

Fires in animal housing facilities

Final Report by:

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Foreword

NFPA 150, *Fire and Life Safety in Animal Housing Facilities Code*, establishes life and safety requirements for both humans and animals in all types of animal housing facilities where animals are kept for any purpose, including barns, stables, kennels, animal shelters, veterinary facilities, zoos, laboratories, and racetracks. The Technical Committee on Animal Housing is responsible for developing the language in the standard and identified there is a lack of a single database of fire events in animal housing facilities, which would show the numerous fires that have occurred and their impacts to the animal industry. This database will provide more exposure of facts and the benefits to using NFPA 150.

The objective of this project is to collect and analyze information on the cause of fires, fire losses (animal deaths and financial loss), and fire protection features (such as fire suppression, detection, etc.) of animal housing facilities through a comprehensive review of literature, news media reports and questionnaire survey.

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The <u>Fire Protection Research Foundation</u> plans, manages, and communicates research on a broad range of fire safety issues in collaboration with scientists and laboratories around the world. The Foundation is an affiliate of NFPA.



About the National Fire Protection Association (NFPA)

Founded in 1896, NFPA is a global, nonprofit organization devoted to eliminating death, injury, property and economic loss due to fire, electrical and related hazards. The association delivers information and knowledge through more than 300 consensus codes and standards, research, training, education, outreach and advocacy; and by partnering with others who share an interest in furthering the NFPA mission.

All NFPA codes and standards can be viewed online for free.



NFPA's membership totals more than 65,000 individuals around the world.

Keywords: animal housing facility, barns, barn fires, structure fires, NFPA 150, animal, heating devices, fire protection, life safety

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Executive Summary:

The goal of this project was to gather and analyze information on the causes of fire, fire losses, and fire protection features of animal housing facilities through a comprehensive review of published literature, U.S. news media reports (2020-21), and an online information collection effort through a survey questionnaire.

The data collected and reviewed from these three sources provided the following observations.

Review of published literature data revealed the leading causes of animal housing fires to be from heating devices and malfunctioning of electrical systems [5] [13]. This was further reinforced by the survey questionnaire responses which reported heating devices were responsible for 33% of all reported fires collected through this study, followed by malfunctioning electrical systems (29%).

Further, papers reviewed from the literature reported that winter months harbored a greater number of fires as compared to other seasons. Both AWI's *Barn Fire* [5] and The Humane Society International's *Untold Suffering* [13] report concluded colder months to have larger number of fires due to facilities using more heating systems or electrical equipment. This was also observed in the incident data collected in this study from U.S. based news media reports for 2020-21 period, which showed February as the month with largest number of incidents reported.

The financial loss due to these fires were also reviewed from the data available in literature. A prior report from NFPA [4] estimated the costs of these animal housing structure fires from the years 2014–18 to be \$37 million. The online questionnaire responses in this study indicated similar magnitude of financial losses (Fig. 21).

The questionnaire survey responses revealed the lack of awareness about fire and life safety standards applicable to animal hosing facilities such as NFPA 150, *Fire and Life Safety in Animal Housing Facilities Code*. The open-ended responses collected from respondents suggested an opportunity to create training outreach program and other fire protection training to better educate animal housing facility owners and staff.

Below is a compiled list of recommended fire protection features gathered from the literature review: sprinkler systems, fire extinguishers, smoke detectors, heat detectors, carbon monoxide detectors, fire doors, emergency exits for animals/people, lightning rods, and having permanently installed electrical systems in the facility. The routine inspection of electrical systems as well as annual inspections of the facilities were also recommended. Further, need for routine fire drills and employee training was emphasized.

It is noted that less data was available and collected from the zoos and aquarium facilities. This study recognizes the need for additional awareness outreach about standards for this section of animal housing facilities.

Chapter 1: Introduction

1.1.Background

Fires affect hundreds of thousands of animals every year in deadly barn and industrial fires. Barn fires can destroy all types of animal facilities ranging from backyard farms to industrial operations. Facility owners and animal housing facility staff should be informed about recommended fire protection measures to provide adequate safety for the facility. That is why it is imperative to learn from these incidents and improve on the quality of animal facilities to ensure catastrophic events are prevented from happening again.

Following a series of horrific and deadly racetrack stable fires in 1975, the National Fire Protection Association[®] (NFPA[®]) established the technical committee on Firesafety in Racetrack Stables (Ref: <u>https://www.nfpa.org/Assets/files/AboutTheCodes/150/TCRA-1979-150.pdf</u>). This committee then created NFPA 150, *Fire and Life Safety in Animal Housing Facilities Code* (Ref: <u>www.nfpa.org/150</u>), to establish life and safety requirements for both humans and animals in all types of animal housing facilities where animals are kept for any purpose, including barns, stables, kennels, animal shelters, veterinary facilities, zoos, laboratories, and racetracks.

NFPA 150 defines the following facilities:

- Animal health care facilities are any animal housing facility used to for short-term care, maintenance, or medical attention of animals
- Horse facilities are any animal health care facility used for temporary or permanent housing for horses
- Research facilities are any animal facility used for experimentation, education, or scientific experimentation or production research on animals in a controlled environment
- Exhibition/Public viewing facilities are any animal facility that allows public access for the purpose of exhibition or public viewing of animals
- General board and care facilities are any animal facility used for temporary or permanent housing of animals used for providing a service or participating in a sport or for the purposes of providing general board and care
- Agricultural animal housing facilities are any animal facility for housing agricultural animals used for food or commodity production
- Emergency facilities are any animal facility used for the shelter or care of animals during an emergency event that are either temporary or not typically used for animal occupancy

It is evident from above that there are different types of animal housing facilities that house a wide range of animal types and in numbers, which require unique fire and life safety protection measures. The damage and loss resulting from a fire incident that may occur in these types of facilities will be also different from one facility type to another. For instance, occurrence of catastrophic fires in zoo settings are rather uncommon, compared to events like barn fires. One historical zoo fire to remember occurred in 1995, where a horrific fire broke out in the primate building of the Philadelphia Zoo killing twenty-three of Philadelphia's most important-endangered-animals including two families of gorillas and orangutans. The building was reported

to have fire alarms but was not equipped with sprinkler systems. All twenty-three animals were reported dead from inhaling the thick black smoke before the fire was put out twenty-five minutes later [1]. Events like the Philadelphia Zoo fire has further inspired and motivated the conversation to improve fire protection in all types of animal housing facilities.

The Technical Committee on Animal Housing Facilities Code (i.e., NFPA 150) is responsible for developing the language in the standard and identified that there is a lack of a single database of fire incidents in animal housing facilities, which would show the numerous fires that have occurred and their impacts to the animal industry. This database will provide more exposure of facts and information that will be useful for NFPA 150.

1.2.Project Goal

The objective of this research project was to collect and analyze information on the causes of fires, fire losses (animal deaths and financial loss), and fire protection features (such as fire suppression, detection, etc.) of animal housing facilities through a comprehensive review of literature, news media reports and an information collection effort through a questionnaire survey.

1.3.Project Tasks

This project involved the following tasks:

<u>Task 1: Literature review</u>: Literature review of published journals, conference proceedings, and news articles to collect information on fire events at animal facilities. The information collected focused on causes of fire, fire losses including animal deaths and financial losses, and information on the fire protection features of the animal facility at the time of the fire event.

<u>Task 2: Information collection through questionnaire survey:</u> Prepared and implemented a questionnaire survey to collect the above information from relevant animal facilities, groups, and individuals. Additionally, the responses from this questionnaire were analyzed and summarized.

<u>Task 3: Analysis and Final Report:</u> Developed a final report to summarize the findings from literature review and questionnaire responses.

Chapter 2: Literature Review

2.1. Review of Prior Publications

This section provides an annotated bibliography of relevant publications from the literature. Number of prior technical reports have been published in the past analyzing the fires in animal housing facilities. When available, a brief description of the article has been provided that includes summary from the paper to provide sufficient coverage of the document.

Pet store or animal hospital structure fires by cause 1994-1998 annual averages, 2003

Structure fires in pet stores or animal hospitals in the U.S. from the year 1994 to 1998 were reported in this paper by Kimberly D. Rohr. This report summarized the following information: cause of fires, number of fires for each cause, civilian deaths, civilian injuries, and direct property loss. The list of cause of fires reported are as follows: electrical distribution, appliances, other equipment, incendiary, unknown, heating, exposure, open flame, other heat, natural causes, smoking, cooking, and children playing. Electrical distribution fires were reported as responsible for the largest percentage of these fires (31.2%). There was a collective zero deaths and injuries associated with these fires and a direct property loss of \$453,000. The second largest cause of these structure fires were from appliances such as air conditioning units (16.2%) with a report of zero civilian deaths and two injuries. The direct property loss was around ten times less than that of electrical distribution fires coming to a total of \$43,400. The cause with the most direct property loss value was from the fourth most reported cause - incendiary, suspicious. These suspicious incendiary structure fires had a total direct property loss of \$580,100. Which was 27.7% of the total cost from all the reported causes of structure fires in these animal housing facilities. [2]

Fires in or at animal occupancies, 2018

This paper provides estimated annual averages of fires reported to local fire departments in the U.S. from the year 2012 to 2016 for livestock or poultry storage properties (barns, stockyards, and animal pens), and livestock production properties. The paper is set up with three sets of tables that provide the following information: fires by incident type, leading causes of structure fires, and items first ignited. This paper estimated heating equipment as the leading equipment involved in 320 fires (38% of total number of fires) for livestock or poultry storage properties, and lamps or lighting equipment as the second most leading cause (26%, 260 fires). The paper makes an important note to remember when looking at the equipment causes, in many cases, the equipment was reported as operating properly but just happened to be too close to a combustible material. In both properties (livestock/poultry storage and production), unclassified organic materials were amongst the leading items that were first ignited in these structure fires. These include hay bales, pine straw, and other flammable organic materials. [3]

Fires in or at animal occupancies, 2021

NFPA Research published another report with a similar scope to the previous report from 2018. This is an updated paper published in 2021. This paper gathered data from 2014-2018, which overlapped some years from the 2018 report.

This paper provides estimated annual averages of fires reported to local fire departments in the U.S. from the year 2014-2018. The two properties are livestock or poultry storage properties

(barns, stockyards, animal pens), and livestock production properties. Between 2014-2018, 1,310 total fires were reported in or at livestock or poultry storage properties with 930 (45%) as structure fires. A total of nine civilian injuries and zero civilian deaths were estimated for these structure fires with a total of \$37 million in property damage. Heating equipment was estimated as the leading cause of these structure fires in livestock or poultry storage properties with 400 fires and 220 fires for livestock production properties. There were an estimated 750 structure fires in or at livestock production properties for a total of \$49 million in property damage. For these properties, agricultural crops were the top items first ignited in these fires. [4]

Barn fires: A deadly threat to farm animals, 2018

The Animal Welfare Institute's (AWI) report presents an analysis of compiled data from barn fires in the U.S. from 2013 to 2017. The report defines "barn" as, "an industrial confinement shed in addition to the more traditional barns that are commonly seen on family farms." AWI aimed to track and compile information over a five-year period to determine the reasons these barn fires occur, how frequently the farm animals die due to these fires, and how to prevent the fires entirely. It was found that weather played a significant role in the prevalence of these barn fires, with more fires occurring during lower temperature periods. The impact of weather was substantial and approximately two-thirds of the reported barn fires occurred in the colder months of October through March. It should be noted that because laws and regulations regarding barn fire reporting vary from state to state, and municipalities are not generally required to report these barn fires and livestock loss, there are unreported fires and animal deaths that AWI's analysis does not account for. A point that further suggests cold weather as a key factor in barn fires is that while many barn fire animal deaths occur in states with significant animal agriculture production, a large disproportionate number occurred in northeastern and midwestern states of U.S. with lower numbers of animal agriculture production. From 2013 to 2017, AWI reports at least 2,763,924 farm animals died because of barn fires, but due to a large number of unreported fires the number of casualties is probably higher.

The main cause of these barn fires was found to be improper use of or malfunctioning heating devices. As well as other electrical devices playing a significant role in these barn fires. Currently, there are no federal or state laws in the United States specifically designed to protect these farm animals from barn fires. Barn fires are devastating and can occur at all levels of animal agricultural production. Some reported fires from small barns only reported one animal casualty while the largest reported fire killed 1 million chickens.

Barn fires per year show 2017 as the year with the largest number of barn fires. 86 fires in 2017, which accounted for 59% of total animal casualties from the four years. A total of 326 barn fires were reported from the year 2013 to 2017. Seventeen different species of farm animals were reported to have been killed in these barn fires. A large majority of these casualties were from chickens. 2,599,145 chickens were killed in barn fires in the four years collected. This accounts for 95% of total animal deaths. This is most likely because chickens are housed and raised in settings where they are densely packed as opposed to other animals who are typically given more space. Now, when looking at the states with the greatest number of reported fires, Minnesota, Wisconsin, Michigan, Pennsylvania, and New York are amongst the top five states. These states tend to be colder and report more deadly barn fires than their larger agricultural production states

such as Alabama, Arkansas, and Mississippi. This further suggests the significance of heating devices and cold weather as a key factor in these large deadly barn fires.

AWI recommends the following fire prevention methods to farm owners: sprinkler systems, annual inspection by fire department, fire extinguishers, smoke detection systems, heat detection systems, carbon monoxide detection systems, employee training, and routine fire drills. AWI also recommends farm owners to follow third-party animal welfare certification programs as a minimum fire safety standard, such as NFPA 150: *Fire and Life Safety in Animal Housing Facilities Code*. Another recommendation from AWI states government should consider adopting NFPA 150: *Fire and Life Safety in Animal Housing Facilities Code* as a great way to start municipalities who are looking to improve fire safety and decrease fire-related animal deaths. They suggest doing so would prevent numerous more animal deaths and protect farm owners and firefighters from injuries. [5]

The most recently updated barn fire database is available from AWI from the following: AWI Animal Deaths in Barn Fires (1/1/2013-8/31/2021), Animal Welfare Institute, Washington, DC, September 2021. Source: <u>https://awionline.org/sites/default/files/uploads/documents/Animal-Deaths-Barn-Fires.xlsx</u>

Structure fires in barns, 2012

This paper discusses reported structure fires in barns from the year 2006 to 2010. These estimates are based on the data from the U.S. Fire Administration's (USFA's) National Fire Incident Reporting System (NFIRS) and the National Fire Protection Association's (NFPA's) annual fire department experience survey. During the timeperiod studied, there were an estimated 830 structure fires in barns in the U.S. with one civilian death, 10 injuries, and \$28 million in property damage annually. The leading cause of these fires in barns were from heating equipment (nearly 25%) and electrical distribution and lighting equipment (15%). An agricultural crop such as fruit or vegetables are leading items first ignited in these fires (15%) followed by a structural member or framing (13%). According to this paper, structure fires in barns are more common in colder months due to the prevalence of heating fires. With fires peaking in January and between noon and 9:00 p.m. Amongst the first items to first ignite organic material. These accounted for 38% of the material first ignited in structure barn fires and 28% are unknown items [6]

How to configure an equine facility to prevent and better respond to barn fires, 2014

This paper discusses how to design/configure an equine facility in the U.S. to prevent barn fires based on new technologies and understanding of how fire behavior affects facilities for a more effective and efficient response. The paper stresses the importance of having a facility with proper and efficient fire protection systems since a large percentage of barn fires that occur become fully involved within the first 5 to 7 minutes. Even if a fire department is able to respond within the first five to seven minutes, the facility will reach a danger to life level amount of smoke production within 3 to 5 minutes.

