Suppression Strategies for Tire Fires

Workbook and Training Program

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A Successfully Fought Scrap Tire has Several Common Elements

- ✓ Good Identification and Pre-Planning
- ✓ Proper Size up and Resource Commitment
- ✓ A Unified Incident Command Structure
- ✓ A Solid On-Site Safety Plan

Suppression Strategies for Tire Fires

- ✓ **An Overview of Tactical and Strategic Thoughts**
- ✓ **Optional Strategies for Suppression**
- ✓ **Environmental Considerations**

Some Fast Facts concerning the use and storage of scrap tires.

* Typically, about *242 million* tires annually are discarded
* *3 to 4 billion tires* are currently held in storage
* Only *28%* are ever recycled...the rest are held in storage

Scrap Tires will produce *34,950 BTU/lb*

No. 6 Fuel Oil will produce *41,940 BTU/lb*

Bituminous Coal will produce *27,960 BTU/lb*

1 Car Auto Tire = *2.5 Gallons of Oil*

Estimates of Quantity

* Chipped Tires = *33 Lbs per cubic foot*
* Average Car Tire = *21.6 Lbs*
* The cubic feet of the total pile divided by 27 and then multiplied by 10 will give the total number of randomly stacked tires

Incident Decision Levels

- ✓ **Prevention**
- ✓ **Pre-Fire Planning**
- ✓ **Suppression Activities**
- ✓ **Environmental Concerns**
- ✓ **Fire Fighter Safety Considerations**

This collection of data is from historic tire fires and established national standards.

* *Hagersville, Ontario, Canada*
* *East Chicago, IN*
* *California State Fire Marshall's Office*
* *Scrap Tire Management Council*
* *NFPA 231D*

The goal of this review is to provide an overview of considerations a suppression agency can use in making decisions towards mitigation of a scrap tire incident.

Resources abound for each level of decision making. State, local and federal agencies, as well as suppression equipment manufacturing firms and Class A foam producers can all provide the needed resources for a successful outcome.

Prevention Considerations

- ✓ ***Identification*** **of all Storage and Processing Facilities**
- ✓ ***Model Management*** **of These Locations following National Guidelines**
- ✓ ***Development*** **of Local and State Codes**

One of the single most important steps in helping to mitigate this growing problem is to identify and track storage and processing facilities within your jurisdiction. Be aware of illegal dumping sites as well as locations with necessary permits. Typical indications of pending trouble include some of the following;

* *Business in financial difficulty*
* *Business involved in court proceedings or litigation*
* *Federal Environmental alert for pollution problems (air or water)*

Refer to NFPA 231D for sample wording and management suggestions to help ward off a possible incident. Some of the items of concern should include;

* *Clearance between piles and between exposures (normally recommended at 60 feet)*
* *Light Flashy Fuels and vegetation kept to a minimum (avoidance of an interzone fire problem)*
* *Security to avoid purposefully set fires*

Work with your state and local jurisdictions to provide sample and model codes that can become a valuable enforcement tool in the future. Also, work closely with mutual aid resources to determine any multi agency coordination that may need to take place in advance of an incident.

Pre-Incident Planning

- ✓Location of the Tire Pile
- ✓Scope of On Site Operations
- ✓Make up and Size of the Pile
- ✓On Site Resources
- ✓Local Mutual Aid Agencies
- ✓Outside Resources

Location

The relationship of the location of the potential fire to the surrounding community. Access into the site and the tires. Water supply locations. Topography and soil types.

Scope of the Operation

Are the tires in an unmanaged dump? An illegal dump site? An active recycling center or cogeneration facility? These differences could provide a great deal of information on exposures, water supply and the like.

Make up and Size of the Pile

Using some simple formulas listed previously, determine the size in cubic feet of the pile. Determination of unconnected and connected piles and exposures are necessary as well. Tires can be in shredded form, unstacked, or stacked. The method of storage will determine total mass and potential resources needed to mitigate the incident.

Resources and Equipment

Generally in a functioning operation, heavy equipment and possible suppression equipment may be stored on site. These should be documented for later use if necessary. Mutual aid and multi agency resources should be identified and brought up to speed on the tactical and strategic plans for suppression. Outside agency or contractual support should be identified and agreements secured before any incident. Within your own agency, all resources needed for a prolonged suppression effort should be identified and training accomplished. If necessary suppression equipment is not available and a plan cannot be made to acquire them, support from mutual aid companies will be necessary.

