

HAY BARN FIRES

By: Mike Wieder

Perhaps the largest volume of fire, and most spectacular looking incident, that many small community and rural fire departments face is the common hay barn fire. Accordingly, in a well-meaning sense, fire departments tend to turn these incidents into massive operations that involve large quantities of resources. I got caught up in these myself during my early years in the fire service. However, after many "all-nighters" spent lobbing water onto stacks of hay and watching dozens of tankers running in circles, I began to question the sense of all this activity. There must be a better way, I thought.

Definition of a Hay Barn

Hay barns are large structures found on a farm in which hay or straw is stored (surprise) for livestock feeding purposes. (For ease of discussion, the commodity stored in them will be simply referred to as hay for the duration of this article.) The actual type or structure used to store the hay will vary and may be dependent on customs in the region of the country you are in. The most common types include:

- All metal buildings, sometimes called pole barns. These buildings feature steel structural supports, covered with light-gauge sheet metal.
- Pavilion-type structures that feature open sides.
- Heavy stone end-walled structures that feature wooden sides and roof.
- All wood structures with heavy timber framing.

The all metal buildings have become increasingly popular on farms since the late 1970's. Their primary advantages to the farmer are that they are relatively inexpensive and may be constructed in a short amount of time. In the early stages of fire development, metal buildings actually promote rapid fire growth because of the heat reflective nature of the metal. This allows fires to progress quickly through the incipient stage to the point where the entire structure quickly becomes involved. The sheet metal walls and roof of these structures will fail very soon after heavy fire engulfs the building contents. This may hinder fire fighting efforts as the sheets of metal tend to fall onto the burning hay and shield it from water, thus increasing the difficulty of extinguishing the fire. If the structural system of the building is of the lightweight variety, the entire building may collapse very soon after heavy fire involvement.

Pavilion-type hay barns are commonly found in more temperate climates. The primary function of the pavilion is to shield the hay from excess rain and snow. Fires as a

result of spontaneous heating of the hay are less likely to occur in these structures as the constant air flow through the hay storage area allows heat to dissipate. One of the most common causes of fires in pavilion-type hay barns is a brush fire that extends into the hay pile. Because there are no exterior walls, there is nothing to stop the brush fire from moving directly into the hay. The only hindrance to extinguishing a fire in a pavilion-type hay barn is that the sheet metal roof may fall onto the top of the hay pile and hinder water from being applied to that area.

Barns that are constructed using heavy stone end walls with wood side walls and roofs are most common in the Mid-Atlantic region of the United States. The end walls of these barns are usually constructed of large field stones, or other heavy rock material, and mortar. Some barns of this construction type may have concrete block or poured concrete end walls. The stone walls are often as much as two feet (0.6 m) thick. Heavy timbers are used to form the roof and side wall structural supports. The side walls are most commonly constructed of wooden boards. The roof may be constructed of any one of the following materials:

- Wooden boards or plywood sheets covered with tar paper
- A typical built-up roof using composite shingles
- Metal (usually tin) sheeting over lathe strips
- Slate shingles over lathe strips

Heavy stone end barns are actually built to burn. The farmers concede that fire is inevitable and they build structures that will serve their purpose, but be easy to clean up and repair after a fire. After a fire, the farmer goes in with a loader and pushes all the debris out, slaps a new roof and sides on it, and is back in business.

All wood hay barns are similar to heavy stone end barns, with the exception that all four sides are constructed from heavy timbers and wooden side walls. The roofing systems on these barns are also the same as those described for heavy stone end wall barns. Both the heavy stone end wall and all wood types of barns are susceptible to fires caused by spontaneous heating of the hay.

All hay barns will have large door openings that allow tractors or trucks to enter the structure for loading and unloading. The hay stored in the barns is usually in the form of rectangular bales that are stacked tightly from floor to ceiling. These doors also provide ample flow of air to supply any fire that starts within the structure. This ample air flow, along with the heavy fuel load and the large open space within the barn, results in the spectacular amount of fire that is present at these incidents.

Common Causes of Hay Barn Fires

There are a variety of causes for fires in hay barns. The most common causes include the followings:

- The heat of decomposition of bulk storage reaches an autoignition point. This is particularly common when the hay is stored while it is still damp or "green." If the amount of air ventilation in the barn is not sufficient to dissipate the heat, ignition of the hay may occur.
- Ignition by a secondary source, such as a trash fire, natural cover fire, or farm implement fire.
- Arson.
- Malfunction of the barn's electrical system.
- Acts of nature, such as a lightning strike.

Why Hay Barn Fires Turn Into Big Incidents

There are many reasons why hay barn fires are turned into major incidents by the fire departments who respond to them. The first is most firefighter's naturally tendency to equate "big fires" with "big operations." While with many incidents, these two terms are synonymous, this need not always be the case with hay barn fires.

The second reason these fires become big operations is because the departments who are responding to them seldom have any other big incidents to respond to. Many of the small community and rural fire departments of North America are among the best trained and most dedicated fire personnel to be found anywhere. However, they lack regular fire activity and tend to apply all their training and preparation on any incident that comes along.