The paper discusses the materials and methods recommended to aid in fire protection and prevention. The best way of protection is prevention.

The first method discussed in this paper are fire doors. Fire doors are built of heavy-duty materials or fire retardants and separate different sections of the barn from each other. By compartmentalizing, combustibles and other barn materials can be separated from the main barn as much as possible. This includes hay, farm equipment, appliances, electrical systems, manure, and fuels. Practically this means there should be separate rooms for everything. One negative effect brought up was a possible increase in property tax due to the increase in rooms and perhaps space.

The next section of the paper discussed the importance of facility access to fire trucks and first responders. The parking lot should be strong enough to hold a fire truck as well as have the space for first responders. They should have the maximal access to sources of water (ponds, fire plugs, pools, etc.).

The next section focused on building materials. When building a barn, the builders must consider masonry, heavy timber, and fire-retardant woods since it takes longer for flames to spread across these materials. The downside to this is these materials are often more expensive compared to commonly used wood and materials.

Electrical service and the importance of having proper electrical systems installed within the facility is also mentioned in the report. According to this paper, electrical failures along with human errors account for an estimated 80% to 85% of barn fires. Most modern barns have as many electrical appliances in them as a residential structure would. When constructing a new building, you should establish the best electrical blueprint for the barn. This will provide the best ability for service repair and minimize the need of multiple extension cords. It is also important to have a clean and safe electrical panel with properly organized wires for better access to repair or install new electrical units. An additional electrical system that could potentially assist with preventive barn fires are lightning protection systems. Such as lightning rods. These rods are run on the roofs of barns and are grounded to the ground outside to help move the flow of current if lightning were to strike the facility.

The next section on the report recommends detection, alarm, and suppression systems such as smoke alarms and sprinkler systems. Egress is also highlighted in the report. It is recommended to have multiple access/egress for humans and horses because it can be an important factor for a successful evacuation of animals and humans. [7]

How to cope with barn fires, 2012

This report by Emma N. Adam from the University of Kentucky was published in 2012 to manage field emergencies in U.S. barn fires that effect horses. However, the beginning of the paper has a section of practical measures for fire prevention. The recommendations are as follows:

- Stall door hardware should operate smoothly enough to make evacuation easier
- Consider front and back stall doors.

- Ensure sufficient electrical outlets to service the number of stalls present in the barn.
- Spring clean the barn by removing debris from electrical equipment and other combustible material.
- Install warning systems such as heat and smoke detectors.
- Install lightning rods, sprinkler systems, and fire extinguishers.

They also recommend storing hay/straw away from the horses. Especially for freshly cut hay that may still retain enough moisture to heat up. Furthermore, they recommend motorized equipment and vehicles with gas tanks to be stored from livestock since hot exhausts could ignite hay. The paper goes into deep detail of the pathophysiology of the response to thermal damage and smoke inhalation in animals. As well as clinical signs from the animal after the barn fire. It further discusses initial therapy treatments for these animals. [8]

A review of strategies to prevent and respond to barn fires affecting the horse industry, 2008

This paper was published from the Gluck Equine Research Center from University of Kentucky, Lexington, KY and authored by Rebecca M. Gimenez. This paper focused on addressing the issues associated with U.S. barn fires. Barn fires have a detrimental effect on equine recreational enthusiasts, horse owners, and practitioners regardless of geographic location or economic conditions. The paper states, fires kill more horses compared to any other type of disaster, and mitigation strategies for these fires exist but are underutilized. Preventative measures to decrease severity of the event and immediate suppression techniques, and a well-planned facility and property strategy can significantly reduce the loss of both equine life and property. It is important to understand basic fire behavior, fire-service response, new construction materials, and advances in fire detection systems and suppression equipment available to better construct a better horse facility.

The second section of the paper discussed their efforts in tracking horse barn fire incidents even though there is no nationalized reporting system. At the time of the data collection, the National Fire Incident Reporting System (NFIRS) subclassified livestock structure fires by cattle, poultry, swine, or "other livestock" facilities. Which means there are not specific means of getting the exact number of barn fires.

The third section discussed the data from one database that included only horse barn fires which was created in Lexington, Kentucky over a span of 20 years and a media analysis of nine horse barn fires. The number of horse deaths in the Kentucky survey per fire ranged from one to thirty-eight horses. In five incidents, no horses were killed due to proper evacuation or due to the horses not being in the facility at the time. From an analysis of nine horse barn fires that were reported by the Associated Press media from October (2005) to November (2007), 178 horses were killed and 55 were rescued.

The fourth section discussed the economic losses as a result of barn fires. In 14 reports that mentioned the economic loss, the total loss was estimated at 5.6 million. The paper reports an estimated \$124.6 million in direct damage to property due to barn fires between the years 1999 and 2000. Those estimates were based on 5800 barn structure fires. The fifth section iterated the

importance of checking for people first in the case of a barn fire. The sixth section dove into details of the basics of fire behavior including: how it ignites, what is required for fire, and what occurs after the initial flame starts. It is an important section to read to better understand how fires develop and grow. As well as the effects of the toxins that get released into the air from the burning materials. The seventh section discussed fire codes, enforcement, and NFPA 150. It went over how and why the first edition of NFPA 150 was created in 1976 after a racetrack fire. The eight section mentions arson as a not-so common cause for barn fires, but because they still occur it is important for arson investigators to consider when insured horses were in the barns or insured structures were involved.

The ninth section of the paper starts going over construction material consideration for facilities. Their recommendations are as follows: Use fire-retardant materials, have a fire-protection strategy, have an evacuation plan, and improve facility design and fire prevention management. The paper also includes a table with how each of these recommendations should look like for these facilities. The tenth and eleventh section states to learn from previous incidents and analysis of those incidents and to learn the anatomy of horse barns to better understand how structure design can impact a fire incident. The twelfth section discusses the effects of having lightweight wood-truss construction in barns. Due to advancements in technology and building materials, trusses can be made using lighter wood and lighter metal plates to create larger spaces never done before. However, these lightweight woods can carry water internally if not fully cured and effectively launches the metal plates off when the water inside the wood turns to steam. This then leads to structural failure of the barn and can cause further damage to the individuals and animals inside. The thirteenth and fourteenth section reiterated the importance of getting animals out safely in the event of a fire but to prioritize human life, as well as to give clear access to large emergency vehicles such as fire trucks. The next section mentioned the importance of having an updated electrical system. Electrical service boxes should be in a dry, dust-free location and mounted on a fire-resistant material. Most if not all electrical systems should be free of dust, cobwebs, chaff, and combustible materials. The following sections recommended installing sprinkler systems. It is said that sprinkler systems are cost effective to prevent a total loss. Early warning devices are also highly reliable. Flame detectors look for electromagnetic radiation signatures emitted by flames but can be expensive. Smoke alarms also simulate the human sense of smell and gives earlier warnings of smoke. Regardless of the early warning device chosen for the facility, it is important to have the devices connected to 911 systems to alert them when a fire incident occurs.

Barn fires are detrimental to equine recreational enthusiasts, horse owners, and practitioners and are the number one local emergency expected to affect horse owners. It is important to employ these strategies and equipment to help mitigate their effects. [9]

How to develop an equine veterinary facility all-hazards sheltering and evacuation plan, 2018

This U.S. based paper was written by Rebecca Husted and intended to teach how to develop emergency plans for an equine facility for various types of natural hazards and community assets. This paper considered risk as the relationship between hazards such as location, extent of emergency, previous occurrences, future provability, and community assets such as population, built environment, natural environment, and economy. Although this paper for the most part discusses natural emergencies such as floods and hurricanes, it mentioned barn fires as a hazard and gave instructions to develop an emergency plan that could be applicable to equine barn facilities. The section of materials and methods stated there are two efforts at a local level that must be done in order to prepare for emergencies and disasters involving horses. *"1) Animal facility owners should take responsibility for the animals under their care and 2) Emergency services management personnel preplan evacuation and sheltering considerations of large groups of animals within the civil jurisdiction."* As mentioned in the paper, the best method for development of disaster plans is planning in the absence of an immediate threat. It is preferred, but the rarest method because it allows for everyone involved enough time to think through the scenario and plans.

The paper said the planning cycle starts once a facility owner or staff conducts a hazard-specific identification, a risk and vulnerability assessment, or a capability and resource assessment for the facility. The procedure starts with thinking through the process and writing plans down and updating them as needed. Having a written plan during chaotic times when thinking is difficult but will help significantly. The plan should also be reviewed and updated regularly as animal facilities or services change, urbanization occurs, or as other factors affecting the facility may change. For example, a rural clinic in Kansas may have different expectations for assistance from their 911 emergency responders than a rural clinic in an urban and suburban environment in Florida. Another recommendation from the paper that could be applicable to a fire incident is, learn to teach all horses how to load safely into trailers. It is also important to have a shelter in place in case of an incident. There should be prior coordination, annual review of plan, hand tools, fore hoses, water pumps, generators for pumps, employees should be trained, access for fire department vehicles, batteries, NOAA weather radio, trailers hitched to fueled trucks, maps and route recon, and communication with family members or clients.

The overall goal from this paper was to increase the resiliency of the entire agricultural community by integrating animal issues into an overall emergency management strategy for the community, state, and nation. [10]

Don't risk hay fires, 2011

This article was published by North Dakota State University and written by J.W. Schroeder. The article discusses the importance of maintaining haystacks as dry as possible and away from crops or combustible materials. It emphasizes hay fires are known to damage and destroy barns and equipment and cost thousands of dollars in property damage across the U.S.

High moisture haystacks are more prone to igniting due to a chemical reaction that occurs inside large haystacks. Since hay insulates, the larger the stack the less the inside cools. When hay's internal temperature rises above 130 degrees Fahrenheit, a chemical reaction produces flammable gas that can ignite the stack. Weather conditions greatly influence the possibility of fires within haystacks and fires can even occur in small stacks of loose hay. The article recommends the following steps to minimize possible hay fires: check your hay regularly, insert temperature probes if suspect of hay heating, survey top of stacks safely while harnessed to avoid falling into possibly hot hay, and use caution if the need to combat a hay fire arises (chemical reactions from the hay are dangerous to inhale).

The directions from the website for combatting a fire are the following: knock down visible flames, prove for hot spots and inject water through a prove to cool hay, once spots cool down remove hay away from barn or stack. Afterward, the hay should be inspected if facility personnel are unsure whether it is too damaged to be used for feed or not. If not, the hay can be used as mulch for erosion control on slopes or gullies. [11]

Building technical fire protection, 2021

This report was published in Sweden and aimed to test two types of fire-resistant walls and floor structures. A full-scale fire test was conducted on farm buildings (barns and livestock houses) with hay lofts and a shed connected at right angles to the barns. Two types of fire-resistant walls and fire-resistant floor structures were studied. The fire development was carefully observed and documented by temperature and radiative heat flux during the fire. According to the report, fire development was intense, but the fire-resistant floor and walls resisted test fires for approximately 60 minutes as they were designed to do, which is reported by the paper as enough time for the barn animals to escape safely.

We included this Swedish report because we have seen from previous articles that fire doors are often recommended methods of preventing fire spread. [12]

Untold suffering: the tragic impact of barn fires on animals, 2020

This report was published in Canada by The Humane Society to provide an in-depth review of barn fire incidents, causes, and impacts in Canada. The Humane Society International/Canada compiled media reports over a five-year period, 2015-2019. From their analysis, at least 740,000 farm animals were killed in barn fires in Canada. Majority of these deaths were from chickens, making up to 74% of barn fire deaths. For reports where a cause was determined or suspected, the primary cause was electrical failure, followed by mechanical failure. The Humane Society recommends federal, provincial, and territorial codes and regulations to require proper preventative and proactive safety measures to be put in place. They additionally wish for education on the subject of fire protection to ensure the safety of farm owners, staff, neighbors, firefighters, and animals. This report also includes a section on the challenges for firefighters in these rural regions of Canada. According to the report, firefighters in winter months often drive to farms on icy roads with poor visibility. They have to drive back and forth on the icy roads due to most farms not having enough water to stop the fire. Temperatures are also known to drop below 30 degrees which can cause physical harm to firefighters and their water supply lines. Furthermore, this report discusses the emotional damage caused to firefighters and the effects of distress to firefighters responding to these barn fires on a regular basis.