Pre-Incident Planning

✓Hazards

✓Exposures

✓Service

✓Access

✓Contacts

Hazards

Typically, a functional facility using equipment will have fuel sites and heat oils etc. on site. These coupled with the heavy equipment and processing equipment can provide additional considerations to responding agencies. Aside from the necessary protective equipment, special considerations will have to be given to internal structural hazards as well. Illegal dumps sites will always pose special hazards from other possible hazmat contaminations as well.

Exposures

Not only exposure from immediate flame impingement, but also exposure of personnel and citizens to smoke. Direct flame impingement in many cases is the smallest of exposure problems. Be aware of surrounding roads, neighborhoods, waterways, as well as the standard exposures we look for upon arrival.

Services

Utilities like gas and electric should be identified and locations of all shutoffs kept clean and accessible. Phone and cable TV hookups should also be identified to avoid confusion. Propane, underground fuel storage, forklift fuels and the like should all be identified before entry into an involved processing structure.

Access and Contacts

Keep records of all after hours numbers for resources to get onto properties. Assess all means of egress and roads into and out of the location. Heavy trucks and soft ground don't mix well. If road surfaces are inadequate for department equipment, work with other authorities having jurisdiction to correct the problem.

Suppression Strategies

Initial Size Up Upon Arrival

✓ Incident Command System Established

✓ Personnel Safety and Accountability Reviewed and Monitored

✓ Local Citizens at Jeopardy

✓ What Environmental Impact will Suppression Activities Have

Incident Command Structure

It will become increasingly important if this incident becomes a long term affair, that a multi agency incident command structure be put into operation. The complexity of dealing with the multitude of resources needed to mitigate an incident of this nature can quickly become overwhelming. Good organized management is a key to a successful outcome on large scale tire fires.

Personnel Safety and Accountability

It is imperative that fire fighter safety not take a back seat to any suppression efforts. Tire dumps and handling facilities present dangers that can only be determined with preplanning. Even movement in scrap tires can become dangerous. A firefighter accountability system is primary to the health and welfare of the responding agencies and should be considered a high priority for the Safety Officer's duties. SCBA use is mandatory within the HOT zone.

Public Health and Safety

Direct flame impingement, smoke and toxic fumes, and run off contamination will all affect the local citizens. Life safety issues must always be of a higher concern than suppression activities. Fires of a large scale will ultimately involve any number of state and federal agencies to protect the interests of the public. Decisions made immediately during initial suppression activities can have a lasting effect. Run off water may pollute local waterways or city sewer systems. Smoke may force evacuation of nearby residences. Fire spread could involve other structures and involve many mutual aid departments. Size up is only one tool, and a tool that must have pre-suppression activities coordinated with it for a successful initial attack to occur.

Suppression Strategies

Initial Size Up Upon Arrival

✓**Size and Extent of the Fire**

✓**Potential Fire Load**

✓**Exposures**

Size and Extent of the Fire

Upon initial observation, a determination must be made as to the extent of the fire. Is it totally involved, or only a percentage. Can a line be drawn, a fire break made and held? Do additional fuel sources pose a potential exposure problem? What is actually burning...chipped or whole tires? Are the tires burning only on the top, or has it become a deep seated fire? For a fire that has gone on for a while, have the tires turned to a liquid molten state and have to be handled more as a Class B flammable liquid? *These are all questions that will help mold the decisions for additional resources as well as an initial attack strategy.*

Potential Fire Load

The Size and Volume of the pile is extremely important to consider during size up. To be too conservative on the commitment of resources could lead to a more long term "campaign" type of fire. As with any suppression activity, to immediately provide sufficient resources and support services is critical to a quick extinguishment. Use the formula given previously to help figure the volume of tires and cubic feet you will have to deal with.

Exposures

As with any structural initial attack all exposures must be considered. Sometimes even the most insignificant one can play a major part in causing problems later in the activities. Initial attack fire flow needs to be given high priority during operation set up to prevent any unwanted extension. Exposures can even be unburnt piles of tires, or structures or equipment and vehicles. In many cases in working facilities, this equipment is someone's business and the value and loss to the local community can be substantial.