Many will concede the point that there is nothing to be gained by launching such a large attack on a lost cause, but that it is good training for the personnel in the event another large structure catches fire some day. While this may be true, one must balance the level of training to be achieved with the potential for injury or death that may occur. When this balance is considered, the practice making a large scale training session out of hay barn fires does not look all that attractive.

Reasons Why We Should Not Make Big Operations Out Of Hay Barn Fires

Fire departments have an obligation to their citizens to protect property and save lives. Most hay barns are well or fully involved upon arrival of the fire department. If the barn is already a total loss and no one is thought to be inside it, then the only thing to "protect" is the exposures. We have an obligation to *save what can be saved*, not pour tons of water onto a lost cause. I think the Phoenix Fire Department has one of the most sensible approaches to risk taking during any type of fire attack. Simply stated, their fire attack creed is:

We will risk our lives to protect savable lives.

We will risk our lives a little to protect savable property.

We will not risk our lives at all to protect lives or property that have already been lost.

With these thoughts in mind, it does not take long to come up with a long list of reasons why we should not make a direct attack on a hay barn fire. The following is a list of some of the more prominent thoughts that come to mind.

- As stated above, most hay barn fires are well-advanced upon arrival of the fire department. There is nothing of the barn left to save. Hay that is not already on fire is useless for feed purposes because of smoke contamination.
- It is difficult to completely extinguish a hay barn fire because of the tightly packed hay, which is found in large quantities. Large quantities of manpower are required for overhaul, if the barn is even structurally safe to enter once the main body of fire is knocked down.
- By pouring large volumes of water on the fire, you are guaranteeing that the mess will smolder for days afterwards. The smoke will drift into any occupancies downwind of the barn. Your fire crews will also find themselves responding to rekindles, odor of smoke investigations, and the like for days to come. If you can let the barn free burn, the bulk of the product will burn up in a few hours, if that long. If you put water on the fire, you can keep it going for days, and it will still burn down anyway.
- The water that runs off the fire site can also contaminate streams, creeks, wells, and other ground water sources. I can remember one all night hay barn water festival my department responded to years ago. Two hours after finally getting home, we were dispatched to an odor of smoke in a house, several miles from the original fire. Upon investigation it was determined that the odor was actually coming from water out of the sink faucet. It seems that the runoff water from the barn fire went into a stream, a mile upstream of the intake for the municipal water system. The system's treatment process did not remove the smoky odor or taste and all the customers were stuck with this situation for the rest of the day. They loved us, and the barn burnt completely to the ground any way.
- Because of the volume of fire, hay barns can become very structurally unsound when they have been on fire for awhile. Many firefighters have been killed by making up-close attacks on hay barns, only to have a wall collapse on them. This is senseless. Again, balance the level or risk with the benefits to be gained.

- Many barns are designed to burn. The farmers concede that fire is inevitable and they build structures that will serve their purpose, but be easy to clean up and repair after a fire. This is particularly true of those barns designed with the thick, stone end walls. After a fire, the farmer goes in with a loader and pushes all the debris out, slaps a new roof and sides on it, and is back in business. He then either pushes the debris into a big hole, or waits for it to dry and burns it again anyway. The more you save, the bigger the mess is for the farmer to clean up. Are we truly helping him by leaving him a bigger mess?
- It is senseless to tie up a large quantity of fire department resources on a fire that is a lost cause. Many hay barn fires turn into massive water shuttle operations that involve 10 or more tankers (tenders). What if another fire were to occur in one of these units first-due territory and they were miles out of their district hauling water to dump on a barn that is going to burn down whether they are there or not? Common sense has to prevail. Another risk to consider is the possibility of one of these far away mutual aid units becoming involved in a traffic accident while on a Code 3 response to a lost cause. Is it worth it? Again, the barn is probably going to burn down anyway, so why take the chance.

When You Do Need To Directly Attack A Hay Barn Fire

After expounding on some of the many reasons not to launch a campaign effort on attacking a hay barn fire, the author must concede that there probably are a few situations where we must make a direct attack on the fire. The most prominent reason to attack a hay barn fire is in those situations where the exposures are endangered to the point where the only reasonable way to save them is to knock down the main body of fire. In these cases the fire should be knocked down only to a level where the threat to the exposures is eliminated and then the fire should be allowed to continue to burn.

The second situation in which direct fire attack may be required is those situations where the flying brands from the fire pose a threat of a secondary fire, such as a natural cover fire or downwind roof fire. This is of particular concern when ground cover is dry.

Standard Tactics For Hay Barn Fires

Just as with any incident, fire departments should establish standard operating procedures (SOPs) for handling hay barn fires. The SOP for a hay barn will vary slightly depending on whether an offensive attack (direct attack) or defensive (let it burn) attack is launched. Because the emphasis of this article is to promote a more defensive stance, the following procedures reflect the "let it burn" philosophy.

- 1. Establish a reasonable water supply.** From the outset, it is important that a water supply adequate for the operation to be conducted, be established. The decision to make an offensive or defensive attack will have the major bearing

on the size of the water supply operation that is needed. Offensive attacks will require much larger quantities of water than will defensive attacks.