This report includes a list of recommendations:

- Recognize barn fires as a serious threat on a provincial, terrestrial, and national level
- Fire and building codes should separate classification of buildings for agricultural operations to account for the unique criteria applicable only to barns

- Fire and building codes should incorporate recommendations from the Technical Advisory Committee on Farm Fires (TACFF) to reduce the potential for life and property loss by identifying the regulatory requirements and best management practices in the industry
- To compliment the introduction of the updates construction codes, provinces and territories should share educational resources with farmers to support the implementation of fire prevention, detection, and suppression systems
- Require fire departments across the country to report all animal deaths resulting from barn fires. By keeping up-to-date records of animal deaths from barn fires will allow officials and farmers to better understand the scope and impact of this issue

The report concludes with information on fire prevention and suppression systems. The report recommends water storages, explains the need for storage and their recommendations with managing a water storage. Sprinkler systems are mentioned and recommended for all large-scale animal facilities. Smoke, heat, and carbon monoxide detection systems are also recommended for all barn structures housing animals. Fire walls are recommended for new construction. Fire extinguishers are recommended as mandatory in every facility. Annual fire department inspections are also recommended to ensure all bar structures do not pose fire hazards. This is also said for mandatory electrical and mechanical inspections. Fire plans should also be necessary and submitted to local fire departments. Ventilation requirements are also recommended to be put in place to ensure dust does not build up in these systems which could lead to overheating of motors or further malfunctions. [13]

Chapter 3: Incident Data Collection and Analysis

3.1. Introduction:

One of the project tasks was to collect relevant data through a survey questionnaire. This chapter will present the details of the survey questionnaire that was developed and implemented for this project. The methodology used for this information gathering effort was through an online data acquisition platform. The survey was open for a period of three months, from July 28, 2021, until the end of September 2021. The intent of the questionnaire was to collect information from relevant animal facilities, groups, global animal organizations, and other relevant groups and individuals. The survey questions intended to capture information from anonymous respondents who have experienced a fire incident in the last ten years and relevant background information for the reason and aftermath of the incident. The questionnaire also included relevant questions for respondents who had not had a fire incident in the last ten years. The survey had key concepts to structure the flow of the questionnaire. It is as follows:

- General Information
- Cause of fire
- Electrical and general policies
- Loss summary
- Fire protection features and preparedness
- Additional information

The following flow chart depicts the structure of the questionnaire and order of questions specific to the response given to the previous question. This allowed for effective questions for both respondents who have or have not reported fire incidents. Those who have reported fire incidents were given additional questions specific to the fire incident, while responses who did not report a fire incident were given additional questions specific to the fire protection features and general best practices adopted in the facility.

It is acknowledged that data collected through this online survey does not represent statistical significance, but rather enough information was collected to be considered useful for providing guidance for this topic.



Figure 1: Questionnaire flow chart

3.2 Results & Discussion:

This section will discuss every question from the questionnaire in the order as it appeared followed by the responses gathered. A total of 137 responses were received from this online information gathering effort. It is important to note that not all respondents received the same question. Hence, every question should not be considered to have been answered by every responder. Specific questions were asked to responders who reported for specific housing facilities. The following table shows the total number of responses and the split between those who have experienced a fire incident in their animal housing facility in the last 10 years.

Table 1: Summary of number of total responses

Has there been a fire incident in the animal housing facility in the last 10 years?	# of respondents
No	70
Yes	65

<u>Question 2:</u> What type of animal housing facility do you have where a fire incident occurred? (Figure 2)



Figure 2: Type of animal housing facility (fire incident reported)

Total respondents, N = 57. The second question aimed to collect the distribution of the various animal housing facilities where fire incidents were reported. There was a total of 57 responses. The seven animal facilities reported through the online survey were: agriculture facilities, horse facilities, animal health care facilities, exhibition/public viewing facilities, research facilities, general board and care facilities, and emergency (disaster relief centers) facilities. Two additional facilities were collected from responders, chamber facilities and government animal shelters.

<u>Question 3:</u> What type of animal housing facility do you have where a fire incident did not occur? (Figure 3)

Total respondents, N = 55. The third question aimed to gather information on responders with animal housing facilities that did not report a fire incident. There was a total of 55 responses. Three responders added additional animal housing facilities that were not listed, Poultry Control Shed, Dog Kennels for Racing Greyhounds, and Human Society. The leading percentage of facilities that did not report a fire incident according to our collected information are horse facilities. NFPA 150 defines horse facilities as facilities that are used for temporary or permanent housing for horses [13]. Three responders were from large private facilities, two from small

private facilities, and the last two from a professional facility. A facility is considered large if it houses more than five horses whereas a professional facility has facilities including arenas with stalls, horse parks, and horse tracks etc.



Figure 3: Type of animal housing facility (no fire incident reported)

Question 4 & 5: Animal health care facility (e.g., veterinary or animal hospital) (Figure 4)

Total respondents, N = 16. The fourth and fifth question gathered information on how animal health care facilities observe their animals. Figure 4 is a collection of responses from animal health care facilities that did and did not have a reported fire incident. One of the reasons why there is a low number of reported animals who are constantly attended is because constantly observing animals is labor intensive and time consuming.



Figure 4: Animal health care facility observation method

Question 6 & 7: Type of horse facility? (Figure 5)

Total respondents, N = 21. The sixth and seventh question asked responders to specify their type of horse facility. A large portion of responses reported having small private horse facilities which house five or fewer horses. Six responders reported having a professional horse facility which includes arenas with stalls, horse parks, horse tracks, and other amenities for horses.



Figure 5: Type of horse facility

<u>Question 8 & 9:</u> General Board and Care Facility (e.g., facilities used for boarding, training, therapy, service animals, or law enforcement animals). (Figure 6)

Total Respondents, N = 6. Questions eight and nine reported all animals in general board and care facilities are housed without constant supervision. This applies for both groups of responders who did and did not report a fire incident in the last ten years.



Figure 6: General board and care facility animal supervision

Question 10 & 11: Type of agriculture facility? (Figure 7)

Total respondents, N = 41. Questions ten and eleven asked for respondents to specify the type of agricultural facility. This question was asked to both respondents who did and did not have a reported fire incident in the last 10 years. The largest type of agricultural facility gathered through this survey was indoor commercial use facilities, such as milking facilities, dairy loafing sheds, poultry housing, and production swine farrowing and nurseries. Of the 41 respondents with an agricultural facility and reported fire incident, 29 had an indoor commercial facility.



Figure 7: Type of agriculture facility



Question 12: Dates of fire incidents? (Figure 8)

Figure 8: Dates of fire incidents by year

Total respondents, N = 32. Most of our survey respondents reported fires that occurred in 2021. Figure 8 is limited by the reported data from the online survey respondents.



Question 13: What was the cause of the fire? (Figure 9)

Figure 9: Cause of fire.

Total respondents, N = 42. From this figure we can see two of the largest portions of the reported fires from this survey were caused from malfunction of electrical equipment and heating devices. These heating devices could have been close to hay bales or other common combustibles in such environments which led to fires. Malfunction of electrical equipment is also a large portion. This might be due to the poor installation and maintenance of electrical equipment.

Other survey responses for the cause of fire include:

- Installation not in compliance with electrical code requirements
- Undetermined
- Natural gas crematory oven
- Car crashed into building
- Under investigation
- Contractor cutting concrete ignited adjacent combustible material
- Lint in the trap on the roof from the clothes dryer
- Occupied RV in barn







7

Total respondents, N = 39. From our survey results, largest number of fires originated in barns. According to the Animal Welfare Institute report, many barn fires occur due to improper use of and malfunctioning heating device [5]. The use of heating devices is common during winter months and can become dangerous if left unattended.

<u>Question 15:</u> Did the fire travel from the area of origin? Please specify where the fire traveled if possible? (Figure 11)



Figure 11: Fire Travel

Total Respondents, N = 43. Question fifteen gathered from respondents whether the fire traveled from the location of origin. A large portion of responses reported the fire traveled from the area of origin. This could be due to many reasons, i.e., combustible construction, facility not having protection systems installed to keep the fire to the area of origin.

Specific responses received with further comments presented as it is below:

- The fire spread to different sections of the building. No firewall combustible construction plus storage of combustion material (hay, straw, etc.)
- Throughout the front half of barn
- Roof Structure above the unit
- Extended from point of origin into insulation
- Fire traveled throughout entire city
- Traveled horizontal through building of origin and adjacent to building
- Across the whole building
- Ignited heat lamp to the remainder of the pens through convection and direct flame contact, then to adjacent mechanical and storage spaces.
- Radiant heat caused an exposure fire to a nearby structure
- Loft
- Throughout whole structure destroying shed containing replacement dairy cows, bales, silage, bedding, stock trailers etc.
- Across the ceiling insulation
- Throughout the barn
- Engulfed whole barn
- Roof area

<u>Question 16 & 19:</u> Is the electrical wiring for your facility permanently installed, allowing you to connect appliances/equipment to electrical receptacles or do you use extension cords as your electrical source? (Figure 12)



Figure 12: Electrical wiring instillation

Total respondents, N = 81. From the survey respondents, a large majority of animal housing facilities have permanently installed electrical systems. Based on our survey responses, the second leading cause of fire incidents is malfunctioning electrical equipment, which coincides with why extension cords and other electrical distribution equipment accounted for 41% of fires from 2015–2019. [14]

Question 17 & 20: What is the smoking policy at your facility? (Figure 13)

Total respondents, N = 81. Many survey respondents reported smoking as prohibited. NFPA 150 2019 edition addresses smoking in animal housing facilities. The low number of reported fires from smoking incidents could be traced back to smoking being prohibited in codes and standards as well as best practices within the industry.



Figure 13: Smoking policy in the facility

<u>Question 18 & 21:</u> Do you implement a consistent animal waste and trash disposal schedule? (Figure 14)



Figure 14: Animal waste and trash disposal schedule

Total respondents, N = 52. Survey respondents largely implemented a consistent animal waste and trash disposal schedule. By implementing a consistent and effective trash disposal system, they ensure the reduction of combustible loading in the animal housing facility. Question 22: How were you/authorities alerted to the fire incident? (Figure 15)

Total respondents, N = 33. Large portion of survey respondents who reported fires were alerted by visual smoke/fire. It should be noted that from the survey responses a "phone call" was not distinguished from "911". This figure provides an illustration of the collected data as it was reported.



Figure 15: Fire incident notice

Question 23: Please provide any additional description/information about the fire incident.

The following lists depicts additional information and descriptions from fire incidents gathered from survey respondents. From the gathered responses, it was noted that a large portion of reported fire incidents either occurred at night, in barns, and/or lacked fire alarm systems. According to the Animal Welfare Institute, *Barn Fires*, the main cause of barn fires is improper use of or malfunctioning heating devices and electrical equipment [5]. There is also a trend in our collected responses where several reported fire incidents occurred after normal hours. Fires that occurred after normal hours cannot be contained early if the facility does not have the proper fire safety/alarm systems in place and thus can lead to a large number of casualties amongst the animal population in the facility.

Descriptions of fire incidents as received through survey response is provided below:

- 1. The fire occurred at the beginning of the night, no alarm system can be installed due to the humid, dusty, and corrosive environment. Poor maintenance program of the electrical installations. Ventilation system continues to operate and fuels the fire (no ventilation shut-off)
- 2. Building located in rural area where the fire department is located more than 10 kilometers away.
- 3. Alarm called staff. Staff had the fire out before the fire department arrived. Two farrowing crates were damaged.
- 4. The engine room, as well as the rest of the facilities did not have an alarm system, which delayed the detection (at night) and not having a special firefighting equipment, the fire developed for hours, and the loss was total (luckily the engine room was isolated).
- 5. Fire happened overnight. Faulty heat lamp except it was one of those safety ones with a cage. Minimal hay in the building, but the wood exterior caught. 2 adult goats and 3 newborns died plus multiple chickens. 7 sheep escaped on their own. Fire department was notified, and they put out the fire but made no attempt to help animals nor did they seem to care that there were animals in the building.
- 6. The incident occurred during normal business hours at approximately 11 am. The building is non-suppressed or alarmed. The oven is not regularly used and only after quantity demands. The failure was because the duct work was installed sometime prior and too close too combustible framework.
- 7. Fire department was called and limited fire to the wall where the fire began and approximately 30 ft x 30 ft area of foam insulation in the ceiling.
- 8. Staff notified via internal alarm system; fire extinguisher was sufficient to extinguish the flame.
- 9. Evacuation of people at facility, attempted to evacuate animals, but only able to evacuate a few due to limited time.
- 10. Many different fire departments involved.
- 11. Fire was potentially thought to be started by power generating equipment.
- 12. Enacted phone tree to alert all staff.
- 13. Fire reached the facility around 11 pm.
- 14. Middle of winter at night. Old trailer was converted into dog kennels. 15 dogs, back doors on boarding area closed for the night. Dogs could not escape. Fire started from faulty heating devices. Trailer was fully evolved by time volunteer department arrived. All 15 dogs perished.
- 15. Hog confinement with no workers present. Fire discovered approx. 5 am by hunter hunting across the road. Furnace turned on prior afternoon in area of origin. Destroyed both confinement buildings. Fire department stopped fire from entering nursery building. Approx. 600 hogs killed. Some hogs released by fire department from confinement building.
- 16. Tractor exhaust igniting combustible wall construction resulting in total loss of a single shed. Space separation and fire brigade intervention prevented it from spreading to adjacent sheds.
- 17. Fire was ignited from the gas open-chamber heater. Fresh and dry straw made fire to spread.
- 18. While loading the broilers.

- 19. Heat lamp placed in a location where it was too close to bedding and could be disturbed by animals.
- 20. 6:28 AM time of dispatch, Sunday morning. Fire Department with mutual aid responded. More than 3 dozen animals perished.
- 21. 43 racehorses perished, fully involved, no rescues, 11 pm, no detection, no sprinklers, however now there is detection, electrical items using proper plugs, receptacles are arc prevent, many changes have occurred for the rest of the buildings and the new one which was built in the fire location.
- 22. Early morning, before dawn. Family evacuated animals. Response was 3 departments. Lack of water (no hydrants, ponds, or rivers)
- 23. Incident occurred at 1 am, security is onsite 24/7 but did not see until making their rounds which takes 1 hour to complete a round. 911 was called then GC, and Managing Director, Fire Department responded. Had a hard time getting into the site with fire truck, had to use multiple hoses. Additional hydrant has been added since the fire, we now use a mass notification system and are working towards adding smoke/heat detection to all animal housing facilities. Lost two toucans in this fire.
- 24. This was poultry grow out barn, 700 ft long and open throughout. 95% involved on arrival. We have about 1 of these yearly
- 25. It happened after hours limited staff on site. No possibility of evacuation of animals given the number of animals housed.
- 26. Owner was unaware of having to report the incident until Animal Services was notified.
- 27. 3 horses in indoor area died. 1 stalled horse rescued. 8 horses loose in runs survived
- 28. Seen fire during a thunderstorm
- 29. Nine horses died during a barn fire
- 30. Full response from the fire department and a tanker shuttle

<u>Question 24:</u> How many people (e.g., facility personnel, first responders, visitors, neighbors, contractors etc.) suffered injuries from the incident, if any? (Figure 16)



Figure 16: Number of people injured

Total respondents, N = 31. Question 24 gathered information on the number of people injured in a reported fire incident at the animal housing facility. The low number of injured humans could be due to multiple reasons, such as most of these facilities being exclusively used to house animals, and some fires occurring only after regular business hours. These could all lead to low injury rates for humans during these fire incidents.

<u>Question 25:</u> How many fatalities (e.g., facility personnel, first responders, visitors, neighbors, contractors etc.) resulted from the incident, if any? (Figure 17)



Figure 17: Number of human fatalities

Total respondents, N = 31. Question 25 asked respondents to report the number of human fatalities for the reported fire incidents. There was a single response who listed more than 10 human fatalities. However, the vast majority of responses reported zero fatalities during the fire incident.

