	8 <sup>a</sup>	6 <sup>a</sup>	8 <sup>a</sup>	6 <sup>a</sup>
Walls	D2	Feet	4	4	4	4
Incompatible Storage	D3	Feet	10	8	10	8
Maximum quantity:						
Individual Pile		Tons	20	5	5	1.2
Total Building		Tons	100	60	50	25

<sup>a</sup> Aisle width must be equal to or greater than pile height.

Table 6. Class 3 Oxidizers-Detached Storage  
Refer to Diagram 2 for location of dimensions

	Dim.	Unit	Sprinklered Building	Non-Sprinklered Type 1 <sup>a</sup>	Building Type 2 <sup>b</sup>
Pile Dimensions:					
Length	L	Feet	No Limit	No Limit	No Limit
Width	W	Feet	No Limit	No Limit	No Limit
Height	H	Feet	10	6	No Limit
Pile Distance to:					
Next Pile	D1	Feet	10 <sup>c</sup>	6 <sup>c</sup>	No Limit
Wall	D2	Feet	4 <sup>d</sup>	4	4
Maximum quantity:					
Individual Pile		Tons	150	75	300
Total Building		Tons	No Limit	No Limit	300

<sup>a</sup> **Type 1** Detached Storage is designed to limit a fire to a single block of material with reasonable manual fire fighting.

<sup>b</sup> **Type 2** Detached Storage limits the total quantity in a single building because the possibility of successfully limiting damage with manual fire fighting is questionable.

<sup>c</sup> Aisle width must be equal to or greater than pile height.

<sup>d</sup> Required for combustible buildings only.

Table 7. Class 3 Oxidizers-Cutoff Storage  
 Refer to Diagram 3 for location of dimensions

	Dim.	Unit	Manufacturing Plant Processing Plant or Warehouse		Retail Store	
			Sprink.	Non-Sprink.	Sprink.	Non-Sprink.
Pile Dimensions: Length	L	Feet	No Limit	No Limit	No Limit	No Limit
Width	W	Feet	No Limit	No Limit	No Limit	No Limit
Height	H	Feet	10	6	10	6
Pile Distance to: Next Pile	D1	Feet	10 <sup>a</sup>	6 <sup>a</sup>	10 <sup>a</sup>	6 <sup>a</sup>
Wall or Partition	D2	Feet	4	4	4	4
Maximum quantity: Individual Pile		Tons	60	15	30	7.5
Total Building		Tons	1200	300	600	150

<sup>a</sup> Aisle width must be equal to or greater than pile height.

### Storage Arrangements for Retail Store Shelves

The same principles which are used for storage in buildings apply to storage on shelves. That is a pool chemical should be stored in such a way as to avoid contact with incompatible materials-including other oxidizers-which could react with the pool chemical or catalyze its decomposition. Use solid shelving so no loose or dripping material can fall through on the items beneath.

In deciding how to place various types of pool chemicals on shelves, use the following guidelines:

Always create barriers between incompatible pool chemicals.

If possible, keep incompatible pool chemicals on their own shelves, in their own compartments, separated by solid vertical partitions.

Try to avoid putting compartments containing incompatible pool chemicals next to one another.

If it is not possible to provide vertical partitions on a shelf, use packages of inert products (such as filter aids like diatomaceous earth) to separate incompatible materials from one another.

Place liquids on bottom shelves to prevent dripping on other pool chemicals in the event of breakage or leakage.

Due to the almost infinite variety of shelving sizes and arrangements, and to widely varying pool chemical stocking requirements, it is obviously impossible to cover every situation. However, the following two diagrams may be of assistance in planning shelf storage.

If the shelves contain only calcium hypochlorite and chlorinated isocyanurates, follow the suggested plan shown in Diagram 4.

If shelves also contain other types of pool chemicals (acid, pH adjusters, algicides, etc.), see Diagram 5.

### Additional Storage Considerations

The general rules of safety, fire protection, house-keeping and strict stock rotation (first-in, first-out) should be followed closely when handling and storing pool chlorinating chemicals.

The following recommendations are based primarily on NFPA Bulletin 43A (1980).

**Fire Protection:** Fire hydrants, water supplies and sprinkler systems should be provided in accordance with the authority having jurisdiction. Installation should be in accordance with NFPA standards.

Fire hydrants: Conditions that affect the need for hydrant protection include:

Nearness of exposures

Size and construction of the building

Amount and Class of NFPA oxidizer stored

Availability of public fire protection

Hydrants should be installed in accordance with NFPA 24, *Standard for Outside Protection*.

