**Chemical Process Safety**
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**Lecture 26**
**Fire Extinguishers – II**

Welcome to the last module of Fire and Explosion, in this particular module we will have the remaining part of the Fire Extinguisher as well as how to use the appropriate method for the use of Fire Extinguishers.

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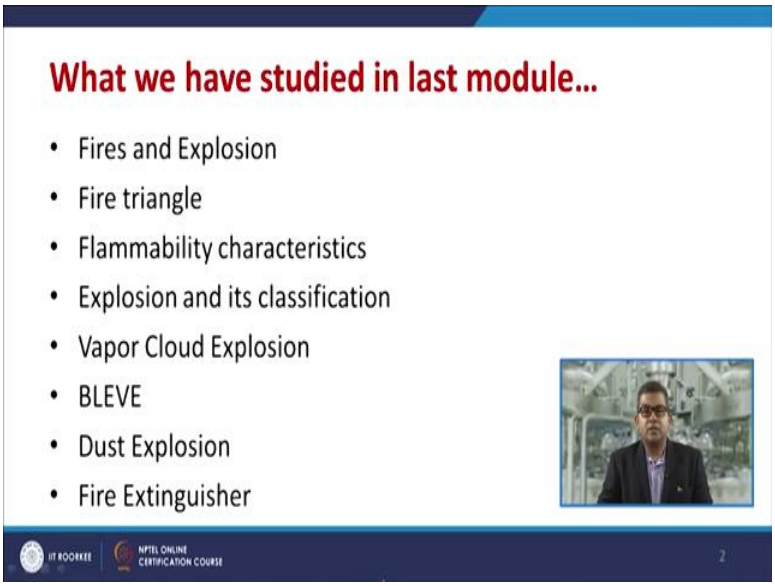


So, let us have a brief look back about what we have studied in the last modules. We have discussed about the Fire and Explosion, discussed about the anatomy of Fire Triangle. We have discussed about the various kinds of Flammability Characteristics like LFL and UFL. We have classified the Explosion along with its definition, discussed about the Vapor Cloud Explosion, BLEVE, Dust Explosion and in the last module we discussed the different class of Fire along with three different type of Fire Extinguishers.

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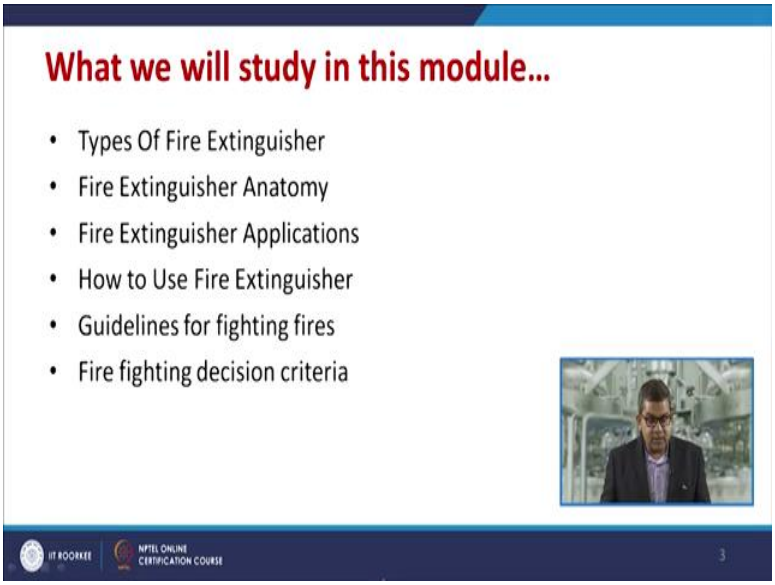


Now, in this particular module we will discuss the remaining part of Fire Extinguisher, what is the Fire Extinguisher anatomy so that you can aware about how to use at appropriate place and when it should be used. What kind of different Fire Extinguisher applications, how to use the Fire Extinguisher in a proper manner, what are the guidelines for fighting of fires and Fire fighting decision criteria.