<u>Question 26:</u> How many animal injuries resulted from the incident, if any (please provide an estimate of injury numbers associated with each type of animal species in the field below)? (Figure 18)

Total respondents, N = 32. Figure 18 presents the gathered number of animal injuries reported from the online survey responses. Various types of animals were reported to be injured, cows, chickens, hogs, ducks, cats, and horses. Out of 32 responses for this question, 18 responded with chickens as the type of animal species injured during the fire.


Figure 18: Number of animals injured

<u>Question 27:</u> How many animal fatalities resulted from the incident, if any (please provide an estimate of number of fatalities associated with each type of animal species in the field below)? (Figure 19)

Total respondents, N = 32. Question 27 gathered the number of animal fatalities. Figure 18 and 19 both have large number of responses for zero fatalities and injuries. They also have similar responses for the type of animal injured or lost during the fire incident. With most responders reporting chickens, cattle, and horses as the type of species mostly lost in the fire.



Figure 19: Number of animal fatalities

Question 28: What species of animals were in the facility?

• Cattle, swine, chickens, cats, dogs, goats, birds, tortoises, primates, hoof stock, duck

<u>Question 29:</u> How were the animals housed within the facility? (Fire incident reported) (Figure 20)

Total respondents, N = 31. From question 29, the survey responses reported most animals are housed in confined areas with latched doors or stalls. This corresponds to the reported animal tragedies and injuries from question 27 and 26 because animals are then unable to escape during these fires.



Figure 20: Animal housing within facility

Question 30: What was the estimated total financial loss associated with this incident (including animal(s), and property)? (Figure 21)

Total respondents, N = 31. The responses collected for question 30 show a large percentage of financial loss was greater than \$500,000. According to the NFPA report, Fires in or at Animal Occupancies, fires caused 37 million dollars of property damage to livestock or poultry storage properties from the year 2014 to 2018 [4]. If we were to sum up the 13 responses with a financial loss of \$500,000 or greater, that would be over 6.5 million dollars in financial loss. It is reasonable to say that the reported numbers from the responses received are consistent with other reports.



Figure 21: Estimated total financial loss

Question 31: What fire protection features were present at the time of incident? (Figure 22)

Total respondents, N = 21. Most of the responders had fire extinguishers. According to NFPA 150, fire extinguishers are required for animal housing facilities with livestock that are not typically occupied by humans. Fire detection, alarm, and communication systems are required systems. Additionally, fire alarms and sprinkler systems are required in all animal housing facilities that fall under Class A facilities and Class B facilities, as defined by NFPA 150, with sleeping quarters.



Figure 22: Fire protection features present

Question 32 & 39: What is the exterior construction type of your facility? (Figure 23)



Figure 23: Type of exterior construction

Total respondents, N = 30. Questions 32 and 39 gathered information on the type of exterior construction from the respondents who reported and did not report fire incidents. Figure 23 is in accordance with previous information we have gathered. Respondents have reported fire

incidents inside barns and figure 23 also shows a large portion of the construction to be a type of timber/wood.

<u>Question 33 & 40:</u> Are you familiar with NFPA 150: Fire and Life Safety in Animal Housing Faculties Code? (Figure 24)



Figure 24: Familiarity with NFPA 150

Total respondents, N = 71. Questions 33 and 40 gathered information on whether the survey responders were familiar with NFPA 150 or not. A large percentage of responders are not familiar with the NFPA 150. Currently we are aware that NFPA 150 is reported to being used in two jurisdictions according to NFPA's CodeFinder®.

<u>Question 34 & 41</u>: Are there any specific fire protection and/or life safety standards that you follow for the animal housing facility? If yes, please specify. (Figure 25)

Total respondents, N = 54. 91% of the survey respondents who reported fire incident did not have fire protection and/or life safety standards that they followed for the animal housing facility.



Figure 25: Fire protection standards

The following are responses for specific fire protection and/or life safety standards followed from our responders:

- 2018 IFC and all referenced standards and guidelines
- Building codes, NFPA 150
- Private, non-zoned operation
- NFPA 150 for all new construction
- NFPA 150
- Electrical standards
- All livestock are turned loose at the sign of any smoke fire
- Consistently remove bedding and dust, remove cobwebs, electrical check 1x a year
- Chapter 4 of Fire Code and Administrative Code
- NFPA 150 and all NFPA codes that apply to humans, when human offices are in animal areas
- NFPA 1, NFPA 101, NFPA 150
- NFPA 150
- Fire sprinkler and alarm
- NFPA 150
- NFPA 1 and NFPA 101
- NFPA 1, NFPA 101, NFPA 72

<u>Question 35 & 42:</u> Does your facility implement procedures and emergency preparedness plans (e.g., pre fire incident plans, occupational safety plans that addresses fire hazards, drills, accreditation requirements)? (Figure 26)



Figure 26: Emergency procedure and preparedness implementation

Total respondents, N = 19. Question 35 and 42 gathered information from both groups of respondents who did and did not report a fire incident on emergency procedures and preparedness implementation occurring at the animal housing facilities. Fire drills may be the amongst the lowest implemented procedures, but it is good to see other emergency procedures in place. The top three responses were annual inspections, pre-fire incident plans, and internal safety inspections. pre fire incident plans, internal safety inspections, and occupational safety plans that address fire hazards. 63% of responses have pre fire incident plans. A pre-fire incident plan, as per NFPA 150 2019 Edition, would include having a complete floor plan of hazardous materials, processes, electrical equipment, shutoffs, and preventative equipment such as smoke detectors and such. [13]

<u>Question 36:</u> Does your facility have arrangements with other institutions to coordinate evacuation (i.e., animal movement)? (Figure 27)



Figure 27: Arrangements with other institutions for evacuation

Total responders, N = 29. A small percentage of responders reported having an arrangement with another institution for evacuation.

Question 38: What fire protection features are present in your facility? (Figure 28)



Figure 28: Fire protection features present

Total respondents, N = 39. Similar to question 31, this question was asked to survey respondents who did not have a reported fire incident. There is a clear difference in the number of fire extinguishers reported from survey respondents compared to other fire protection features. The second largest being monitored fire alarm. Referencing back to figure 22, there are less reported monitored fire alarm systems for those who had a fire incident in the animal housing facility. Facilities with monitored fire alarms would be expected to have fewer injuries and fatalities due to the notification of a fire.

<u>Question 43:</u> Does your facility have arrangements with other institutions to coordinate evacuation (i.e., animal movement)? (Figure 29)



Figure 29: Evacuation arrangements

Total respondents, N = 41. Over 70% of respondents do not have evacuation arrangements. Even though NFPA 150 states "Disaster/emergency management programs shall be required in all animal housing facilities to protect and ensure the safety of the animal and human occupants during fire...". An evacuation plan with floor plans should be in place.

Question 44: Additional Comments?

These are additional comments from survey responses. Based off these additional comments, we see there is a need for additional communication for an action plan/safety sheet. NFPA 150 safety sheet is available.

- Example(s) of emergency action plans to share and assist with training of these type of facilities.
- Participate in training in order to improve knowledge on animal housing facility design.
- Discussed animal movement with other institutions, but have not figured out logistics of how it would actually work.
- Very interested in this information and what other Zoos & Aquariums do to make our program better. Very interested in knowing if fast response sprinkler heads should be

used in animal areas, versus regular. Would they make a difference (a cold wet animal is better than one that has perished)? What can be done to make sprinkler head less vulnerable to great apes/chimps that can use sticks or pack material into tubes, other than making them out of their reach (lowering caging so they cannot access them)

<u>Question 45:</u> Have you had more than one fire incident in your facility in the last 10 years? (Figure 30)



Figure 30: More than one fire incident

Total respondents, N = 28. For the most part, most responders did not experience more than one fire.

Question 46: Do You Intend to Report Another Incident? (Figure 31)





Total respondents, N = 30. There were a few responders who reported another incident after finishing the survey. This could relate to the previous question where a small number of responders reported more than one fire in the animal housing facility.

Chapter 4: Incident Data Collection and Analysis of News Media Reports Within the U.S.

This section is a summary of review of fire incidents that occurred in the animal housing facilities that were reported in the news media reports. Since this is an extensive number of reports, the primary focus has been to consider the incidents reported during the period of year 2020 and 2021. The goal was to find what information is relevant to the overall project objective that is available from the news media reports. It is important to note that the data and information collected from news media reports have not been validated, they are presented in this report after a quantitative analysis of the data and information collected from the reports. The full database of incidents collected is presented in Appendix B of this report. Note that the news media reference URL listed in Appendix B was acquired during time of this research and presented for future reference.



Figure 32: Reported Fires

Figure 32 shows the counts of fires reported by news media gathered per state. It is important to note that the count of states with news recorded accounts of fires does not show the total number of fires for that state. Not all fires are reported by news and perhaps not all recorded fires were gathered for this report. However, according to our collected news articles, states with the largest number of animal housing fires reported by news media were California, Illinois, Indiana, Ohio, Pennsylvania, and New York. According to a previously discussed paper from AWI [5], the currently gathered news articles agree that many barn fires occur in northern states with colder weather.



Animal casualties per animal facility





Animal casualties per animal facility



Figure 33 is a log scaled count of every animal casualty from fires reported by the news media in the U.S. The figure is scaled in order to be able to clearly see the values from every animal housing facility, otherwise their values would be trumped by the number of casualties gathered for barn facilities. According to reports from news media, barn facilities had 1.2 million animal casualties in the years 2020–2021.

Figure 34 allows us to see the disproportionate number of animal casualties related to barn fires from the U.S. news articles that was gathered. Barn fire animal casualties far outweigh the number of casualties from every other animal facility.

The largest animal casualties were from chickens, livestock, cows, horses, and goats. Large number of news articles did not specify the species of animals that passed in the fires due to the lack of information at the time of reporting the fire.





Figure 35: Causes of fire

Figure 35 shows the causes of fires reported from the gathered news articles. It should be noted that these news articles are written during or shortly after the fire incident and reporters only share the knowledge they are given from firefighters at the time of the incident. Due to this, we have a large number of 'Undetermined' causes for these fires.



Fires reported by news media (2020-2021)

Figure 36: Total fires reported by U.S. news media (2020-2021)

Figure 36 is a collection of the number of U.S. fires of every month for the years 2020 and 2021. This figure shows the months with the largest reported fires from the years 2020 and 2021. The months with the largest number of reported fires according to our gathered news articles are February, May, March, and June.

Fire protection	# Reported by news media
Unreported in news article	149
Evacuation plan	3
Fire alarm	1
Fire hydrant	1
Nearby water supply	1
Smoke doors	1
No fire protection reported in news article	0

	Table	2:	Fire	protection
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From the collected news sources, it was found that most facilities did not have a proper fire protection system in place at the time. Fire suppression/alerting systems such as sprinklers, smoke detectors, and alarms were not found in the majority of these animal facilities. We know from previously mentioned papers that fire suppression and alerting systems can play a significant role to mitigate or suppress potentially life-threatening fires in animal facilities, especially outside of regular working hours when there is not any human supervision.

Chapter 5: Summary Observations

The goal of this project was to gather and analyze information on the causes of fire, fire losses, and fire protection features of animal housing facilities through a comprehensive review of published literature, U.S. news media reports (2020-21), and an online information collection effort through a survey questionnaire.

The data collected and reviewed from these three sources provided the following observations.

Review of published literature data revealed the leading causes of animal housing fires to be from heating devices and malfunctioning of electrical systems [5] [13]. This was further reinforced by the survey questionnaire responses which reported heating devices were responsible for 33% of all reported fires collected through this study, followed by malfunctioning electrical systems (29%).

Further, papers reviewed from the literature reported that winter months harbored a greater number of fires as compared to other seasons. Both AWI's *Barn Fire* [5] and The Humane Society International's *Untold Suffering* [13] report concluded colder months to have larger number of fires due to facilities using more heating systems or electrical equipment. This was also observed in the incident data collected through U.S. based news media reports for 2020-21 period, which showed February as the month with largest number of incidents reported.

The financial loss due to these fires were also reviewed from the data available in literature. The prior report from NFPA [4] estimated the costs of these animal housing structure fires from the years 2014–18 to be \$37 million. The online questionnaire responses in this study indicated similar magnitude of financial losses (Fig. 21).

The questionnaire survey responses revealed the lack of awareness about fire and life safety standards applicable to animal hosing facilities such as NFPA 150, *Fire and Life Safety in Animal Housing Facilities Code*. The open-ended responses collected from respondents suggested an opportunity to create training outreach program and other fire protection training to better educate animal housing facility owners and staff.

Below is a compiled list of recommended fire protection features gathered from the literature review: sprinkler systems, fire extinguishers, smoke detectors, heat detectors, carbon monoxide detectors, fire doors, emergency exits for animals/people, lightning rods, and having permanently installed electrical systems in the facility. The routine inspection of electrical systems as well as annual inspections of the facilities were also recommended. Further, need for routine fire drills and employee training was emphasized.

It is noted that less data was available and collected from the zoos and aquarium facilities. This study recognizes the need for additional awareness outreach about standards for this section of animal housing facilities.

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Appendix A: Questionnaire

Background: Welcome! You are invited to participate in a research study on "Fires in animal housing facilities" conducted by the Fire Protection Research Foundation (FPRF), the research affiliate of National Fire Protection Association (NFPA), where the objective is to collect and analyze information on cause of fire, fire loss (animal deaths and financial loss), and fire protection features (such as fire suppression, detection, etc.) of animal facilities. You can read more about the overall project from this <u>project summary document</u>.

This questionnaire has been created as part of this research study to gain insight from you, and others you may know, regarding fires that have occurred in animal housing facilities. <u>NFPA 150: Fire and Life Safety in Animal Housing</u> <u>Facilities Code</u>, establishes life and safety requirements for both humans and animals in all types of animal housing facilities where animals are kept for any purpose, including barns, stables, kennels, animal shelters, veterinary facilities, zoos, laboratories, and racetracks. A database with information on the fire incidents and related loss along with an understanding of the fire protection features of the animal facility will provide much needed information for the NFPA 150 Technical Committee responsible for developing this safety standard.