**Water supplies:** Water supplies should be adequate for the protection of the oxidizer storage by hose streams and automatic sprinklers.

Where protection is by means of hose streams alone, the water system should be capable of producing not less than 750 gpm (gallons per minute). Where there are automatic sprinklers, the system should provide 500 gpm in excess of the sprinkler water demand.

Duration of the water supply should be in accordance with NFPA 231, *Standard for Indoor General Storage* and NFPA 231C, *Standard for the Installation of Standpipe and Hose Systems*.

**Automatic sprinkler systems:** The need for automatic sprinkler protection is determined by the nature of the materials, the manner of storage and the construction of the buildings under consideration. When automatic sprinkler systems are required, they should be installed in conformance with NFPA 13, *Standard for the Installation of Sprinkler Systems*.

However, as previously noted (page 2), an oxidizer fire probably will not be contained by the sprinkler system alone. The fire department must be called.

**Smoking:** Smoking should be prohibited in all storage areas which contain oxidizing materials. "No Smoking" signs should be placed conspicuously within the area and at all entrances to such storage areas.

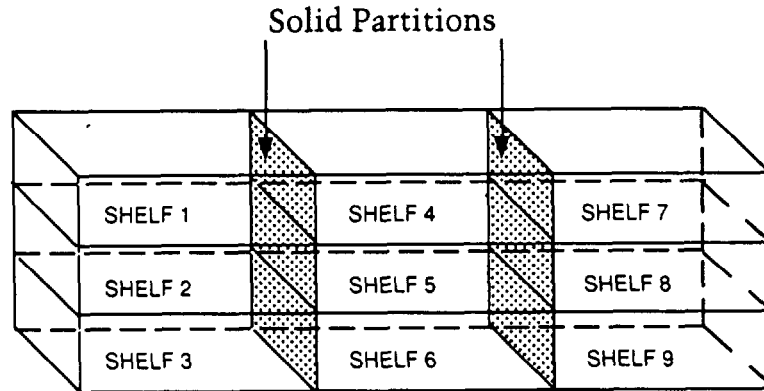
**Waste disposal:** The accumulation of combustible waste should be prohibited. Spilled materials, and leaking or broken containers, should be immediately removed to a safe area to await disposal. See Handling Minor Spills, page 19.

Disposal should be in accordance with the manufacturers' instructions and with all Federal, state and local regulations.

**Disposal Equipment:** Items such as brooms and shovels should be dedicated to this use and kept clean, dry and uncontaminated. Clean polyethylene-lined drums for disposal of spilled material should be kept nearby.

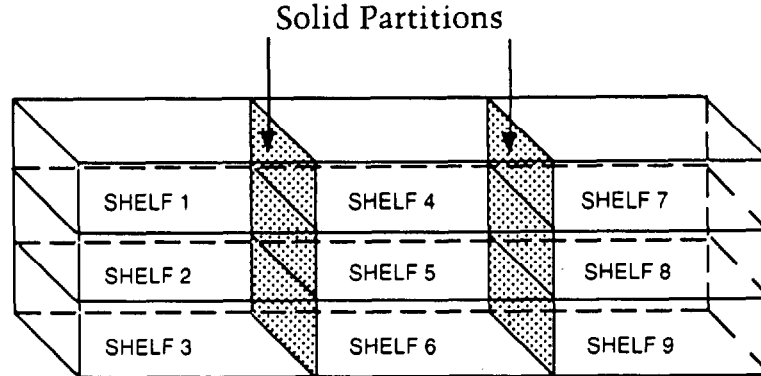
**Forklifts:** To minimize danger of contamination from spillage, forklifts should be either electric or propane. Diesel- or gasoline-powered forklifts are not recommended.

Diagram 4. Retail Store Suggested Shelf Arrangement for Calcium Hypochlorite and Chlorinated Isocyanurates



Shelf 1: Cal. Hypo.	Shelf 4: Dichlor	Shelf 7: Trichlor
Shelf 2: Cal. Hypo.	Shelf 5: Dichlor	Shelf 8: Trichlor
Shelf 3: Cal. Hypo.	Shelf 6: Dichlor	Shelf 9: Trichlor

Diagram 5. Retail Store Suggested Shelf Arrangement for Pool Chemicals and Acids, pH Adjusters, Algicides, etc.