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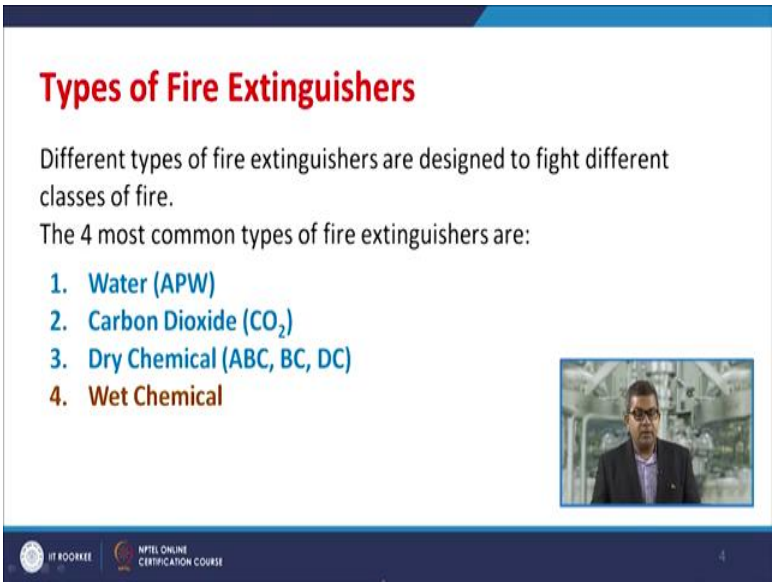


Now, we have discussed different type of Fire Extinguishers so until now we have discussed about the Air Pressurized Water Fire Extinguisher, Carbon Dioxide based Fire Extinguishers, Dry chemical based Fire Extinguishers.

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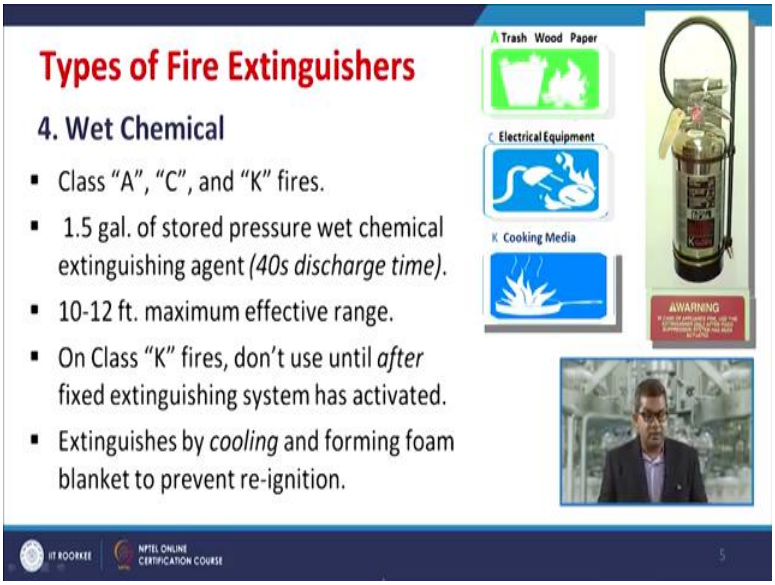


Now, in this particular module we will start with Wet Chemical Fire Extinguishers. Now, this Wet Chemical based Fire Extinguisher is applicable for Class "A", Class "C" and Class "K" of fire. This is one of the kind of Wet Chemical Fire Extinguisher. Usually they are having 10 to 12 feet effective range, so you must know that from where or how proximity you have to use this Fire Extinguisher.

On Class "K" fire do not use until after the fixed extinguishing system has deactivated because it has certain other disadvantage associated with it. Extinguishes by cooling and forming foam blanket to prevent the re-ignition so this is the added benefit of this Wet Chemical Fire Extinguisher.

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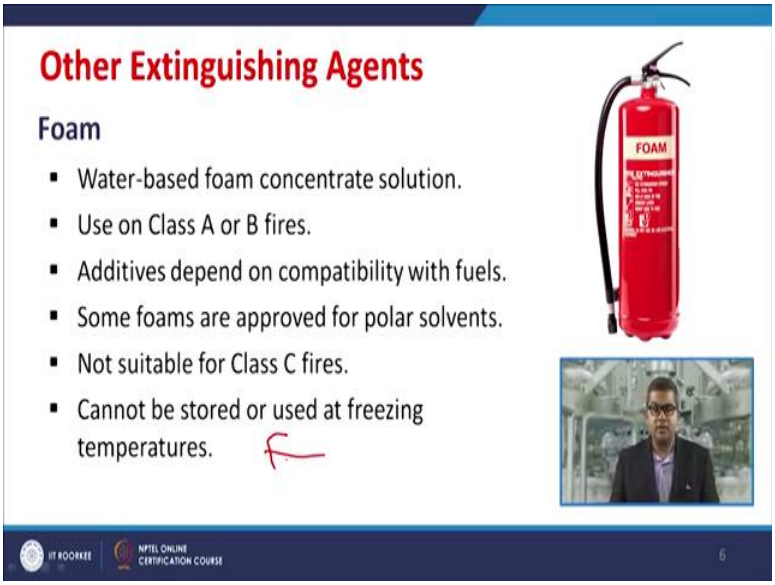

Foam, usually this is another class of fire extinguishing agent and it is one of the most common type of fire extinguishment media that is foam. This is the water based foam, concentrate solution used on Class “A” or Class “B” type of fire. Sometimes we may use different additives, so additive depend on the compatibility with the fuel that is the next source of fuel.