Confidentiality: Your participation in this research survey is voluntary. You will receive no payment for participating in this study. You may skip any questions that make you feel uncomfortable and can stop the survey at any time. The information you provide through this survey will be anonymous. This means that your name or your organization's name will not be collected or linked to the data in any way. The researchers will not be able to remove your data from the dataset once your participation is complete. **The anonymized and compiled results of this survey will be used in the final report, the researchers will not identify you or your organization.** The final report will be published publicly from the Fire Protection Research Foundation website (www.nfpa.org/foundation).

If you agree to participate in this study, please click "**Next**" below and proceed to an internet-based questionnaire. It is estimated that the questionnaire will take approximately 10 minutes to complete.

We ask that you please

For any questions you have concerning the study or your participation in this questionnaire, please contact:

- Sreeni Ranganathan, Fire Protection Research Foundation. Email: <u>sranganathan@nfpa.org</u>
- Jacqueline Wilmot, Fire Protection Research Foundation. Email: jwilmot@nfpa.org

We thank you for your participation in this research study.

General Information:

- 1. Has there been a fire incident in the animal housing facility in the last 10 years?
 - O Yes
 - 🔿 No

General Information: Fire Incident Reported

2. What type of animal housing facility do you have where a fire incident occurred?

\bigcirc	Animal Health	Care Facility (e.g.,	Veterinary or Anin	nal Hospital)
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- O Horse Facility
- Research Facility used for experimentation, education, or scientific experimentation or production research on animals in a controlled environment (e.g., this includes laboratories, schools, and universities).
- Exhibition/Public viewing Facility that allow public access for the purpose of exhibition or public viewing of animals) (e.g., zoos, petting zoos, nature centers, circus, carnivals etc.)
- General Board and Care Facility (e.g., facilities used for boarding, training, therapy, service animals, or law enforcement animals. *This does not include horse facilities.*)
- Agriculture Facility
- Emergency (Disaster relief centers)
- Others. Please specify in the field below. Examples may include but are not limited to exotic, game ranches, hunting ranches, conservation breeding centers, wildlife sanctuaries, farm animal sanctuaries please specify in the field below.

General Information: No Fire Incident Reported

2. What type of animal housing facility do you have?

Animal Health Care Facility (e.g., Veterinary or Animal Hospital)

- 🔵 Horse Facility
- Research Facility used for experimentation, education, or scientific experimentation or production research on animals in a controlled environment (e.g., this includes laboratories, schools, and universities).
- Exhibition/Public viewing Facility that allow public access for the purpose of exhibition or public viewing of animals) (e.g., zoos, petting zoos, nature centers, circus, carnivals etc.)
- General Board and Care Facility (e.g., facilities used for boarding, training, therapy, service animals, or law enforcement animals. *This does not include horse facilities.*)
- Agriculture Facility
- Emergency (Disaster relief centers)
- Others. Please specify in the field below. Examples may include but are not limited to exotic, game ranches, hunting ranches, conservation breeding centers, wildlife sanctuaries, farm animal sanctuaries please specify in the field below.

General Information: Fire Incident Reported

2a) Animal Health Care Facility (e.g., Veterinary or Animal Hospital)

- Animals are observed overnight but not constantly attended.
- Animals are constantly attended.

General Information: No Fire Incident Reported

2a) Animal Health Care Facility (e.g., Veterinary or Animal Hospital)

- Animals are observed overnight but not constantly attended.
- Animals are constantly attended.

General Information: Fire Incident Reported

2a) Horse Facility

- Small Private horse facility housing 5 or fewer horses
- C Large Private horse facility housing more than 5 horses
- Professional Facility (e.g., arenas with stalls, horse parks, horse track)
- O Polo Facility

General Information: No Fire Incident Reported

2a) Horse Facility

- Small Private horse facility housing 5 or fewer horses
- () Large Private horse facility housing more than 5 horses
- Professional Facility (e.g., arenas with stalls, horse parks, horse track)
- Polo Facility

General Information: Fire Incident Reported

2a) General Board and Care Facility (e.g., facilities used for boarding, training, therapy, service animals, or law enforcement animals. *This does not include horse facilities.*)

- Animals housed without constant supervision.
- Animals housed with constant supervision.

General Information: No Fire Incident Reported

2a) General Board and Care Facility (e.g., facilities used for boarding, training, therapy, service animals, or law enforcement animals. *This does not include horse facilities.*)

- Animals housed without constant supervision.
- Animals housed with constant supervision.

General Information: Fire Incident Reported

2a) Agriculture Facility

- **Outdoor** Commercial Use (e.g., production swine farrowing and nurseries, milking facilities and dairy loafing sheds, poultry housing)
- Indoor Commercial Use (e.g., production swine farrowing and nurseries, milking facilities and dairy loafing sheds, poultry housing)
- Private residential-type animal housing, zoned or permitted as residential or private (e.g., chicken coups, small fenced-in pens for private diary animals, family farms), pastures, feed lots, and hutches)

General Information: No Fire Incident Reported

2a) Agriculture Facility

- **Outdoor** Commercial Use (e.g., production swine farrowing and nurseries, milking facilities and dairy loafing sheds, poultry housing)
- **Indoor** Commercial Use (e.g., production swine farrowing and nurseries, milking facilities and dairy loafing sheds, poultry housing)
- Private residential-type animal housing, zoned or permitted as residential or private (e.g., chicken coups, small fenced-in pens for private diary animals, family farms), pastures, feed lots, and hutches)

General Information: Date and Occurrence

3. Please provide the date of the fire incident (exg. MM/YYYY or YYYY).

C

ause of Fire:
5. What was the cause of the fire?
Heating device (e.g., heat lamps, heating cable, spaces heaters including electrical space heaters, water heaters, fireplace/chimney etc.)
C Electrical equipment, malfunction of electrical equipment (e.g., lighting, transformer, power supply, cords, plugs etc.)
O Agricultural equipment & tools
○ Wildfire
○ Spontaneous combustion or chemical reaction
Cigarette smoking or similar
◯ Hay fires
Arson (intentional)
Fires resulting from incendiary/explosive devices, which result in fire? (e.g., fireworks coming over perimeter fences)
Other (please specify)

6. Where did the fire originate? (e.g., barn, laundry facility, kitchen, animal occupied space etc.)

7. Did the fire travel from the area of origin? Please specify where the fire traveled if possible.

O Yes

O No

O Please specify

Cause of Fire:

8. Is the electrical wiring for your facility permanently installed, allowing you to connect appliances/equipment to electrical receptacles, or do you use extension cords as your electrical source?

Permanently installed.

Use extension cords.

9. What is the smoking policy at your facility?

- Smoking prohibited.
- Smoking permitted only in designated areas.
- Smoking permitted throughout the facility.
- Other (please explain)

10. Do you implement a consistent animal waste and trash disposal schedule? If yes, please specify how often.

🔵 Yes

🔵 No

Please specify

Electrical and General Policies:

3. Is the electrical wiring for your facility permanently installed, allowing you to connect appliances/equipment to electrical receptacles, or do you use extension cords as your electrical source?

Permanently installed.

) Use extension cords.

4. What is the smoking policy at your facility?

- Smoking prohibited.
- Smoking permitted only in designated areas.
- Smoking permitted throughout the facility.
- Other (please explain)

5. Do you implement a consistent animal waste and trash disposal schedule? **If yes, please specify how often.**

O Yes

🔿 No

Please specify

Cause of Fire:

11. How were you/authorities alerted to the fire incident? (e.g., visible fire, alarm sound, phone call?)



12. Please provide any additional description/information about the fire incident. (We are looking for any information you can provide including but not limited to: approximate or exact time of the fire incident, staff notification, whether fire department response was involved, evacuation of animals and people)

Loss Summary:

13. How many people (e.g., facility personnel, first responders, visitors, neighbors, contractors etc.) suffered injuries from the incident, if any?

0
Less than 5
5 to 10
Greater than 10

Unknown

14. How many fatalities(e.g., facility personnel, first responders, visitors, neighbors, contractors etc.) resulted from the incident, if any?

0
Less than 5
5 to 10
Greater than 10
Unknown

15. How many animal injuries resulted from the incident, if any (please provide an estimate of injury numbers associated with each type of animal species in the field below)?

○ 0
C Less than 10
○ 10 to 50
○ 51 to 100
101 to 1,000
1,001 to 10,000
10,001 to 50,000
○ 50,001 to 100,000
Greater than 100,000
Unknown
Please specify what animal species were injured

16. How many animal fatalities resulted from the incident, if any (please provide an estimate of number of fatalities associated with each type of animal species in the field below)?

O 0
C Less than 10
10 to 50
🔵 51 to 100
101 to 1,000
1,001 to 10,000
10,001 to 50,000
50,001 to 100,000
Greater than 100,000
🔿 Unknown

Please specify what animal species were involved

17. What species of animals were in the facility?

18. How were the animals housed within the facility? (Select all that apply)

Open area, freely roaming.
Confined to grouped areas.
Confined to individual areas.
Locks requiring a key or special access.
Latches/doors requiring manual release.
Automatic release
Tanks
Cages
Stalls
Other (please specify)

19. What was the estimated total financial loss associated with this incident (including animal(s), and property)?

- Less than \$1,000
- () \$1,001 to \$10,000
- () \$10,001 to \$100,000
- () \$100,001 to \$500,000
- Greater than \$500,000
- 🔿 Unknown

Fire Protection Features and Preparedness: Fire Incident Reported

20. What fire protection features were present at the time of incident? (Check all that apply):

Monitored Fire Al	larm System (e.g.	central station	monitored smok	e detection)
 1.1011100100 1 110 1 1	tarini oyotomi (o.g.	, oonuu ouuon	momon ou omon	o docoonon)

Non-Monitored Fire Alarm System (e.g., battery powered smoke detection)

	Notification Appliances (e.g.,	horn/bell/speaker/strobe/other)
--	---------------------------	-------	---------------------------------

Fire	Sprinkler	System
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Fire Extinguishers

Smoke Management or Smoke Control System (e.g., smoke exhaust)

Fire Barriers, Fire Doors, Fire Windows or a combination thereof

Fire and/or Smoke Dampers

Fire Hydrants

- 21. What is the exterior construction type of your facility?
 - Non-combustible (e.g., concrete, steel, masonry)
 - () Limited combustible (e.g., mixed masonry/wood)
 - Combustible (e.g., heavy timber, stick construction)
 - 🔵 Unknown

22. Are you familiar with NFPA 150: Fire and Life Safety in Animal Housing Facilities Code?

- O Yes
- 🔿 No

23. Are there any specific fire protection and/or life safety standards that you follow for the animal housing facility? **If yes, please specify**.

(Yes
)	105

🔿 No

\bigcirc	Please	specify

24. Does your facility implement procedures and emergency preparedness plans (e.g., pre fire incident plans, occupational safety plans that addresses fire hazards, drills, accreditation requirements)? **Select all the apply and please explain**.

Pre fire incident plans
Emergency response handbook/plan
Occupational safety plans that address fire hazards
Accreditation requirements
Internal safety inspections
Annual inspections by the local fire department and/or by insurance carrier, or other regulatory agencies
Training (please specify the frequency in the text field below)
Fire drills (please specify the frequency in the text field below)
Evacuation drills (please specify the frequency in the text field below)
Others
Please specify as needed

25. Does your facility have arrangements with other institutions to coordinate evacuation (i.e., animal movement)?

🔵 Yes

🔵 No

20. Any additional comments.	26.	Any	additional	comments?
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Fire Protection Features and Preparedness: No Fire Incident Reported
6. What fire protection features are present in your facility? (Check all that apply):
Monitored Fire Alarm System (e.g., central station monitored smoke detection)
Non-Monitored Fire Alarm System (e.g., battery powered smoke detection)
Notification Appliances (e.g., horn/bell/speaker/strobe/other)
Fire Sprinkler System
Fire Extinguishers
Smoke Management or Smoke Control System (e.g., smoke exhaust)
Fire Barriers, Fire Doors, Fire Windows or a combination thereof
Fire and/or Smoke Dampers
Fire Hydrants
7. What is the exterior construction type of your facility?
Non-combustible (e.g., concrete, steel, masonry)
C Limited combustible (e.g., mixed masonry/wood)
Combustible (e.g., heavy timber, stick construction)

🔿 Unknown

8. Are you familiar with NFPA 150: Fire and Life Safety in Animal Housing Facilities Code?

- O Yes
- 🔿 No

9. Are there any specific fire protection and/or life safety standards that you follow for the animal housing facility? **If yes, please specify**.

\bigcirc	Yes
\bigcirc	No
\bigcirc	Please specify

10. Does your facility implement procedures and emergency preparedness plans (i.e., pre fire incident plans, occupational safety plans that addresses fire hazards, drills, accreditation requirements)? **Select all the apply and please explain**.

Pre fire incident plans	
Emergency response handbook/plan	
Occupational safety plans that address fire hazards	
Accreditation requirements	
Internal safety inspections	
Annual inspections by the local fire department and/or by insurance carrier, or other regulatory a	gencies
Training (please specify the frequency in the text field below)	
Fire drills (please specify the frequency in the text field below)	
Evacuation drills (please specify the frequency in the text field below)	
Others	
Please specify as needed	

11. Does your facility have arrangements with other institutions to coordinate evacuation (i.e., animal movement)?

) Yes

🔿 No

12. Any additional comments?



Additional Information:

27. Have you had more than one fire incident in your facility in the last 10 years?

O Yes

🔿 No

28. Do you intend to report another incident?

O Yes

🔿 No

Thank you for taking the time to fill out the survey! Feel free to share this survey with others!

Please click the "Next" button and follow the link to fill out another response to the survey if you wish to report another case!

Thank you for taking the time to fill out the survey! Feel free to share this survey with others!