Shelf 1: Cal. Hypo.	Shelf 4: Trichlor	Shelf 7: Trichlor
Shelf 2: Diatomaceous earth	Shelf 5: Dry pH adjusters	Shelf 8: Diatomaceous earth
Shelf 3: Dichlor	Shelf 6: Muriatic acid	Shelf 9: Algicide

# Processing Guidelines

Pool chemicals are sometimes sold to other companies for further processing, repackaging or tableting. If these companies are using various incompatible pool chlorinating chemicals (such as calcium hypochlorite and chlorinated isocyanurates) they must provide means of completely segregating their processes.

The processing area should be a cool, dry, well-ventilated location, preferably air-conditioned. The room should be under a slight negative pressure provided by a suitable vapor and dust removal system. See Dust Disposal, page 17.

Presses, conveyors and equipment associated with each processing operation—including *dust collection* systems—must be dedicated to that particular product line. Mixing of the products can result in serious fire and/or explosion and release of toxic gases.

Forklifts should be electric- or propane-powered to reduce the hazards from spillage of flammable or reactive products. Diesel- or gasoline-powered forklifts are not recommended.

It is recommended that operators of forklifts and mixing equipment wear safety glasses or goggles and protective clothing to prevent contact between pool chemicals and eyes or skin. The operator should also carry appropriate respiratory equipment. See Personal Protective Equipment, page 18.

## Formulating

Before manufacturing large quantities of material containing chlorinated pool chemicals, performance and stability tests should be run with smaller quantities of the formulation. This enables the processor to determine—among other things—the compatibility of all ingredients, the formulation's stability in mixing and storage, and differences which may be caused by batch size alone. Details of such tests should be discussed with the manufacturer of the pool chemicals.

Chlorinated pool chemicals should be moved with care from storage to the processing area. For the protection of the handlers, the drums should be opened in such a manner that any chlorine vapors sealed in the drums will be vented to the exhaust system. If desiccants are present in the drums, they should be removed and disposed of as instructed by the supplier.

Once chlorinated pool chemicals have been introduced into the formulation, mixing should be

continued only for the length of time needed to insure homogeneity of the blended product. Overmixing will, in most cases, expose the product to moisture pickup. It will also cause product attrition (by grinding) of particles in the formulation. This, in turn, leads to increased segregation of individual components, as well as excessive fines or dust.

Excessive mixing of formulations containing chlorinated pool chemicals leads to undesirable and irritating dust in the air. Contact with moisture may then produce caked deposits in the mixer and less than the desired stability of the contained chlorine.

Use silicone or fluorocarbon lubricants on packaging and processing machines. For specific recommendations, contact the appropriate pool chemical manufacturer (see inside front cover).

## Special Precautions When Formulating With Trichloroisocyanurates

Certain formulations of trichloroisocyanurates may create hazards involving preparation, storage and use.

It is hazardous to formulate trichlor with nitrogen-containing organics such as quaternary ammonium algicides ("quats"). Trichlor can react with the quat and result in decomposition, gas generation and even fire under certain storage conditions.

Certain mixtures of trichlor and soda ash ("fast-tabs"), or other alkaline materials, are not recommended.

For example, combinations of trichlor with alkaline materials which bring the solution pH into the range of 4.5-11, and the concentration of trichlor above 0.1% could be hazardous. Under these conditions, there may be sufficient decomposition with attendant release of gases, to create a potentially explosive situation.

A dry mixture of about 70% trichlor and 30% sodium carbonate would have a solution pH of 6-8.5 if everything were dissolved. At this pH, trichlor is unstable. Moisture reaching the dry mixture during preparation or storage will lead to gas generation and possible explosion.

Use of granular trichlor, cut or uncut, is not recommended for routine sanitation of swimming pools.

Storage and use of the granular trichlor is more hazardous than that of trichlor which has been compressed into tablets or sticks.

# Transportation Guidelines

## Dust Disposal

Dust from chlorinated pool chemicals is neither combustible nor explosive. It will, however, cause irritation to the eyes, skin and respiratory tract.

Therefore, provision should be made to conduct any dust from the mixer away from the area by a suitable dust collecting system. Such a system should consist of:

Ducts of either plastic or epoxy-coated metal, located as close to the mixer or tablet press as possible.

*Cyclonic collector* made of epoxy-coated steel or fiberglass-reinforced polyester to receive dust from the ducts.

Filter, fiberglass mesh type.

Fan to exhaust into the outside atmosphere.

Material which accumulates in this system must be collected and disposed of daily, according to applicable Federal, state or local regulations.

The Department of Transportation [DOT] regulates the transportation of calcium hypochlorite and chlorinated isocyanurates in commerce under 49 CFR.

