



# Developing a Protocol “Cattle Barn Fire”

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### Abstract

Fires on farms with animals still occur annually. The causes of such fires can be many in nature, although a farm's electrical system may play a specific role in fire causes. Farm fires result in major economic losses and dramatically compromised welfare. If the animals survive at all, there is little chance of recovery, while productivity is significantly affected. These animals will often have to be disposed of early.

Fire prevention through protocols is a key word in modern farm management. One can compare such protocols with the biosecurity plans that deal with animal health. In addition to prevention, attention should be paid to the actions that a farmer and his/her staff can already take themselves to contain an incipient fire until the Fire Department arrives.

This article focuses on causes of fire in farm buildings with cattle, the main risk factors involved, the development of a prevention “protocol farm fire” as well as the development of a “fire action plan”. The veterinary farm advisor can play a supporting role in the development of such protocols, as he/she does already in biosecurity plans.

### Introduction

Fires in commercial buildings, including farm homes, occur frequently each year. Smoke alarms are mandatory in homes and

small hand-held fire extinguishers are sometimes present. The causes of fires in buildings have changed little over the years. Table 1 lists the main causes [1].

**Table 1:** Overview of major causes of fire in buildings and homes [1].

Human activities ( <i>smoking, nonprofessional actions</i> )
Electricity related ( <i>see Table 2</i> )
Overcharged motors and equipment ( <i>tractor</i> )
Defect equipment causing sparks
Heat sources ( <i>such as high Watts lamps</i> )
Blockbuster strikes
Other causes: arson and scalding in hay

**Table 2:** An example of fire causes on farms, related to electrical installation, one of the most common causes [2] Brochure du Gouvernement Québec, Ministère de la Sécurité Publique.

Points of Interest	Fire Risk Increasing Items
The electrical installations	Are they too old? Are they non-compliant to standards?
	Are they overcharged? Is their maintenance poor?
	Thick dust layers everywhere? ( <i>Dust is combustible</i> ). Is there other combustible material present?
Presence of problems	Humidity or various leaks? ( <i>Provide ventilation; fans</i> ).
	Rodents are present? ( <i>They destroy insulation materials: cables, protection tubes</i> ).
	Accidental damage? (Of cables, <i>protection tubes, sockets</i> ).
	Straw or other combustible material present on several spots?
Amperage of fuses	Chalk or paint on cables or on installations? Cables are nailed?
	Caliber not adapted to charges ( <i>motor <math>\diamond</math> heavy caliber needed</i> )
Other points	Stacked dust everywhere ( <i>to be cleaned!</i> )
	Not 1 m free space around electrical fuse boxes and switch boxes
	No protective glass around lamps getting (too) hot
	Plastic ( <i>Polyurethane</i> ) is being used for electrical circuits
	Too old (faded) extension cords are being used ( <i>these lose their protective features</i> )
	Too many devices in one socket
	Equipment not fixated on the ground or wall. Electrical cords are hanging loose.

The main causes of fire related to electricity are then shown in Table 2 [2]. The electrical system is a leading cause of fire in farm animal buildings.

The results of Table 2 indicate several human factors involved in the occurrence of fire in cattle barns. Important risk factors are maintenance of electrical installations, overloading of installations, too weak amperage of fuses, layers of dust, damage to pipes, leaks. The risk factor of straw or litter (wood chips) is present too.

This article focuses on fire in cattle barns, from a general point of view.

The purpose of this article is to arrive at a general “protocol for fire in cattle barns,” which lists important actions that can be both preventive and curative in nature. The specific implementation is farm-dependent, must be tailor-made and therefore cannot be detailed here.

## Fire In Cattle Barns

Farm fire is a sometimes-unavoidable catastrophe, leading to great suffering for the people involved, but certainly also for the animals housed. Mortality of cattle is a common phenomenon, especially in outbreak fires. Even if the cows survive, they may show severe symptoms that in many cases lead to disposal. The most affected organ is the respiratory organ, because of the heat of the fire itself, but especially from the smoke production [3]. Smoke itself is also combustible and toxic, depending on the substances contained in the smoke. Examples of such substances are gases (CO, CO<sub>2</sub>, HCN, NO), chemicals (formaldehyde, H<sub>2</sub>S, hydrocarbon, dioxin, acrolein, benzene), soot particles and fine particulate

matter. Especially the latter can, if they are less than 10 microns in size, penetrate deep into the lungs and lead to destruction of cells. By comparison, human hair has a size of 60 microns [3].

The objectives of a Fire Department in case of fire are to rescue people; to guide evacuation of people from a building; to create survival conditions; to secure entry into a building; to limit fire spread; to extinguish the fire; to limit environmental and social impacts [4]. Choices need to be made.