Appendix B: Incident Collected from US News Media (2020-21)

Incident	State	Date	Occupancy	Fire Cause	Fire Protection	Animal Casualty	Animal Casualty (num)	Human Casualty	Financial Loss	Reference URL:
Philladelphia zoo fire	000 Pennsylvania	12/24/1995	Zoo	Electrical	Unreported in news article	23 animals	23	0	6 million +	https://www.brown.edu/Research/Primate/fire.html
Wildlife in need center	""Indiana	1/15/2016	Sanctuary	Undetermined	Unreported in news article	41 animals	41	0	30,000	https://www.thedodo.com/wildlife-in-need-fire-controversy-1555547493.html
										https://www.chicagotribune.com/news/breaking/ct-charges-in-west-chicago-dog-kennel-fire-
DuPage County kennel fire	""Illinois	1/14/2019	Kennel	Neglegence	Unreported in news article	29 dogs	29	0		20190711-cpgqmebayrg3xatd76hfxh2czu-story.html
D E'		1/20/2010	D				2	0		https://www.myrecordjournal.com/News/Meriden/Meriden-News/Barn-fire-reported-on-Canyon
Barn Fire	Connecticut	1/30/2019	Barn	Undetermined	Unreported in news article	2 Animals	2	0		Drive-in-Meriden.aspx
Barn fire	^{con} Connecticut	2/1/2019	Barn	Undetermined	Nearby Water Source	14 cows	14	0		https://www.greenwichtinie.com/initialietown/article/Fitengitiets-battle-battle-initigia-cola-
8 houses killed in home fine	000 Monulond	2/0/2010	Dam	Undetermined	Lingenested in news esticle	2 homos	14	0	11001100	https://wtop.com/feederick.coverty/2010/02/8.horeces.killed.in.feederick.co.hore.fire/
8 horses kined in barn me	wiai yianu	2/9/2019	Dalli	Ondetermined	Onreported in news article	8 1101505		0	unsure	https://www.wfty.com/news/local/animals_killed_after_fire_at_orange_county_animal_sanctuary
Wildlife Sanctuary	^{coo} Florida	2/15/2019	Sanctuary	Explosion	Unreported in news article	40+ animals	40	0		firefighters-say/914339742/
,			, i		1		-			https://www.chronofhorse.com/article/three-horses-killed-in-barn-fire-at-kelli-cruciottis-
Barn fire	Florida	3/14/2019	Barn	Undetermined	Evacuation plan	3 Horses	3	0 deaths 1 injury		wellington-farm
Fire engulfs barn	^{oco} Michigan	3/25/2019	Barn	Undetermined	Unreported in news article	none		0	unnsure	http://www.wbkb11.com/fire-engulfs-barn-at-alpena-county-residence
700 hay bales destroyed in barn arson	""Georgia	3/29/2019	Barn	Arson	Unreported in news article	none		0	unsure	https://www.walb.com/2019/03/30/hay-bales-destroyed-brooks-co-barn-arson/
Barn goes up in flames	Oregon	5/9/2019	Barn	Undetermined	Unreported in news article	none		0	unsure	https://www.koin.com/local/clackamas-county/barn-goes-up-in-flames-at-canby-nursery/
Fire	Alabama	6/7/2019	Chicken house	Undetermined	Unreported in news article	25,000 Chickens	25000	0		https://www.wsfa.com/2019/06/07/fire-destroys-pike-county-chicken-houses/
Horse barn burns	""Virginia	6/27/2019	Barn	Undetermined	Unreported in news article	Unsure		0	unsure	https://wset.com/news/local/famous-horse-barn-burns-on-virginias-chincoteague-island
Several cows killed during barn fire	""New York	7/29/2019	Barn	Undetermined	Unreported in news article	30+ cows		0	unsure	https://www.wrfalp.com/several-cows-killed-during-ahsville-barn-fire/
5					1					https://www.mcall.com/news/breaking/mc-nws-lynn-township-hogs-barn-fire-20190921
Thousands of hogs killed	""Pennsylvania	9/21/2019	Barn	Undetermined	Unreported in news article	4,000 hogs		0	unsure	2pzpz2lidzcvlikz3hznz4gzy4-story.html
										https://www.desertsun.com/story/news/fires/2019/09/25/moreno-valley-fire-spreads-one-acre-
Hay fire spreads to acre	California	9/24/2019	Barn	Undetermined	Unreported in news article	10 goats		0	unsure	leaves-goats-dead-cows-injured/2439116001/
Hay bales spontaneously combust	""Oregon	10/6/2019	Barn	Hay bales	Unreported in news article	none		0	unsure	https://www.koin.com/news/oregon/hay-bales-spontaneously-combust-at-newberg-dairy/
a . a	mara	10/00/00/10								https://www.eastbaytimes.com/2019/10/28/farm-animals-rescued-others-perish-in-knighsten-
Contra Costa Fire	California	10/28/2019	Farm	Undetermined	Unreported in news article	57 deaths of numerous species	57	0		oakley-tire/
19 show horses die in raging fire	Georgia	10/29/2019	Barn	Undetermined	Unreported in news article	19 horses		0	usure	https://www.fox5atlanta.com/news/19-show-horses-die-in-raging-fire
Down fino	THin also	11/1/2010	Dom	Undetermined	Unreported in news orticle	10 mins	10	0		https://www.shawloosl.com/2010/11/01/fire.contain.woodstock.hom.fire.kille.10.nigs/co2k0w/
Balli life	minois	11/1/2019	Dalli	Olidetermined	Onreported in news article	19 pigs	19	0		https://www.snawiocal.com/2019/11/01/ine-captain-woodstock-balli-ine-kins-19-pigs/ag2k9vy/
Fire evacuation		11/2/2019	Shelter	Wildfire	Evacuation plan	None	0	0		animals-find-shelter-after-maria-fire-breaks-out/4128606002/
	Cumonia	11.2.2017	bliefter		2 rueuation plan	Tione	0	0		https://www.thechronicle.news/content/turtle-town-fire-destroys-exhibit-all-turtles-safely-
Aquarium fire	^{cco} Oklahoma	11/26/2019	Aquarium	Heat lamp	Unreported in news article	0 animals	0	0	0	transferred
•					· ·					https://www.nbcnews.com/news/animal-news/fire-engulfs-barn-ohio-wildlife-park-unknown
Wildlife park fire	""Ohio	11/28/2019	Zoo	Undetermined	Evacuation plan	10 animals	10	0		number-animals-killed-n1093186
	mou					4.0				https://www.cbsnews.com/news/fire-at-ohio-african-safari-wildlife-park-leaves-10-animals-dead
Barn fire at wildlife park leaves 10 animals dead	Ohio	11/29/2019	Barn	Electrical	Unreported in news article	10 animals		0	Unsure	after-barn-fireon-thanksgiving-night/
Parn destroyed by fire	- Indiana	12/12/2010	Dorn	Undetermined	Unreported in news article	Unsure		0	uncura	https://www.goshennews.com/news/middlebury-barn-destroyed-by-tire/article_720/8e2e-1eb5- 11co_b28f_8bcf204520f2_html
Balli desitoyed by file	Indiana	12/12/2019	Darn	Ondetermined	Onreported in news article	Olisuic		0	unsure	https://www.goshennews.com/news/middlehury_harn_destroyed_by_fire/article_72078e2e_1eb5_
Barn fire		12/14/2019	Barn	Heat lamp	Unreported in news article	Multiple animals	n/a	0		11ea-b38f-8baf294520f3.html
Michigan egg farm	^{ooo} Michigan	1/3/2020	Barn	Undetermined	Unreported in news article	300.000 chickens	300000	0		https://kfor.com/news/about-300000-hens-were-killed-in-a-fire-at-a-michigan-egg-farm/
Ava NV fire destroys barn kills livestock	""New York	1/3/2020	Barn	Undetermined	Unreported in news article	10 livestock	10	0		https://www.uticaod.com/news/20200103/ava-fire-destrovs-barn-kills-livestock
Michigan Barn Fire Kills Fleven Animals	^{aco} Michigan	1/13/2020	barn	Explosion	Unreported in news article	11 livestock	11	0		https://www.radio.com/www.naweradio/articles/michigan_harn_fire_kille_eleven_animale
Wienigan Dam File Kins Eleven Ammais	whenigan	1/15/2020	oan	Explosion	Onreported in news article	11 IIVESIOCK	11	0		https://www.mado.com/wwylewsradio/articles/intelligan-bailt-inte-kins-cleven-animals/
Animals killed in De Soto-area barn fire	"" Missouri	1/16/2020	Barn	Undetermined	Unreported in news article	14 livestock	14	0		fire/article 1993cc44-3d69-11ea-8e01-1f6409aede05.html
					· ·					https://www.montanarightnow.com/kalispell/family-loses-animals-and-thousands-of-dollars-
Barn fire	"" Montana	1/19/2020	Barn	Heat lamp	Unreported in news article	20 livestock	20		1000-10,000	worth-of-farm/article_5e64185e-3cb7-11ea-87e8-cbcd629224ca.html
Neave Township barn fire	Ohio	1/20/2020	Barn	Undetermined	Unreported in news article	17+ livestock	17	0		https://www.earlybirdpaper.com/animals-lost-barn-destroyed-in-fire/
VA	""North Carolina	1/23/2020	Barn	Undetermined	Unreported in news article	10,000 Chickens	10000	0		https://www.charlotteobserver.com/news/state/north-carolina/article239624708.html
										https://www.whsv.com/content/news/Firefighters-responding-to-massive-fire-at-Fulks-Run-farm
Rockingham County farm fire	^{and} Virginia	1/24/2020	Poultry House	Electrical	Unreported in news article	24,000 chickens	24000	0		567272591.html?newest
Franklin Township barn fire	2000 Pennsylvania	2/1/2020	Barn	Undetermined	Unreported in news article	20 chickens	20	0		https://www.pahomepage.com/top-news/fire-tears-through-barn-in-franklin-township/
2 pigs killed in Corning barn fire	""California	2/4/2020	Barn	Electrical	Unreported in news article	2 pigs	2	0	100,000	https://www.redbluffdailynews.com/2020/02/04/2-pigs-killed-in-corning-barn-fire/
Fire destroys Lowell township barn	""Michigan	2/5/2020	Barn	Undetermined	Unreported in news article	4 horses	4	0		https://www.woodtv.com/news/kent-county/fire-destroys-lowell-township-barn/
Casper barn fire	""Wyoming	2/11/2020	Barn	Heat lamp	Unreported in news article	1 dog	1	0		https://k2radio.com/dog-dies-in-barn-fire-west-of-casper/
Stables in Hampshire catches fire	""Illinois	2/14/2020	Barn	Undetermined	Unreported in news article	1 horse	1	0		https://abc7chicago.com/5932846/
Brookings County barn fire	"" South Dakota	2/18/2020	Barn	Undetermined	Unreported in news article	32 sheep	32	0	30,000	https://kelo.com/2020/02/19/aurora-barn-fire-kills-over-30-sheep-and-lambs/986491/
										https://www.appeal-democrat.com/corning_observer/fire-kills-student-s-third-try-at-raising-fair-
Fire kills student's third try at raising fair pig	""California	2/20/2020	Barn	Heat lamp	Unreported in news article	2 pigs	2	0	3,000+	pig/article_32324752-58ef-11ea-9f1a-87ba1dc93527.html
UPDATE: Cause determined in Sherrard hog										https://www.kwqc.com/content/news/-Multiple-fire-departments-respond-to-fire-at-Sherrad-hog-
confinement fire	""Iowa	2/21/2020	Barn	Electrical	Unreported in news article	2 pigs	2	0		refinery567906151.html
Arlington barn destroyed by fire	""Nebraska	2/23/2020	Barn	Undetermined	Unreported in news article	2 sheep	2			https://www.enterprisepub.com/stories/arlington-barn-destroyed-by-fire,3240
Delanson, NY	""New York	2/24/2020	Barn	Undetermined	Unreported in news article	7 sheep	7	0		https://www.news10.com/top-stories/crews-respond-to-barn-fire-in-delanson/
Hanover Township barn fire	""Ohio	2/26/2020	Barn	Undetermined	Unreported in news article	10 livestock	10	0		https://www.morningjournalnews.com/news/local-news/2020/02/animals-lost-in-barn-fire/
400,000 chickens killed in Bloomfield, Nebraska,										https://omaha.com/news/chickens-killed-in-bloomfield-nebraska-poultry-plant-
poultry plant fire	Nebraska	2/27/2020	Barn	Undetermined	Unreported in news article	400,000 Chickens	400000	0		fire/article_d6f4a95a-e2ad-5ca9-840c-9c5d5e34b33a.html
Wellington, OH barn fire	""Ohio	2/29/2020	Barn	Heat lamp	Unreported in news article	12 livestock	12	0	30,000 - 50.000	https://chroniclet.com/news/204622/animals-die-in-bursley-road-barn-fire/
U / ·					1	1	-		.,	https://www.wthr.com/article/news/local/sheep-killed-hamilton-co-barn-fire/531-ddc77d81-
Sheep killed in barn fire.	^{coo} Indiana	3/1/2020	Barn	Undetermined	Unreported in news article	4 sheep	4	0		b49b-48b3-8de9-614822585dcd
										https://www.ydr.com/story/news/crime/2020/03/08/15-horses-die-lebanon-county-barn
Bethel Township barn fire	Pennsylvania	3/7/2020	Barn	Undetermined	Unreported in news article	15 Horses	15	0		fire/4993863002/
Three calves die, equipment destroyed in Vernon				1						https://romesentinel.com/stories/three-calves-die-equipment-destroyed-in-vernon-barn-
barn fire	""New York	3/8/2020	Barn	Undetermined	Unreported in news article	3 cows	3	0		fire,93807
Pickford Fire Destroys Barn, Kills Hogs	"" Michigan	3/13/2020	Barn	Undetermined	Unreported in news article	120 pigs	120	0		https://www.9and10news.com/2020/03/13/pickford-fire-destroys-barn-kills-hogs/
							25	-	-	https://www.dailyamerican.com/story/news/local/2020/03/17/heat-lamp-believed-to-be-cause-of-
Summit Township barn fire kills goats	Pennsylvania	3/17/2020	Barn	Heat lamp	Unreported in news article	27 Goats	27	0		barn-fire-in-summit-township/115803108/