These swimming pool chlorinating chemicals are oxidizing agents and are very reactive with other pool chemicals, as well as with many other products.

Therefore, any vehicle loaded with 1,000 lbs. or more of DOT-regulated dry chlorinator products must display "oxidizer" placards in the proper manner, along with adequate bill of lading descriptions governing pool chemicals.

DOT regulations must be followed when making mixed shipments of pool chemicals and other products.

Every effort must be made to segregate incompatible products by establishing buffer zones of compatible materials, such as plywood.

# Personal Protective Equipment

In normal handling of calcium hypochlorite and chlorinated isocyanurates, the following personal protective equipment is recommended.

At all times:

Goggles/safety glasses

When handling chemicals or cleaning a spill:

Impervious gloves

Impervious boots

Coveralls

Aprons

When in dusty areas:

NIOSH/MSHA approved chlorine gas/dust cartridge respirator

When fighting a fire:

NIOSH/MSHA approved positive pressure self-contained breathing apparatus

NOTE: The "Buddy System" is mandatory in fire fighting. Therefore, duplicate sets of equipment are required.

## First Aid

In the event of an emergency, follow these three steps:

1. Remove contaminated clothing.
2. Perform the first aid procedures indicated below.
3. Call a physician immediately.

### First Aid Procedures

Skin contact: Immediately flush the skin with water for 15 minutes.

Eye contact: Immediately flush eyes with water for 15 minutes.

*Ingestion:* Immediately drink large quantities of water. Do not induce vomiting.

*Inhalation:* Immediately remove victim to fresh air.

Any clothing which has come in contact with pool chemicals should be washed before reuse.

# Emergency Procedures

Any spill involving chlorinated pool chemicals can lead to an emergency. The only emergency which you should consider handling without assistance from the manufacturer or the fire department is the cleanup of dry, uncontaminated minor spills, less than 100 lbs. (See page 191).

In all cases, alert the supervisor and report:

- Which chemical has spilled
- How much has spilled
- The condition of the spilled material
  - Is it dry or damp?
  - Is there evidence a reaction has started (bubbling, fuming, hissing, bulging drums)?
  - Are there signs a fire may have started?

If there are signs of fire, the building should be evacuated and the fire department called immediately, even if the building has a sprinkler system. In extinguishing a fire, copious amounts of water should be used. Do not use dry powder fire extinguishers.

Whether or not there is a fire, the supplier should then be called for instructions on how best to clean up and remove spilled material prior to its disposal according to regulations. See the list of Emergency Telephone Numbers on the back cover of this brochure.

### While Waiting for Instructions

If the spill is dry and uncontaminated, follow these steps:

1. Have other personnel leave the immediate area.
2. Provide ventilation.
3. Mark off the area and make sure no foreign material enters it.
4. Obtain protective clothing (see above).
5. Get clean, dry drums for holding the spilled material and the leaking containers.
6. Get clean brooms and shovels for picking up the spilled material.
7. Be sure there is a clear, unobstructed route from the spill area to the outside of the building.



# Handling Minor Spills

Minor spills (less than 100 lbs.) of calcium hypochlorite or chlorinated isocyanurates must be cleaned up promptly. Proper safety precautions should be followed at all times.

## Preparation

Before attempting to clean up a small spill be certain that the material is uncontaminated and dry. If there is any sign that a reaction has begun (bubbling, smoking, burning, hissing, even a strong smell), evacuate the area and contact the manufacturer immediately for assistance. If there is any evidence of a fire, call the fire department immediately. See preceding section.

In cleaning up a spill, use a clean, dedicated broom or shovel (dirt or oil could contaminate the chemicals).

Do not use floor sweeping compounds when cleaning up chlorinated pool chemicals; they may cause a reaction.

Have two clean drums available; an overpack drum to receive the damaged container and another for the spilled chemical.

Do not put spilled chemicals back into the original container. They have been contaminated by other material on the floor. Returning them to the original container can cause a reaction.

Do not put spilled product into the trash. Contact with incompatible materials could cause a reaction.

Keep spilled material dry. If allowed to stand in damp or wet areas, tear-producing vapors may result. And do not dampen the product with water during the cleanup process; a reaction may occur. However, see Neutralizing Calcium Hypochlorite or Dichlor, below. If the material is trichlor and has been wet or contaminated, contact the manufacturer for neutralizing methods.

Keep unneutralized and/or chlorinated compositions out of sewers, watersheds or water systems.