Since most hay barn fires are in rural areas, rarely will fire departments have the luxury of hydrant systems to work from for water. Water supply to hay barn fires is most commonly provided by an alternative supply operation such as a relay pumping operation or a tanker (tender) shuttle operation. While it is not the purpose of this article to the way the advantages and disadvantages of these operation (much has been written on them in the past), it is clear that relay pumping is probably the most reliable and safest of the two. The relay pumping operation duplicates the advantages of a hydrant system and eliminates the chance of accident present with tankers running back and forth between the loading and unloading sites.

Be reasonable with the water supply operation you seek to establish. If you are going to take the "let it burn" defensive approach, laying dual 3,000 foot (900 m) lays of 4- or 5-inch (100 mm or 125 mm) hose is probably overkill. So would be running 11 tankers in a shuttle operation. However, operations of those magnitudes would not be unreasonable if an offensive operation were undertaken.

- 2. Protect exposures.** Once the water supply has been established, handlines can be put in place to effect exposure protection. While it may seem possible to protect small outbuildings with a booster line, it is recommended that all lines be of at least 1 1/2-inch (38 mm) or larger. Apply water to the exposures as required to prevent excessive damage or ignition. If the water supply is adequate, unmanned monitors may be used.
- 3. Remove exposed livestock and equipment.** The best way to protect exposures is to remove them from the vicinity of the fire. Any farm machinery, vehicles, or other equipment near the barn should be moved away, if possible. Many farm have fuel tanks attached to or next to the barn. Hose streams should be played on them to keep them cool. Tanks that are mounted on skids may be dragged clear of the fire area using a small fire vehicle or a tractor. Beware of chemicals stored in tanks or other containers around the barn. If they are known, or even suspected, to be present, treated the incident as you would any other hazardous materials fire.

Livestock still inside the barn, or adjacent to it, should be moved to a place safety if safely possible. Large animals, such as swine, cattle, and horses can become dangerous if panicked. Use care when around them.

- 4. Let it burn.** Once the water supply is established, the exposures are covered, and anything that can be moved is moved, let the fire burn until the fuel supply is exhausted. As the intensity of the fire decreases, fire units can be released when it is clear that they will no longer be needed. Water supply operations can

be scaled back as the need for them lessens. This makes termination of the incident easier when it is all done.

Some years ago, when I wrote on this topic in IFSTA's *Speaking of Fire* newsletter, I was bombarded with criticism from some fire service personnel who were concerned that many barns contain costly milking equipment and that the "let it burn" approach might cause the farmer to lose this valuable equipment. Typically, hay and milking equipment are not kept in the same part of a barn, or even in the same building for that matter. Obviously, I would not advocate a nonintervention approach to a structure that contains such valuable equipment. If milking equipment, or any other valuable equipment for that matter, is threatened but still savable, an aggressive, offensive fire attack should be launched.

Making A Direct Attack

When it does become necessary to make a direct attack on a hay barn fire, do it right, or don't bother. A half-hearted, or poorly planned attack will serve little purpose as the magnitude of fire will exceed the effort to stop it. The following are some hints on how to control a hay barn fire.

- 1. Use big water.** We're talking about large volumes of water. Water supplies of at least 750 gpm (3 000 L/min) will be needed, probably more in most cases. The initial knockdown should be effected with 2 1/2-inch (65 mm) handlines and master streams. Anything smaller is a waste of time. Coverage of the entire fire area by the streams will be necessary to knock down all the fire.
- 2. Use Class A Foam or Light Water (Wetting Agents).** The use of wetting agents will dramatically increase the success rate for total extinguishment of hay barn fires. These agents reduce the surface tension of water and allow it to more easily penetrate into the hay. This helps extinguish the deep seated fire much more effectively than plain water itself.

It would be most desirable to apply the wetting agent during the initial attack. However few departments have the capability to discharge these agents through large caliber hose streams. In most cases it will be necessary to knock the fire down with plain water and large caliber streams and then use smaller handlines with the wetting agent to soak down the hay.

- 3. Overhaul.** Be prepared to do a lot of overhaul. Extra alarms may have to be called to get fresh manpower. If it is safe to enter the structure, hay should be removed, the bales broken open, and all hot spots removed. This poses many logistics problems. Large quantities of air cylinders will be needed for personnel working in and around the smoldering hay. A place will be needed to discard the extinguished hay. Rehabilitation for firefighters will have to be established because this is long, hard work.

4. Be prepared to go back. If you are going to mess with a hay barn fire, be prepared to go back. Even when good techniques are used, rekindles are inevitable. Establish a procedure for responding to reports of rekindles. Officers may wish to check these reports out before apparatus are sent. The level of response can then be altered to fit the situation. Some departments leave hoselines in place for a day or two after the initial fire to make later responses go easier.

HAVE A PLAN

Regardless of the approach you take to handling hay barn fires: *Have A Plan.* before you get there. This will ensure success and safety. Avoid the temptation to escalate the incident beyond what is reasonable for the probable outcome. Regardless of all the efforts taken, I seen very few barns standing when we went home.

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