									https://www.meadvilletribune.com/news/garage-barn-fire-in-summit-township-kills-
Summit Township barn fire kills horse	^{cco} Pennsvlvania	3/17/2020 Barn	Wood stove	Unreported in news article	1 horse	1	0		horse/article 854fe73a-6896-11ea-bdde-efcf85afccaf.html
Barn fire	Wisconsin	3/22/2020 Barn	Undetermined	Unreported in news article	2 cows	2	0		https://fox11online.com/good-day-wi/barn-fire-in-town-of-russell
Fire enculfs barn in Macedon	⁰⁰⁰ Naw Vork	2/24/2020 Barn	Undetermined	Unreported in news article	2 cows	2	*		https://13wham.com/news/local/fire-enoulfe-ham-in-macedon
The enguns barn in Macedon	New TOIK	3/24/2020 Balli	Ondetermined	Onreported in news article	5 cows	5			https://www.extwintions.com/nows.cot/broaking.nows/fing.com/s battle on oversight here fing
5 horses die in Caton barn fire	""New York	3/25/2020 Barn	Undetermined	Unreported in news article	5 horses	5			in-caton/
	THE FOR	572572626 Barn	Chaetenhined	omeported in news article	5 1101505	5			https://www.chicagotribune.com/suburbs/daily-southtown/ct-sta-locknort-township-farm-fire-st-
Lockport Township barn fire kills 20 sheep	""Illinois	4/3/2020 Barn	Undetermined	Unreported in news article	20 sheep	20	0		0408-20200407-pihhlwrqzngsrk3lptydr20yam-story.html
Barn fire destroys structure		4/5/2020 Barn	Undetermined	Unreported in news article	1 nigs	1	0		https://www.mystateline.com/news/local_news/harn_fire_leaves_family_displaced_in_kirkland/
					- 1-5-	-	*		
Potware 55 and 60 agree killed in Donnellville fine	TTO Norr Voels	4/8/2020 Dam	Undetermined	Unreported in newsportials	55	55			https://www.nny360.com/news/oswegocounty/pennellville-barn-fire-kills-55-
Between 55 and 60 cows kined in Feinenvine file	INCW I OIK	4/8/2020 Balli	Undetermined	Onreported in news article	55 cows	35			bttps://www.standard.ast/says/local/saturday.morning.firs.dostrous.hom.tmalr.in.mornist
Slaterville barn fire	""Utah	4/11/2020 Barn	Heat lamn	Unreported in news article	4 livestock	4	0	40.000	slaterville/article_ca9a766c_b555_531c_b092_2b5108b1b5f2 html
Einsfighten hettle mud strong winds in hem fine	oun	101112020 Bail	rieut lump	omeported in news article	1 II VESTOOR		0	10,000	Sater Metallele Cayarooc 0555 5510 0052 205100010512.html
the filled 20 an involu		4/12/2020 D	The determined	There are a first second section.	20 lineate de	20	0		
that killed 20 animals	Maine	4/13/2020 Barn	Undetermined	Unreported in news article	20 IIVestock	20	0		https://www.wmtw.com/article/covid-19-vaccination-record-card-holder/3596/644
Fire crews battle barn blaze	Michigan	4/14/2020 Barn	Undetermined	Unreported in news article	20 cows	20	0		https://www.hollandsentinel.com/news/20200415/hre-crews-battle-barn-blaze
Rosendale barn fire	Wisconsin	4/16/2020 Barn	Heat lamp	Unreported in news article	200 chickens	200	0		https://fox11online.com/news/local/200-chickens-dead-after-fire-in-fond-du-lac-co
Delay City Leave have and 22 an involute for	on ru	4/10/2020 D	Els statis el	There are the difference of the later	22 lineate de	22	0	20.000	https://www.tcpalm.com/story/news/local/martin-county/2020/04/21/palm-city-tire-destroys
Paim City loses barn and 23 animals to life	r Iorida	4/19/2020 Barn	Electrical	Unreported in news article	23 IIVESTOCK	23	0	30,000+	veterinarians-barn-and-kilis-23-animais/2998434001/
Suffield Township barn fire	""Ohio	4/19/2020 Barn	Undetermined	Unreported in news article	7 lambs and 4 sheep	11	0		https://www.record-courier.com/news/20200421/11-animals-killed-in-harn-fire-over-weekend
I owell barn fire	^{coo} Vermont	4/20/2020 Barn	Undetermined	Unreported in news article	8 cows	8	0		https://newportdispatch.com/2020/04/22/lowell-barn-destroyed.by-fire/
Eowen bain me	vermont	4/20/2020 Dam	Ondetermined	omeported in news article	0 00 00 00	0	0		https://www.wthr.com/article/news/nation-world/280000.chickens-killed-harn-fire-california.
280 000 chickens killed in barn fire in California	""California	4/23/2020 Barn		Unreported in news article	280000 Chickens	280000	0		owner-says/531-5c84624a-62dd-4f8h-bb9c-75ecc0626538
,									https://www.ifiberone.com/columbia_basin/authorities-reveal-suspected-cause-of-fatal-barn-fire-
Royal City area barn fire	"" Washington	5/3/2020 Barn	Electrical	Unreported in news article	10 horses	10	0	80,000	that-killed-ten-horses/article_db6f4ed0-8e5c-11ea-bdc1-3b0f52c1a67e.html
Barn Fire Sunday Results In Loss Of Poultry.	U U								https://timesuniononline.com/Content/Local-News/Local-News/Article/Barn-Fire-Sunday-
Property		5/10/2020 Barn	Undetermined	Unreported in news article	50 livestock	50	0		Results-In-Loss-Of-Poultry-Property/2/453/126466
				1	· ·				https://www.wkyc.com/article/news/local/geauga-county/newbury-firefighters-battle-200-year
Geauga Country barn fire kiils multiple animals	^{cco} Ohio	5/13/2020 Barn	Undetermined	Unreported in news article	Several chickens	n/a	0		old-barn-blaze/95-0220eea0-98ea-42e3-8b46-a389903ac660
Barn fire in Madison Township kills several birds	^{one} Ohio	5/22/2020 Barn	Undetermined	Unreported in news article	several ducks and chickens	n/a	0		https://abc6onyourside.com/news/local/madison-county-barn-fire-may-22-2020
County	^{coo} lowa	5/25/2020 Barn	Wind storm	Unreported in news article	303 pigs	303	0	250.000	https://cbs2iowa.com/news/local/barn-fire-kills-hundreds-of-hogs-in-dubuque-county
Spookane Valley harn fire	Washington	5/25/2020 Barn	Undetermined	Unreported in news article	4 chickens	4	0		https://www.kxly.com/fire_destroys_harn_kills_chickens_in_spokane_valley/
PHOTOS: Baby chickens die during barn fire in	in domington	0.20.2020 Ball	Chaetenhined	omeported in news article	1 emercens		0		
I averatt	""Maccachucatte	5/26/2020 Barn	Heat lamp	Unreported in news article	2 chickens	2	1 injured		nups://www.wwip.com/news/tocat-news/tranktin-county/tirefignter-injured-barn-destroyed-in-
Three days are in a first day to see here and hills areas	wassachuseus	5/20/2020 Barn	ricat lamp	Onreported in news article	5 chickens	5	1 injured		ive cut me over might
in Debusers Counts	000 T	5/28/2020 D	The destruction of	The second start in a second start of a	1	1	0	750 000	https://kwwl.com/2020/05/28/thursday-morning-fire-destroys-barn-and-kills-cow-in-dubuque-
in Dubuque County	Iowa	5/28/2020 Barn	Undetermined	Unreported in news article	1 cow	1	0	/50,000	county/
Barn destroyed by fire	∞ Nebraska	5/30/2020 Barn	Undetermined	Unreported in news article	5 nigs	5			1f225a1eb58e html
Ball desitoyed by me	Hoordond	5/50/2020 Ball	Chaetenhined	omeported in news article	5 Pi85	5			https://wiacty.com/news/local/pennsylvania-dairy-farmer-loses-over-50-cows-as-fire-torches-
Upper Tulpehocken barn fire	^{cco} Pennsvlvania	6/5/2020 Barn	Undetermined	Unreported in news article	64,000 chickens	64000	0	700.000+	barn-06-15-2020
** *									https://wjactv.com/news/local/pennsylvania-dairy-farmer-loses-over-50-cows-as-fire-torches-
Bradford County barn fire	"Pennsylvania	6/11/2020 Barn	Undetermined	Unreported in news article	59 cows	59	0		barn-06-15-2020
									https://www.wtol.com/article/news/local/firefighters-battle-fulton-county-barn-fire/512-
Fulton Country barn fire	Ohio	6/21/2020 Barn	Undetermined	Unreported in news article	Several chickens	n/a	0		51b37125-cd00-4bb4-9890-cc9ab8e577a9
Fireworks spark blazes across Contra Costa									https://www.mercurynews.com/2020/07/04/fireworks-spark-blazes-across-contra-costa-county-
County: Crews fight 14 fires in 7 hours	"" California	7/3/2020 Barn	Fireworks	Unreported in news article	1 Horse	1	0		crews-fight-14-fires-in-7-hours/
									https://www.starvedrock.media/wlpo/authorities-look-into-two-sunday-barn-fire
Authorities look into two Sunday barn fire calls	⁶⁶⁰ Illinois	7/19/2020 Barn	Undetermined	Unreported in news article	5 livestock	5	0		calls/article_7ea18062-ca19-11ea-a05e-5b6dc643e2e7.html
Nearly 300,000 Chickens Killed Following									https://philadelphia.cbslocal.com/2020/07/21/nearly-300000-chickens-killed-following-massive-
Massive Fire in Pilesgrove	"New Jersey	7/20/2020 Barn	Undetermined	Unreported in news article	280,000 Chickens	280000	0		fire-at-red-bird-egg-farm-in-pilesgrove/
									https://www.mcall.com/news/breaking/mc-nws-weisenberg-township-barn-fire-aftermath-
Weisenberg Township barn fire	Pennsylvania	7/22/2020 Barn	Undetermined	Unreported in news article	1 cow	1	0		20200723-e6ggnn4ivzf5zcjs7ur2ckp4kq-story.html
									https://www.lancasterfarming.com/farming/poultry/4-alarm-martic-township-blaze-killed-42-
Mostio Township home fire	000 Donnovlytonio	7/28/2020 Dam	Flootnical	Unreported in newsportials	42 000 Chielene	42000	0	1.95 million	000-chickens-tirefighters-saved-2-attached-buildings-chief/article_1b54ab01-1b64-5e44-a09e-
Eine at har and formation has doubt	1 Chilisyivaina	//28/2020 Balli	Electrical	Onreported in news article	42,000 Chickens	42000	0	× 1.85 mmon	ebbe40ed0951.httm
rire at nog continement farm; nundreds of		0/5/2020 D			100	100	0		https://www.wandtv.com/news/fire-at-hog-confinement-farm-hundreds-of-animals-
animais affected	1111nois	8/5/2020 Barn	Undetermined	Unreported in news article	100 pigs	100	0		affected/article_8e1a1c1c-0/8a-11eb-b6bd-1badf5066d80.html
Hundreds of calves die in barn fire	Indiana	8/5/2020 Barn	Undetermined	Unreported in news article	241 cows	241	0		https://www.wndu.com/2020/08/06/hundreds-of-calves-die-in-barn-fire/
Two fire departments extinguish barn fire in									https://www.cheboygannews.com/story/news/2020/08/14/two-fire-departments-extinguish-barn-
Walker Township	Michigan	8/5/2020 Barn	Undetermined	Unreported in news article	4 birds	4	0		fire-in-walker-township/42818465/
Fire destroys barn, kills thousands of pigs	Minnesota	8/7/2020 Barn	Undetermined	Unreported in news article	4,800 pigs	4800	0		https://www.pipestonestar.com/articles/fire_at_heartland_colony/
Approximately 100 Chickens Killed in Fire at	California								https://mynewsla.com/crime/2020/08/09/approximately-100-chickens-killed-in-fire-at-large-
Large Coop in Pacoima	California	8/9/2020 Barn	Undetermined	Unreported in news article	100 chickens	100	0		coop-in-pacoima/
animals	"New York	8/11/2020 Barn	Undetermined	Unreported in news article	17 livestock	17			https://www.mytwintiers.com/news-cat/barn-fire-in-troupsburg/
Brownington barn fire	Wermont	8/12/2020 Barn	Undetermined	Unreported in news article	50 cows	50	0		https://bartonchronicle.com/fire-destroys-brownington-dairy-barn/
			1						https://www.wifr.com/2020/10/29/rockford-fire-battles-fully-engulfed-barn-fire-thursday-
Rockford Fire battles barn fire	""Illinois	8/29/2020 Barn	Undetermined	Unreported in news article	2 chickens	2	0	60,000	morning/
	max	0/04/00000							https://www.wavy.com/news/local-news/gloucester/two-horses-die-in-barn-fire-in-gloucester-
Hayes barn fire	Virginia	8/31/2020 Barn	Undetermined	Unreported in news article	2 horses	2	0		county/
Duluth ham fina	Washinston	8/21/2020 B (Sh	Undator: in a	Unconcerted in a second star	2 agests	2	0		https://www.clarkcountytoday.com/news/clark-county-fire-rescue-responds-to-fully-involved
Duluui oam lire	w asnington	6/31/2020 Barn/Shop	Undetermined	omeported in news article	2 goats	2	U		oan-meenteen en seen aan aan aan aan aan aan aan aan aan
Undate: More than 800 pigs die in harn fire	"Minnesota	9/17/2020 Barn	Undetermined	Unreported in news article	870 Pigs	870	0		nups://www.mankatoireepress.com/news/local_news/barn-fire-Kills-about-60- nigs/article_99af9600.f917_11ea_908e_67b2282c2c96.html
Barn fire claims more than 200 cattle on	minicouta	2.17/2020 Dalli	Chartennined	Simeported in news at ucle	0101169	070	v		https://www.aberdeennews.com/farm_forum/barn-fire-claims-more-than-200-cattle-on-
Minnesota farm	""Minnesota	9/29/2020 Barn	Undetermined	Unreported in news article	200 cows	200	0		minnesota-farm/article 1d2ddbd8-0424-11eb-9f3e-336049da985f.html
			1						https://newschannel9.com/news/local/crews-battle-chicken-house-fire-in-birchwood-wednesday-
Birchwood farm fire	Tennessee	9/30/2020 Farm	Undetermined	Unreported in news article	14,000 chickens	14000	0		night