## Procedure for Cleaning up Small, Dry Spills

In cleaning up a *minor spill* (less than 100 lbs.), follow the recommended steps, below. (There is one possible alternative: If the spilled material is *calcium hypochlorite or dichlor, and involves* about 10 lbs. or less, you may choose to neutralize the material. If so, see the next section, Neutralizing Calcium Hypochlorite or Dichlor.

1. Notify the supervisor of the situation.
2. Put on the appropriate protective gear (see page 18).
3. Place the damaged container in a clean overpack drum. It is important that the drum be clean so the spilled chemical does not react with dirt or any other contaminant.

4. Place the lid loosely on the drum and leave it unsealed.
5. Sweep up any dry, spilled material and place in another clean, dry, DOT-approved container for proper disposal.
6. Apply appropriate labels to both containers.
7. Contact the manufacturer for further instructions.

**Neutralizing Calcium Hypochlorite or Dichlor**  
This optional procedure is for small spills (10 lbs. or less) of calcium hypochlorite or dichlor. All spills of trichlor should be kept dry, and handled as described in the preceding section. This procedure may be used only if local regulations permit disposal of solutions containing 1 ppm available chlorine in the sewer.

If the spill includes both calcium hypochlorite and dichlor, they must be neutralized separately. These products are incompatible with each other and therefore must not be neutralized together.

To neutralize small spills, take the following steps:

1. Notify the supervisor of the situation.
2. Put on the appropriate protective gear (see page 18).
3. Place the damaged container in a clean overpack drum. It is important that the drum be clean so the spilled chemical does not react with dirt or any other contaminant.
4. Place the lid loosely on the drum and leave it unsealed. Put an appropriate label on the container and contact the manufacturer for further instructions.
5. Place a clean 55-gallon drum out of doors and away from the spill, Fill the drum with tap water.
6. Sweep up any spilled material and place in the water-filled drum.

**NOTE:** Always put calcium hypochlorite or dichlor in the water; *do not add water to a vessel which already contains calcium hypochlorite or dichlor.* If contaminated, toxic fumes may be evolved and a reaction may occur.

7. Allow the calcium hypochlorite or dichlor to decompose.
8. When the available chlorine is less than 1 ppm (as determined with a pool water test kit) it may be flushed to the sewer, assuming local regulations permit.

# DO's and DON'Ts

## For Storing and Handling Calcium Hypochlorite and Chlorinated Isocyanurates

### **DO:**

- Have an established emergency response plan in place
- Maintain good housekeeping standards
- Separate incompatible materials
- Store in a cool, dry, well-ventilated space
- Store on pallets or shelving at all times
- Clean all equipment thoroughly prior to changing product lines
- Empty all hoppers at the end of each day
- Wear or carry appropriate personal protective equipment
- Keep clean overpack drums nearby in case of emergency
- Notify supervisor of an emergency situation
- Keep spilled material dry and free of moisture

### **DON'T:**

- Store liquid materials above solids
- Allow oil, grease or organic material to accumulate on the floor
- Smoke where chlorinating chemicals are stored or processed
- Use a common dust exhaust system for incompatible products
- Operate diesel- or gasoline-powered forklifts
- Use floor sweeping compounds when cleaning up chlorinating chemicals
- Put spilled material back in the original container
- Allow material in the container to come in contact with water
- Dispose of spilled material in trash or waste container
- Allow unneutralized and/or chlorinated materials into the sewer
- Use dry powdered fire extinguishers

# Notes

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# Emergency Telephone Numbers

For assistance, call the company from which you purchased the product:

Calcium hypochlorite supplier:

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Tel. \_\_\_\_\_ Name \_\_\_\_\_

Chlorinated isocyanurate supplier:

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Tel. \_\_\_\_\_ Name \_\_\_\_\_

If you do not have an emergency telephone number for your supplier, you may use any of the following emergency numbers:

1-800-325-1110 Monsanto Chemical Company  
(regarding trichlor and sodium or potassium dichlor)

1-800-OLIN-911 Olin Corporation Emergency  
Action Network [OCEAN]  
(regarding calcium hypochlorite,  
trichlor or sodium dichlor)

1-304-843-1300 PPG Industries (regarding calcium  
hypochlorite)

1-800-424-9300 CHEMTREC (regarding calcium  
hypochlorite or any chlorinated  
isocyanurates, in transit)

## Local Emergency Numbers

\_\_\_\_\_ Fire Department

\_\_\_\_\_ Police Department

\_\_\_\_\_ Physician

\_\_\_\_\_ Other: \_\_\_\_\_