

Bulk gaseous hydrogen storage facility research papers examples

[Health & Medicine](#), [Stress](#)



This essay paper shows how the use and effective use of carbon dioxide as a fire protection system for the hazard of bulk hydrogen gas facility. This paper will provide the information on the advantages and disadvantages of using carbon dioxide as an agent for fighting fires resulting from the hazard of hydrogen.

Fire protection systems involving gases allow for the use of fire fighting agents such as carbon dioxide, wet chemicals or dry chemicals and foams. Carbon dioxide has been the most successful fire suppression agent that has been used for many years in many countries worldwide. It can effectively put out fires caused by most materials except those fire that are as a result of active metals, metal hydrides and those materials that contain their own oxygen an example being the cellulose nitrate. The effective use of carbon dioxide as a fire fighting agent is only limited by factors that influence the method that is used in its application and the risk of health it presents. It has been used extensively internationally in marine applications in locomotive rooms, vehicle transport areas and on bulk processing machines and also in flammable liquid storage systems where it is most effective. Many carbon dioxide systems in the metal industry use a rapid discharge local application system. The containers containing the carbon dioxide agent are put in a strategic place that is adjacent to the outlet nozzle so that it can start to flow from the nozzle in under 5 seconds when the need arises. It works in mechanism that is predominantly thermo physical in extinguishing fires of hydrogen nature. The hydrogen gas will be prevented from reaching a temperature that is required to maintain the flame chemistry of the gas. It also dilutes the concentration of the species that cause the fire to be big

thereby reducing the collision frequency of the fire molecules and greatly slows down the rate of heat release.

It is the commonly used inert gas and is twice as effective in fire suppression as other agents such as nitrogen. Nitrogen is a lot lighter than carbon dioxide by about 1.57 times but they do have an almost same effectiveness on a weight basis. A relatively high amount of carbon dioxide gas is needed in suppression of a fire caused by hydrogen. However, these high amounts and do cause some health concerns to the person using the agent. Carbon dioxide has some very good advantages as a fire suppressor in that it is not combustible. It does not produce its own products for decomposition as a result of burning like other gases do. The gas also provides its own pressure from the cylinder and so requires no need to be super pressurized. The gas leaves no residues and hence removes the need of cleaning up after its use. The gas is also a non reactive agent as it does not react with most other materials and will also provide a three dimensional protection as it operates under ambient condition. The gas can also be used in the presence of much energized electrical equipments as it is non conductive to electricity. However, it does pose some health concerns to the user. The health concerns are paradoxical and it is designed at a minimum concentration of 34% for the use on the total flooding fire suppressant. At higher exposure of this gas it can be lethal and over exposure to it can cause convulsions, coma and death can occur within one minute of its initial exposure but it has to be on the ranges of about 17%. Unconsciousness occur at the exposure rate of about 10 and 15%. Exposure can also cause headaches, difficulty in breathing, tremors and in some cases mental depression.

A number of agencies are concerned with the task of administering the design, installation, testing, maintenance and the use of carbon dioxide systems. An example of this authority is the (AHJ) that regulate the industrial, commercial and also on non-marine applications that utilize NFPA consensus standards that actually cover carbon dioxide extinguishing system(NFPA 12). The authority regulating the system depends entirely on where the system is located, its intended use and the type of system that is in use. Governments and local authorities adopt these standards as their fire codes governing them. The marine applications are regulated depending on the fact whether the vessel will navigate the domestic or international waters. The Occupational Safety and Health Administration (OSHA) regulate exposure to carbon dioxide in order to ensure that work safety is observed. The process of actually owning a fire suppression system starts from the manufacturer. He will list the suppressor systems components through the organizations such as the underwriter's laboratory or the factory mutual that is based in the United States of America. The listing process includes the development of an instruction and maintenance manual that include how the full system operates. It also incorporates some drawing of the system. The specifications are prepared under the supervision n of very qualified person who can design the carbon dioxide system using also some advice from the AHJ to whom the designs are then submitted before the installation of the system is done.

The installation of the carbon dioxide system is mostly done by the manufacturer's representatives or the distributors if they have any. The installers receive training from the manufacturer on the proper installation of

these systems. The system then undergoes some testing procedures so that the installation can meet the requirements of the AHJ. Some of the requirements include; performance of the entire design quantity through piping to the area where the hazard is. This is done through a full discharge test. There is also the operational checking of the devices that are necessary for proper functioning of the system that include detection, alarm, and actuation. There also be the checking of the proper labeling of all the devices and protected areas that should warn the people who are there of the possibilities of inhaling carbon dioxide in case of leakage. The system will also be inspected to confirm that it actually meets the specifications and is the right system for the type of hazard it has been assigned.

People should be educated and warned of the hazards involved and also regarding the signal for the alarm and safe evacuation procedures. NFPA 12 insists that a supervised lock out should be put in place to ensure that there is no accidental or even deliberate discharge of the systems. It provides a few guidelines that are meant to save lives and prevent injury. It also demands a mandatory evacuation in case of any testing, servicing or maintenance on the system.

There should be clear routes of exit and the aisle ways and routes should be adequate. The lighting should be enough and directional signs showing the way and route ensuring a quick and safe evacuation. Alarms should be in place and should operate almost immediately upon being activated on detection of fire. The systems should also provide self closing doors that swing only outwardly. These doors should be latched and have a provision of panic hardware. In a number of regulations concern has been raised on the

likely hood of carbon dioxide leaking and flowing into low lying spaces such as pits and passage ways. It can cause suffocation atmospheres that will not be detectable or visible.

When it comes to the maintenance of these systems electric power should be provided for the mechanical refrigeration system. When a high pressure system is being used there would be no need for use of the refrigeration.

Using the low pressure contents of storage are read weekly from a liquid level gauge. The storage containers need to be weighed twice a year as per the NFPA recommendations. No retesting of the pressure vessel is required under normal conditions when the system is using the low pressure storage and the ASME codes apply. However, when it comes to high pressure cylinders they must be tested after 12 years. To recharge the low pressure tanks the cost is less than 12 cents a pound which is inclusive of labor.

Recharging a high pressure system the cylinder must be removed from the service and take them to a recharging centre and test them hydrostatically and after finding that five years have passed since the last hydrotest then they should be recharged and then reinstalled in the system.

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