Suppression Strategies

Initial Size Up Upon Arrival

✓ **Resources**

* **Local**
* **State**
* **Federal**

✓ **Costs for Suppression and Cleanup**

Resources

If the fire progresses past the initial attack stage, (the first day), potential additional resources may be needed. Locally, mutual aid agencies may provide additional suppression equipment and support services as with any structural attack. The problem will arise as the fire goes on for a period of time, Food, fuel, sanitary facilities, medical, and mechanical support services will all need to be provided. Preplanning this can save considerable time. State agencies that deal in health and welfare can be a tremendous resource for support and management of the fire. These agencies (Fire Marshall's office, State Board of Health, and Departments of Emergency Management) are also the conduit to get things like funding and resources at a state level. Federally, EPA, the Coast Guard Spill Response Teams, OSHA, and other air and water quality control agencies can provide extensive data collection and monitoring equipment. The key to working with this myriad of agencies is to create a unified multi agency incident command structure. When working in harmony each agency can bring resources to the table that no other has. This type of structure is one that can only take place with preplanning. To expect this type of coordination the day of the fire will only promote individual agency freelancing and a delay in final mitigation of the problem.

Costs

Though not thought of on an initial attack strategy, a long term fire can quickly become an overwhelming financial burden on the local fire jurisdiction. Support and suppression costs mount very quickly leaving the department budget in ruins. In an operating facility insurance should be investigated immediately. In the case of an illegal dump site, the local and state administration personnel should be notified as quickly as possible. More times than not, contractual heavy equipment is needed to break a pile apart. This equipment comes with a price and many times only with a guarantee of payment. *Again, preplanning for financial support can avoid a painful lesson.*

Suppression Tactics

✓ **Allow it to Burn out on its own, or Accelerate the Burning Process**

✓ **Drown it with Fire Streams**

✓ **Bury it**

After you have taken into account all of the items in pre-planning of the fire site and collected all of the data from the initial size up upon arrival, one of these three tactics will more than likely be used to come to a successful conclusion. *Never limit yourself to a single tactic either. In a many cases one tactic was employed initially and another later in the operation.*

Each tactic has its' own set of needs. To declare the fire as one that will be allowed to burn must take into consideration the problems of smoke pollution into the surrounding area. If populated, a lengthy evacuation may be in order. "Let burn" tactics also must consider the exposures and if a long term fire is inevitable, what resources will be needed to protect them. On several occasions accelerants have been used to speed the process along. *In all cases this strategy must be the recognized solution by both local, state and federal authorities.*

To drown the fire requires the necessary resources in water supply and/or foam to provide a critical application rate. To apply water and never reach the seat of the fire does nothing more than create additional contaminants in the waterways and sewage treatment facilities. More times than not, a drown tactic must be worked with heavy equipment to get into the seat of the fire and to segment the piles for more effective extinguishment.

The option of burying the burning pile can be effective if the size is right. Additional heavy machinery and soils and topography that are appropriate for this tactic will dictate its effectiveness. Again, this tactic should only be undertaken when a strategy is in place that involves all local, state and federal agencies.

All of these tactics should be preplanned for the greatest effectiveness.

Suppression Tactics

Burn The Pile

- ✓ **Find Ways to Speed up the Process**
- ✓ **Air Pollution vs. Ground Water Contamination**
- ✓ **Personnel Exposure**
- ✓ **Public Safety Concerns**

Let it Burn Tactic

A let it burn tactic may have a great deal of merit when resources are minimal, water supply inadequate, and personnel limited. As with a burning tanker of flammable liquids, sometimes the best strategy is to stand back at a safe distance and allow the fire to burn in a somewhat controlled manner.

The use of accelerants has been discussed as well as breaking the pile apart with heavy equipment to allow air to move freely, but it again in one case cannot be done safely and the other requires the use of equipment resources that may not be available.

The production of smoke is a major consideration, but the creation of ground water pollution is the other side of the coin. If the wind conditions and location of the fire warrant, a let it burn tactic can be the most effective and prudent. The more heavy equipment becomes involved, the higher the costs of suppression will be.

A let it burn conclusion can on be a weighed decision made by all involved in the multi-agency unified command structure. Public relations will become a very important part of the operation as well. ***A PIO or public information officer should be assigned immediately upon a let it burn decision to prevent potential "bad" press for the operation.***

Suppression Tactics

Drown the Fire

✓Water Supply Resources

✓Run off Water Containment

✓Pumping Resources

✓Supportive Equipment

The Drown the Fire Tactic

A drowning tactic needs to take several factors into consideration. **The primary is run off of contaminated suppression water.** A good knowledge of the area's topography and soil types is a must. Water runoff routes and nearby bodies of water must be protected with run off water containment methods. In a drown situation the water is typically heavily laden with pyrolitic oils from the burning tires. This can be a major concern along with the volume of heavy metals in the water. *Fire fighter safety is critical and handling of soaked materials should follow the same operating procedures as that of a hazmat spill.* The Coast Guard and contractual clean up companies are the best source of long term containment and cleanup of this runoff. Realize that many thousands of gallons a minute can be applied to the fire, and that translates to a great deal of possible contamination.