Some foams are approved for the polar solvents because the solvents may sometimes like Hexane and etc they may act as a fuel for different class of fire. They are not at all suitable for class “C” fires and cannot be stored or used at a freezing temperature. So, these are some advisories for using foam type of fire extinguisher because ultimately your aim is to extinguish the fire.

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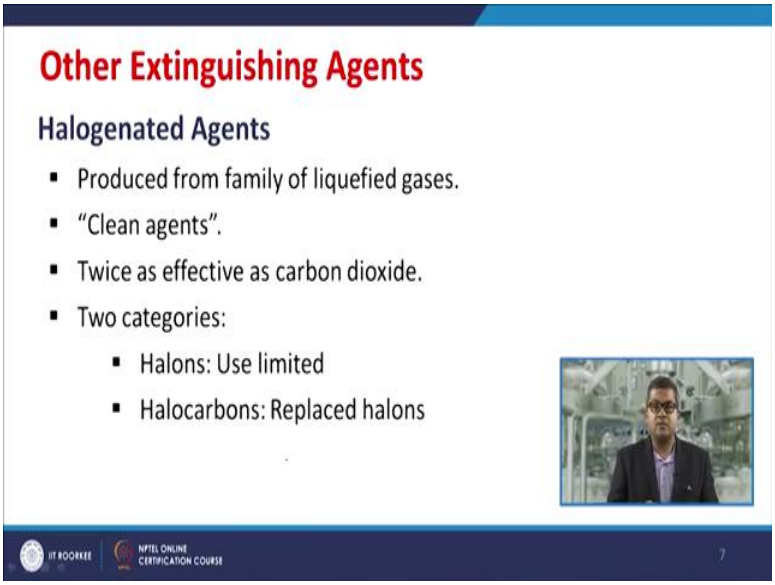


There are certain halogenated agents they are acting as a fire extinguishing media. They are produced from the family of liquefied gases, clean agents, they are twice as effective as Carbon dioxide and they are having the two categories. One is the Halons and they are having very limited usage and Halocarbons they replace the Halons. So sometimes because people are using halocarbons, so they replace the Halons. Now, Halons they are having very limited usage, very specific use for the extinguishment of fire.

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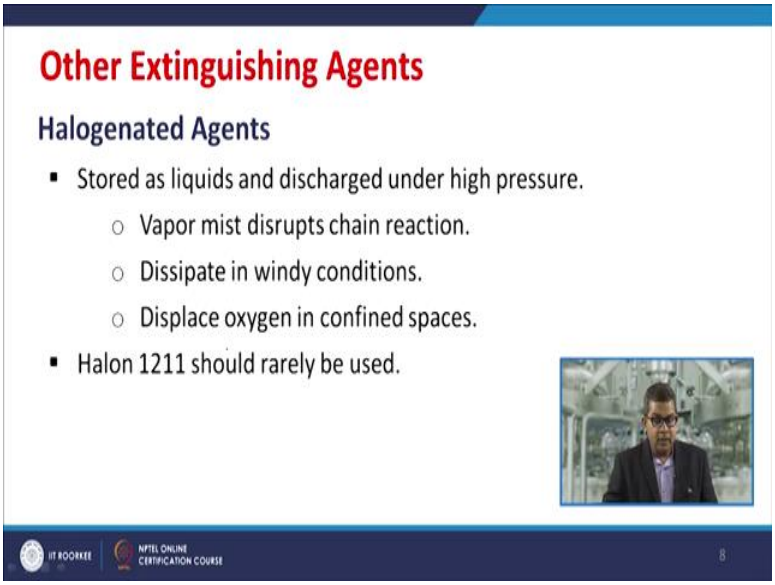


Usually it is stored as liquid and discharged under very high pressure. Now, vapor mist disrupts chain reaction, this is one of the added benefits of Halogenated agents. Dissipate in windy condition and Displace Oxygen in a confined space so these are some of the added benefits of these Halogenated agents. One advisory is that the Halon 1211 should rarely be used because it creates the environmental problem.