Hundreds of cattle die in Beekmantown barn fire	""New York	10/5/2020	Barn	Undetermined	Unreported in news article	400 cows	400	0	2-3Mil	https://www.mynbc5.com/article/hundreds-of-cattle-die-in-beekmantown-barn-fire/34293043#
Horses, chickens die in Jackson County barn fire	""Michigan	10/6/2020	Barn	Undetermined	Unreported in news article	7 livestock	7	0		https://www.mlive.com/news/jackson/2020/10/horses-chickens-die-in-jackson-county-barn- fire.html
			_							https://www.ktbs.com/news/man-injured-horse-dead-in-natchitoches-barn-fire/article_97ec005e-
Man injured, horse dead in Natchitoches barn fire	Louisiana	10/15/2020	Barn	Sparks	Unreported in news article	1 horse	1	1 injured		0f17-11eb-8ec8-93a61eecd523.html https://www.whey.com/2020/11/12/diadexide_family_looks_to_mehvild_loopey_efter_famfim/
Maurice	Iowa	11/3/2020	Barn	Sparks	Unreported in news article	17 cows	17	0		https://www.woay.com/2020/11/12/dedencin-fainity-focks-to-rebuild-regacy-arter-nami-me/
Horse dies in Norwich barn fire	Connecticut	11/8/2020	Barn	Gas bottles	Unreported in news article	1 Horse	1	0		https://www.norwichballetin.com/story/news/local/2020/11/08/horse-died-during-norwich-fire- corning-road/6214104002/
Crews Rescue About 40 Cows, 2 Horses in Geneva Barn Fire	""New York	11/11/2020	Barn	Undetermined	Unreported in news article	1 cow	1	0		https://spectrumlocalnews.com/nys/rochester/public-safety/2020/11/12/crews-rescue-about-40- cows2-horses-in-geneva-barn-fire
Garage/Barn destroyed in Scott Township fire	Pennsylvania	11/16/2020	Barn	Undetermined	Unreported in news article	32 livestock	32	0		https://www.ncnewsonline.com/news/local_news/barn-fire-claims-small-animals-sheep-and- horses-rescued/article_3d58d9dc-ed20-56ae-b525-649f3ab04e55.html
Fire destroys shed, chicken coop	""Michigan	11/17/2020	Barn	Heat lamp	Unreported in news article	20 chickens	20	1 dead		https://www.monroenews.com/story/news/crime/2020/11/19/fire-destroys-shed-chicken- coop/114982508/
Barn destroyed; 19 head of cattle perish in blaze	"New York	11/23/2020	Barn	Undetermined	Unreported in news article	19 cows	19			https://romesentinel.com/stories/barn-destroyed-19-head-of-cattle-perish-in-blaze,107155
Blooming Prairie	""Minnesota	12/3/2020	Barn	Undetermined	Unreported in news article	2,000 pigs	2000	0		https://kttc.com/2020/12/03/crews-respond-to-fire-at-hog-farm-near-blooming-prairie/
50 Farm Animals And A Dog Perish In Howard County Barn Fire		12/5/2020	Barn	Undetermined	Unreported in news article	51 livestock	51	0		https://www.shorenewsnetwork.com/2020/12/07/50-farm-animals-and-a-dog-perish-in-howard- county-barn-fire/
Fire destroys three barns in Dade City, killing at least 250,000 chickens		12/17/2020	Barn	Undetermined	Unreported in news article	250,000 Chickens	250000	0		https://www.abcactionnews.com/news/region-pasco/fire-destroys-three-barns-in-dade-city- containing-tens-of-thousands-of-chickens
Alba-Golden ISD barn fire		12/26/2020	Barn	Undetermined	Unreported in news article	3 goats	3	0		https://tylerpaper.com/news/local/alba-golden-isd-ag-barn-destroyed-in-fire/article_c9e4d0bc-
	^m	12/20/2020	Dall	Undetermined	Chieported in news article	5 50415	5	0		https://www.metrowestdailynews.com/story/news/2021/02/02/marlborough-firefighters-scene-
Fire destroys barn at school farm	Massachusetts	2/2/2021	Barn	Undetermined	Unreported in news article	none		0	unsure	barn-fire-hillside-school/43525/9001/ https://www.sharonherald.com/news/local_news/two-rare-animals-lost-in-fire-at-pymatuning
Deer Park fire	2000 Pennsylvania	2/9/2021	Zoo	Heat lamp	Unreported in news article	Binturong and a lemur	2	0	20,000	deer-park/article_9e52a5aa-fc5f-589d-afa4-e154083dbf0f.html https://www.columbian.com/news/2021/feb/12/heat-lamp-caused-barn-fire-in-battle-ground-that
Heat lamp caused barn fire that killed 14 goats	⁶⁰⁰ Nevada ⁶⁰⁰ Indiana	2/12/2021	Barn Pet store	Undetermined	Unreported in news article	14 goats 100+ animals	100	0	unsure	killed-14-goats/
	Indiana	2/10/2021	i et store	Ondetermined	i ne alaim	100 · animais	100	0		https://www.syracuse.com/news/2021/05/central-ny-animal-rescue-farm-destroyed-by-fire-
Central NY animal farm fire	""New York	2/22/2021	Animal farm	Undetermined	Unreported in news article	20 animals	20	0		featured-on-rachael-ray-show-gets-20000-donation.html
40 animals die in barn fire at animal sanctuary	""California	2/22/2021	Sanctuary	Undetermined	Unreported in news article	40 animals	40	0		https://fox40.com/news/local-news/40-animals-die-in-barn-fire-at-newcastle-animal-sanctuary/
7 horses die in barn fire	""Louisiana	2/22/2021	Barn	Heat lamp	Unreported in news article	7 horses		0	unsure	https://www.kplctv.com/2021/02/23/horses-die-south-bossier-barn-fire/
Barn fire started by hawk	""New York	2/23/2021	Barn	Heat lamp	Unreported in news article	20+ animals	20	0	unsure	https://cnycentral.com/news/local/baldwinsville-barn-fire-started-by-hawk-chased-away-by-pete the-peacock-defending-flock
Fire destroys barn, kills animals	""Michigan	2/23/2021	Barn	Undetermined	Unreported in news article	31+ animals		0	unsure	https://www.mlive.com/news/jackson/2021/02/i-lost-all-my-babies-woman-devastated-after-fire- destroys-barn-kills-animals.html
		2/24/2021	D			20		0		https://www.syracuse.com/crime/2021/02/fire-that-killed-20-animals-haunts-lysander-rescue-
Fire that killed 20 animals haunts farm owner Several animals die in barn fire	New York Michagen	3/3/2021	Barn Barn	Undetermined	Unreported in news article	20 animals Several		0	unsure	farm-owner-i-hear-their-cries-video.html https://www.wndu.com/2021/03/04/harn-fire-in-berrien-county/
165 000 hone die	A rizono	2/6/2021	Dam	Undetermined	Unreported in news article	165 000 hono		0	unsure	https://www.azcentral.com/story/news/local/arizona-breaking/2021/03/06/165-000-hens-die-2-
165,000 nens die	Anzona	3/6/2021	Barn	Undetermined	Unreported in news article	105,000 nens		0	unsure	barns-destroyed-tire-nickmans-tamity-tami/4614221001/ https://www.wusa9.com/article/news/local/virginia/roers-zoofari-in-reston-reopens-after-fire-
Zoofari fire	Virginia	3/8/2021	Zoo	Electrical	Unreported in news article	2 Giraffes	2	0		killed-2-giraffes/65-0b0c28a3-72d6-4ce6-a35d-db28fb9ab03d https://www.wusa9.com/article/news/local/virginia/virginia-zoo-fire-roers-zoofari-fairfax-county
Two giraffes die after a barn fire	Virginia	3/8/2021	Zoo	Undetermined	Unreported in news article	2 giraffes	2	0		reston/65-9e3a7735-893e-45dd-bf02-f16b6f481365 https://www.metrowestdailynews.com/storv/news/2021/03/17/fire-tears-through-barn-natick-
14 piglets killed in barn fire	""Massachusetts	3/17/2021	Barn	Electrical	Unreported in news article	14 piglets		0	unsure	community-organic-farm-three-pigs-killed/4729967001/
Petting zoo fire	""Missouri	3/19/2021	Zoo	Undetermined	Unreported in news article	11 reptiles	11	0		https://www.peta.org/blog/roadside-zoo-fires/
Two racehorses die in barn fire	""New York	4/14/2021	Barn	Undetermined	Unreported in news article	2 racehorses		0	unsure	https://www.newsday.com/long-island/belmont-park-racehorses-barn-fire-c14399
						75 animals				
Noccalula Falls Park petting zoo		5/2/2021	7.00	Undetermined	Unreported in news article	(birds, baby alligator, gineau pigs, turtles)	75	0		https://www.peta.org/blog/roadside-zoo-fires/
1 8						18, 7				https://www.gadsdentimes.com/story/news/2021/05/02/fire-noccalula-falls-park-petting-zoo-
About 75 animals lost in fire at park petting zoo	^{ono} Alabama	5/2/2021	Petting zoo	Undetermined	Unreported in news article	75 animals	75	0		closes-facility/4914657001/
Crews battle barn fire	New Hampshire	5/2/2021	Barn	Undetermined	Unreported in news article	Unsure		0	unsure	https://www.wmur.com/article/tire-destroys-two-buildings-in-barrington/36315040
Fire destroys largest barn at historic farm	""New Hampshire	5/11/2021	Barn	Undetermined	Unreported in news article	100+ animals	100	0	unsure	https://www.wmur.com/article/firefighters-battle-fire-at-scamman-farm-in-stratham/36391401#
Barn fire causes 2 million + in damages	"" Maryland	5/11/2021	Barn	Undetermined	Unreported in news article	none		0	2,000,000+	in-damage/
Barn fire kills an estimated 12,000 pigs	""Minnesota	5/18/2021	Barn	Undetermined	Unreported in news article	12,000 +		0	unsure	https://www.keyc.com/2021/05/17/waseca-barn-fire-kills-an-estimated-pigs/
Jurupa Valley river fire	""California	5/24/2021	Animal shelter	River fire	Smoke doors	0 animals	0	0		https://patch.com/california/banning-beaumont/shelter-animals-saved-lake-fire
Fire at chicken barn causes about \$3M in damage	""California	5/24/2021	Barn	Undetermined	Unreported in news article	none		0	3,000,000	https://fox40.com/news/local-news/crews-responding-to-chicken-barn-fire-north-of-oakdale/
Rockingham barn fire	""North Carolina	5/29/2021	Barn	Undetermined	Fire hydrant	19,000 chickens	19000	0		https://richmondobserver.com/national-news/item/12356-19k-chickens-estimated-lost-in- richmond-county-fire.html
Fireworks spark blazes	"" Minnesota	7/5/2021	Barn	Fireworks	Unreported in news article	none		0	unsure	mups.mocnontana.com/news/tocar/tireworks-spark-blazes-in-trenchtown-across-western- montana
Barn destroyed after lightning strike	Pennsylvania	7/19/2021	Barn	Lightning strike	Unreported in news article	Zero or unsure		0	unsure	https://www.connectradio.fm/news/barn-destroyed-near-curwensville-after-lightning-strike
2 goats dead, barn complete loss after fire	Wisconsin	8/2/2021	Barn	Wildfire	Unreported in news article	2 goats		0	unsure	https://www.cbs58.com/news/two-goats-dead-barn-complete-loss-after-racine-county-fire
animal barn	*** New York	8/12/2021	Barn	Undetermined	Unreported in news article	1 bull	1	0	unsure	nups://www.syracuse.com/crime/2021/08/tiretighters-work-to-put-out-blaze-engulfing-animal- barn-in-camillus.html
6.000 turkeys killed in large barn fire	^{and} Ohio	8/26/2021	Barn	Undetermined	Unreported in news article	6.000 turkeys		0	unsure	https://www.whio.com/news/local/6000-turkeys-killed-large-darke-county-barn-fire-thursday morning/2VNKG5NT0JB4BNS0DUK256PYN4/
Barn fire	"Indiana	9/9/2021	Barn	Undetermined	Unreported in news article	Unsure		0	unsure	https://www.abc57.com/news/barn-fire-in-bremen-thursday-evening
23 cats killed in fire at Florida pet adoption										https://www.nbcnews.com/news/animal-news/23-cats-killed-fire-florida-pet-adoption-facility-
facility	^{oco} Florida	9/16/2021	Adoption facility	Undetermined	Unreported in news article	23 cats	23	0		n1279389
fire	Texas	9/19/2021	Boarding facility	Undetermined	Unreported in news article	75 animals	75	0		https://www.kxan.com/news/texas/over-70-animals-die-at-central-texas-pet-in-late-night-fire/
Arson suspected in a string of harn fires	MIndiana	9/21/2021	Barn	Arson	Unreported in news article	30 animals		0	unsure	https://www.southbendtribune.com/story/news/2021/09/23/elkhart-county-barn-fires-suspected- arson-animals-perish-goshen-indiana/5814751001/
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										https://www.wtol.com/article/news/local/firefighters-battling-blaze-at-animal-feed-and-supply-
Barn a total loss	∰Ohio	9/27/2021	Barn	Undetermined	Unreported in news article	33 animals	33	0	unsure	store-in-fremont-ema-tracking-escaped-animals/512-923af807-164b-41d1-a06d-69ce5131c714
			_							https://www.thenews-messenger.com/story/news/2021/09/28/dozen-animals-die-monday-barn-
Over a dozen animals die in barn fire	∭Ohio	9/28/2021	Barn	Undetermined	Unreported in news article	12+ animals		0	unsure	fire-artzs-feed-supply/5896169001/
			_							https://www.nny360.com/communitynews/business/more-than-200-calves-lost-in-ellisburg-barn-
More than 200 calves lost in barn fire	IDNew York	10/27/2021	Barn	Undetermined	Unreported in news article	200 calves		0	unsure	fire-owner-says/article_ef9b7bbf-a4ac-541c-a7d1-6e62b8f708f6.html
			_							https://www.cbs17.com/news/local-news/cumberland-county-news/large-fire-breaks-out-at-farm
Large fire breaks out at farm store		10/30/2021	Barn	Undetermined	Unreported in news article	Several		0	unsure	storm-in-fayetteville-officials-say/
										https://apnews.com/article/explosions-fires-texas-texarkana-william-barnes-
Barn explosion kills 2 owners	©Texas	11/4/2021	Barn	Undetermined	Unreported in news article	none		3	unsure	783f6b133bf538adc06e494e0bc9c46e
										https://www.kxan.com/news/local/williamson-county/dog-owners-suing-ponderosa-pet-resort
75 animals killed in Pet Resort fire	∭Texas	11/5/2021	Pet resort	Electrical	Unreported in news article	75 pets	75	0		after-fire-that-killed-75-animals/
										https://www.citizen-times.com/story/news/2021/11/16/buncombe-county-barns-north-carolina-
80-year-old barn fire in act of arson		11/27/2021	Barn	Arson	Unreported in news article	None		0	1,000,000 +	destroyed-arson-fire-fires-suspects-arrested-charged/8639341002/
										https://www.mytwintiers.com/news-cat/local/early-morning-barn-fire-in-cohocton-leaves-no
Early morning barn fire kills multiple animals	IIINew York	12/2/2021	Barn	Undetermined	Unreported in news article	all animals died		0	unsure	animal-survivors/
Barn destroyed by fire	₩isconsin	12/19/2021	Barn	Undetermined	Unreported in news article	Some		0	unsure	https://www.wbay.com/2021/12/20/barn-destroyed-by-fire-town-pound-dairy-farm/
										https://www.ketv.com/article/they-were-like-family-to-us-bellevue-family-loses-6-horses-in-
Family loses 6 horses in barn fire	∭Nebraska	12/25/2021	Barn	Wood stove	Unreported in news article	6 horses		0	unsure	barn-fire/38562368#