Fires on farms with cattle lead to major economic damage and hugely compromised animal welfare. It is therefore important to take a preventive approach and draw up a Protocol Barn Fire (PBF), incorporating the most important preventive measures. In addition, it is strongly indicated to also draw up an Action Plan Fire (APF), with specific instructions what to do, when how and where and by whom, in case of a fire. This can benefit the activities of the Fire Department and thus the outcome. In everything, the safety of the people must be paramount.

## The Broad Outlines of a Protocol Cattle Barn Fires (PCBF)

A protocol serves to be properly prepared for an emergency such as a fire. To this end, it contains actions and instructions that can be vital to the people and instructions that can save as many animals and the farm as possible.

It is strongly recommended to develop the “protocol cattle barn fires” (PCBF) together with the Fire Department. To do this, however, it is necessary for the cattle owner to first map out the basic outlines of such a PCBF him/herself.

Table 3 contains as an example a preliminary elaboration of a PCBF, with domains for action and specific instructions. Some actions/instructions are meant to be preventive, and other measures and actions applicable in case of fire outbreak itself (Action Plan Fire, APF) as presented in Table 4.

**Table 4:** Major example of measures and actions in case of a cattle barn fire (the curative part of a PCBF).

Preventive issues in a PCBF	Details
<p><b>Phone numbers</b> of Veterinarians</p> <p>Fire Department</p> <p>Police</p> <p>Ambulance</p> <p>Insurance agents</p> <p>Close neighbors</p> <p>Cattle transporters</p>	<p>Responsible person is the owner.</p> <p>(The farm manager can be his replacement)</p>
Access road for the Fire Department people	
Draw a <b>schematic plan on paper</b> , with all buildings, their contains, access roads, installations, and water sources	Indicate on the plan where the doors are. They are relevant for a potential evacuation of cattle. These doors should never be obstructed or closed by key.
Have a <b>calamity pasture</b> available for evacuating cattle. Or a developed mobile reception device (mesh based) which can be placed at distance and is meant to receive evacuated cattle. Check with the transporter about evacuation	Maybe it is possible to contact a transporter to evacuate cattle to a safe place nearby. Remind that the available time is limited ( <i>see text</i> ).
Have <b>fire hoses</b> available in good shape close to barns and sheds, to be coupled to water sources	Check the hoses yearly for good functioning and state of condition.
Install <b>handheld extinguishers</b> in the barns and other buildings, close to entrance doors	Extinguishers should be checked yearly for quality. If needed fill them. Indicate on the plan where they are positioned.
<b>Install smoke detectors and fire alarms in barns and sheds</b>	Have available one operational handheld fire alarm which activates a fire siren (cattle owner or manager)
Have a <b>Booklet of Maintenance of the Electrical Installation and technical drawings</b> on paper available	Booklet and drawings must be saved in a fire-resistant place, with phone numbers of certified technicians who know the electrical installations
Design an " <b>Action Plan Fire</b> " with instructions and actions to be taken. Use clear, shorthand writing	<p><b><i>Who does what, when, where, with what and how?</i></b></p> <p>(Assign responsibilities to persons)</p>
Make sure that accesses to dung pits are always closed	
Put <b>Action Plan Fire</b> in poster-format on various spots on the farm (barns; sheds)	Be sure that names of persons responsible for different tasks are listed clearly (everyone should know what to do)

**Table 4:** Major example of measures and actions in case of a cattle barn fire (the curative part of a PCBF).

Curative in the PCBF: The Action Plan Fire (APF)	Objectives are to limit fire and its consequences whenever possible. Personnel is to be instructed.
Exercise once a year the action plan at a quiet period on the farm.	Such a simulation leads often to an adjustment of the APF.
1. Who activates the fire alarm?	The owner or replacer is the main coordinator; he/she triggers the alarm. The first thing to do then is to <b>assess the situation</b> . The <b>siren</b> must function, and red lights are on.
2. Who <b>turns off the gas and electricity</b> ?	The owner or his replacer. If available on short notice, the technician electricity.
3. <b>Who calls</b> the Fire Department and the others from the list (see under PBF)	The owner or replacer. He/she can tell shortly the results of his first inspection.
4. Are there any persons missing?	The owner or replacer should check whether all persons have left the building(s).
5. Who handle the <b>handheld extinguishers</b> ?	Indicated persons. Coordinator decides the moment of action. If smoke is thick, do not approach the fire spot or room. Close windows and doors.