For this tactic to be effective a reliable, sustainable and adequate water supply must be established. The other problem that comes about is getting the water into the areas of deep seated fire. Most times this can only be accomplished with the help of heavy machinery and a great deal of time and expense. The addition of foams and water additives will be discussed later. One thing to remember as well, is that if your tactical operations are being effective, the smoke will become more of a problem as more and more unburnt particulate matter is generated from the growing incomplete combustion of partial suppression.

Fire pumping apparatus must be positioned for the "long haul" on this type of campaign. To have to stop and reset operations is not only time consuming but equally frustrating. Engines, portable pumps, pollution cleanup equipment must be kept fueled and maintained at all times and sufficient support services should be maintained with this as a primary responsibility. *This will be one of those fires that taxes the ability and resources of a single department.* Mutual aid response will be critical for not only pumping and support operations, but the use of personnel as replacements on the fire line is mandatory.

Suppression Tactics

Foam Enhancement to the Water Supply

✓ **Reduction of Run off Water and Contamination**

✓ **Acts as a Smothering and Penetrating Agent**

✓ **Easily Added with Portable Injection Equipment**

✓ **Cost Effective**

Foam Enhancement to Initial Attack Fire Streams

The use of foaming agents has shown the greatest potential for suppression of deep seated tire pile fires. Though water is still the product of choice for heat absorption and is the basis for modern day fire fighting, its' inherently high surface tension works against you in this type of fire as the water beads up and rolls away.

Foam not only reduces the surface tension of the water for quicker and deeper penetration into the pile, but when expanded into finished foam, will coat, cling, and stick to burning tires. This ability to smother the fire is the greatest benefit water additives and foams provide. This allows water to work on several sides of the fire tetrahedron simultaneously.

Federally approved (USFS / Missoula Fire Sciences Labs / NFPA 298) foaming agents are the best choice, as they provide the highest foaming characteristics and the best reduction in surface tension for the least cost. Also, these foams are approved for use on the ground. They biodegrade quickly and do not make the runoff water contamination worse. On the contrary, when foam is used, a marked decrease in the amount of water necessary is typically noted. This means less runoff and cleanup, and ultimately cost.

Foam injection and application equipment is portable, simple, rugged and can easily be used by any fire agency with minimal training. Approved Class A foams are available from a number of national manufacturers and can in many cases be delivered on very short (emergency) notice. Though there is a cost of using foam, the cost of a prolonged fire can be substantially worse.