6. Is there a <b>need to unroll and use the fire hoses</b> ?	Indicated persons. Coordinator decides yes or no. If smoke is thick, do not approach the fire spot!
7. Is there an indication to <b>evacuate</b> cattle?	Coordinator decides yes or no. If yes, he decides the location for evacuation too. <b>Evacuation lamps are blue.</b>
8. Is a <b>mobile reception device</b> available for the evacuated cattle? Who install it?	The alternative for the cattle is a separate pasture, closed all around by gaze and not close to the fire.
9. Who <b>evacuates</b> the cattle?	Indicated persons. Coordinator decides the moment.
10. Who <b>open the doors</b> for evacuation?	Indicated persons.
11. If there is <b>hay/straw/litter storage</b> , be sure that handheld extinguishers are present. Who handles them? There is a risk for outbreak of fire there	Indicated persons. Coordinator decides the yes or no.
12. The same is valid for machine storage. Use adapted handheld fire extinguishers.	Indicated persons. Coordinator decides the yes or no
13. <i>Etcetera</i>	<i>Etcetera</i>
The Action Plan Fire should be updated when needed. The assistance of the Fire Department is a valuable aid.	Revise the APF yearly for optimization. Exercise the ABF with all personnel. Often this leads to adjustment of the APF.

The initial inspection of the situation in case of fire is crucial. The owner or his manager uses a checklist for this purpose. This checklist includes the items such as those listed in Table 5, which are not exhaustive. This list is given to the fire chief upon arrival.

**Table 5:** A rough overview of topics on the checklist for first inspection of the fire situation in the barn or buildings [4]. The dotted lines indicate where figures or features are required.

Checklist Current Situation of the Fire	Results of the Inspection
1. Have all persons left the buildings or are there missing persons?	Everybody is out <b>or</b> xx persons are missing
2. Where is the focus of the fire	Barn/Building number(s) ..... Cattle groups ..... Number of animals/group .....
3. What kind of fire is it? (yes/no answers)	Small, localized fire ..... Limited fire ..... Outbreaking fire ..... Building structure seems affected ..... Only material inside is on fire .....
4. Are there specific dangers	Is there storage of chemical products in barn of building (which one) ..... What are the combustible materials in barn or building .....
5. Flame features	Where exactly ..... Colors = ..... Forme of flames .....
6. Smoke development	Much smoke (color = ) Few smoke (color = ) Direction Turbulent Whistling/suction noise
7. Smoke- and Fire Alarm devices	They are all in function (Yes-No) Which ones do not work
8. Fire resistant clothing	Personnel included in anti-fire action have correct, appropriate fire-proof clothing

The fire resistance of a building (barn) according to the Dutch construction standard is at least 90 minutes [5].

This gives an indication of the time frame during which one must carry out fire-resisting actions by oneself.

To carry out an evacuation of people near a fire in a building (barn or house), one has less than 15 min. So, this evacuation is a necessary priority [6].

As for Fire-proof clothing, one should think of clothing made from natural fibers (linen, flannel, cotton) and professional firefighter clothing. One can also think about creating some specific fire blankets cupboards.

## Discussion and Conclusion

A veterinarian conducting a farm advisory program on a dairy farm with cattle seems to be a prime candidate to support the animal owner in the preliminary design of a PCBF and an APF. After all, the veterinarian can provide valuable, additional information for the protocols from a neutral perspective.

Obviously, it is wise to do a further elaboration of the PCBF (preventive and curative), specific to the farm with the assistance of the Fire Department. The preventive part is usually a matter for the cattle owner/manager because it involves strategic choices. The curative part is a matter for the entire farm team.

The PCBF and APF, once developed, should be practiced, and questioned every year and adjusted as deemed necessary. The input of staff members is important because in the event of a fire, one must work as a “cohesive team” and responsibly.

It should not be forgotten that practicing the curative plan (APF)

in the event of a simulated fire alarm usually leads to adjustments to the APF in the post-fire debriefings. Practicing is thus an important part of PCBF and APF in practice.

Another matter of great importance concerns the safety of people. In case of a heavy fire (a lot of fire and flames, a lot of smoke) it is wiser to wait for the Fire Department and certainly not to enter a burning building with a fire extinguisher or fire hose. Fire-extinguishing equipment other than handheld extinguishers and fire hoses has not been addressed here, because that extinguishing equipment is so professional that it often requires several people to be deployed at once to man one piece of equipment (e.g., the mist ball, the Fog nail, large fans, pressurized air foam) and that this equipment is far too expensive for a single cattle farm and its operation requires specific training.

Aside from the flames, there is also the smoke that can burn and contains various toxic chemicals and fine particles, depending on what is being burned in the fire. Initial signs of difficult breathing indicate smoke poisoning in both humans and cattle [3].

This article was written because the Protocol Cattle Barn Fires (PCBF) fits into modern animal husbandry, where welfare plays a major role.

In addition to a Biosecurity Plan for preventing the introduction and/or spread of infectious agents, as is increasingly applied on dairy farms [7], a PCBF and an Action Plan Fire (APF) are an excellent fit for high quality farm management. So, the step to follow up with PCBF and APF is a logical one. This further emphasizes the role of the veterinarian-farm advisor in animal health, farm management and risk factors from the animals' environment.



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## Conflict of Interest

No conflict of interest.

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