Suppression Tactics

Bury the Burning Pile

✓**Ground Contamination**

✓**Equipment Resources**

✓**Geological and Soil Compatibility**

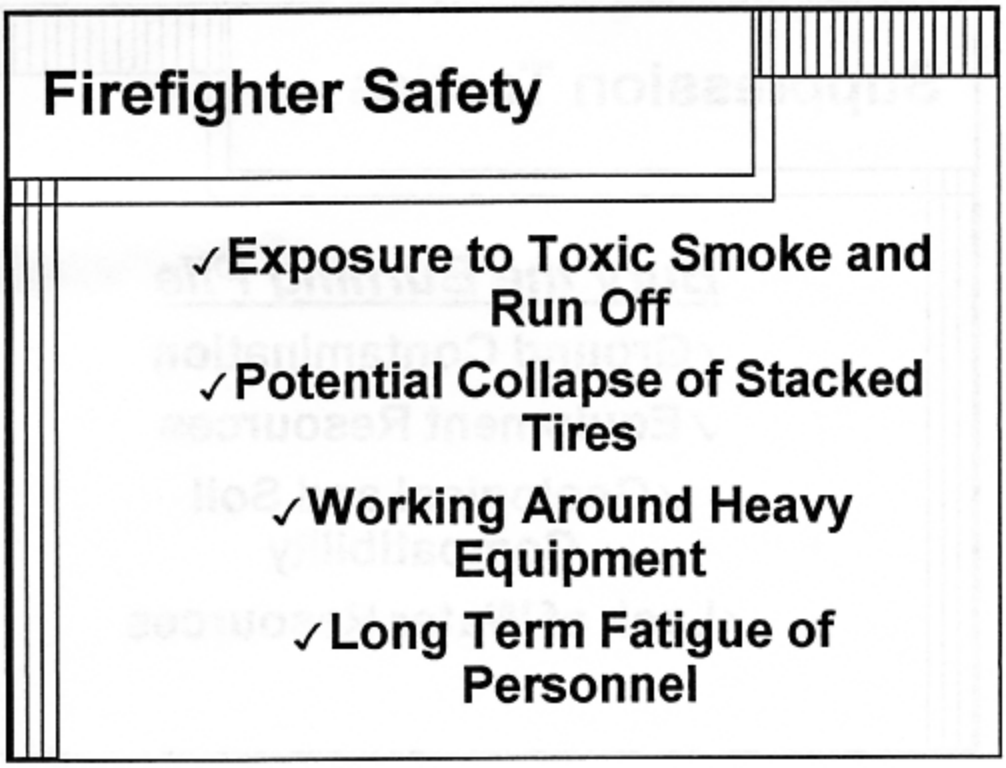
✓**Lack of Water Resources**

The Bury the Pile Tactic

Occasionally when water and pumping resources are scarce or inadequate, the opportunity exists to dig a hole, or just bury the burning pile. **This tactic is extremely effective when an immediate cessation of toxic smoke is necessary for public safety reasons.** Possibly the location is ideal for this type of tactic. Then the only question is how to secure the materials and equipment to use this suppression strategy.

Pre-planning and immediate access to heavy equipment are two key elements in a successful bury it strategy. Some of the materials used to bury piles in the past include soil, sand, cement dust and rock. Often these materials have to be hauled in at potentially great expense. Again, this tactic should only be undertaken with complete coordination and input from members of the multi agency incident command team. Serious ground water contamination can take place well after the fire from pyrolitic oil given off and everyone needs to be ready to deal with this problem. *Soils types and topography have to be looked at very carefully to find the right fit of elements to make this work.*

Working with heavy equipment in smoky conditions will tax the ability of the assigned safety officer to keep up with the activities of not only the local fire agency, but the members of local companies working on site. **It is imperative that a solid command structure be followed even by these outside resources to prevent unwanted injuries to personnel.**



Fire Fighter Safety Considerations

One of the first duties of any command structure is to put into place the position of Safety Officer. Duties of this position are typically widely varied, but vitally necessary. Fire operations on or around tires present special dangers. Collapse of stacked tires, unfamiliar scrap processing equipment, heavy equipment usage during operations, and exposure to contaminants from the air and ground water all have to be considered in a site safety plan. Even walking around and through scrap tires with the metal belting mixed in can be a challenge.

The use of SCBA in any area that has smoke should be a mandatory requirement for fire as well as support or contractual personnel. Anyone falling into or even walking through runoff water should follow department guidelines for hazardous materials cleanup. *A medical sector should also be part of the overall command structure.* The safety officer should work closely to see that all personnel are monitored and receive sufficient rehab in long term operations.

In operations that put personnel in close working proximity to the burning tires, expect contaminants such as heavy metals, dioxins, polynuclear aromatic hydrocarbons PNA, Carbon Monoxide, and other volatile organic chemicals also typically are present in both air, ground and run off water. Something as simple and as much a nuisance as a tire fire should not be overlooked from the exposure level. Good safety and medical practices during fire operations are necessary for all involved. *Some of the outside resources mentioned earlier such as state and federal air and ground water quality agencies can provide extremely accurate air and run off water sampling data in real time while on site. This data can be invaluable to the decisions made by the safety officer.*

Summary

A Successfully Fought Scrap Tire has Several Common Elements

✓Good Identification and Pre-Planning

✓Proper Size up and Resource Commitment

✓A Unified Incident Command Structure

✓A Solid On-Site Safety Plan

Reference Materials

The Scrap Tire Management Council
1400 K Street NW, Suite 900
Washington DC 20005 202-408-7781

The California State Fire Marshall's Office
(Tire Fire Training Program)
7171 Bowling Drive, Suite 600
Sacramento, CA 95823 916-262-1883

National Fire Protection Association
(Standard 231D)
Batterymarch Park, Quincy, MA

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