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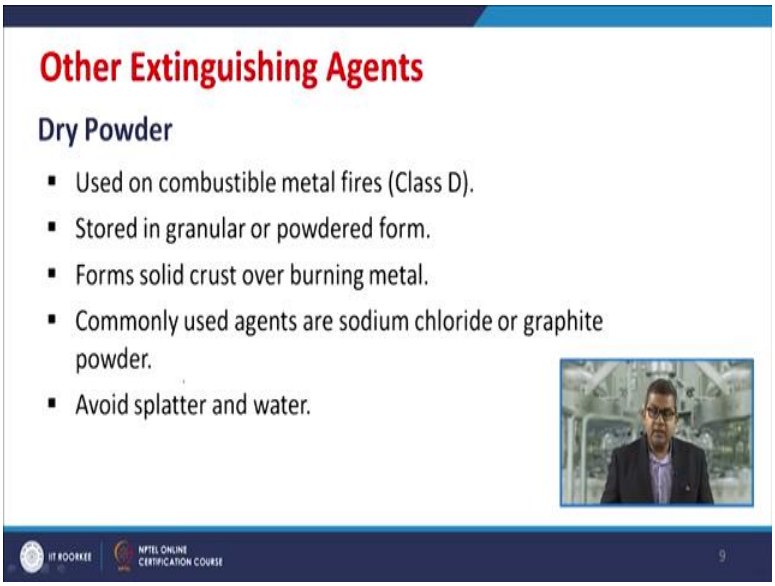


There are certain Dry powders being used as fire extinguishment media. Now they used on the combustible metal fires that is attributed to Class “D” fire. Usually they are stored in granular or powdered form and this forms solid crust over the burning material so it can cordon off the fuel supply with the atmospheric Oxygen, so it creates the blanket and that is

why the fire is extinguished. Commonly used as agent as Sodium Chloride or a Graphite powder, avoid splatter and water.

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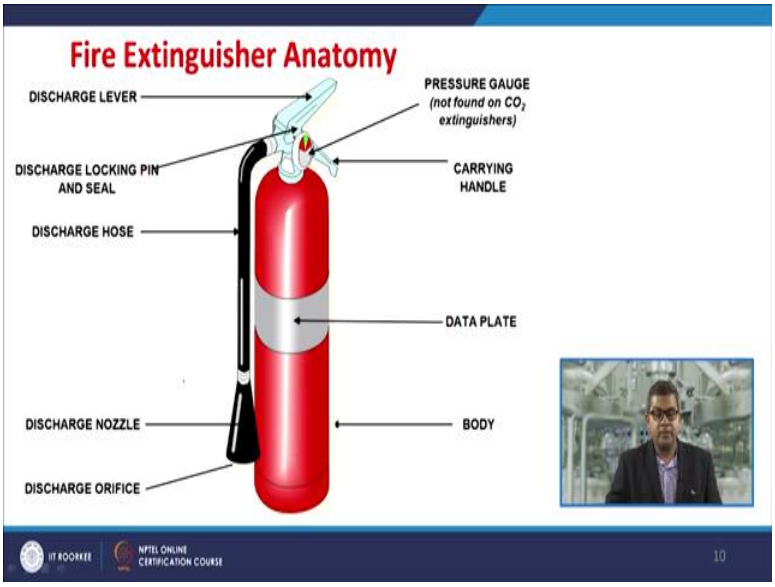


Now, this is the Fire Extinguisher anatomy. You can think upon the basic methodology and basic anatomy of this Fire Extinguisher, they are having the discharge liver, so you can press it with the help of this carrying handle to release the pins, the pin they are located over here, that is a Discharge locking pin and seal so that accidentally if anybody presses then definitely it will come out.

Now, here this is a pressure gauge and usually it is not found in $CO_2$ type of extinguisher. The pressure gauge tells you that how effectively you can use this one and whether there is any efficiency left in this particular type of fire extinguisher, so it is quite obvious that the needle should be green paraphernalia so this is the safest zone because you cannot go with the excessive pressure and if pressure is too lean then definitely it will not give the desired result.

This is the discharge hose through which you can direct the chemical or water to the place of fire. This is the discharge nozzle and sometimes the people are using discharge orifice so that you can direct towards the fire. Here this is the data plate where you can put the relevant information that is for which class of fire it is to be used like “A”, “B”, “C”, “D”, etc. At what point of time it is being refilled? So because I told precisely that the dry chemicals, or $CO_2$ they are having some shelf life or expiry. So, it is nearly approaching the expiry irrespective of the pressure in question you need to recharge it or refill it.

Apart from this there are certain regulatory information being placed, one is that who is responsible for refilling it, who has manufactured it, etc. And some of the data plates they are having endorse type of advisory that it is to be used for specific type of fire for which this particular extinguisher is designed for. This is obviously the body of the fire extinguisher.

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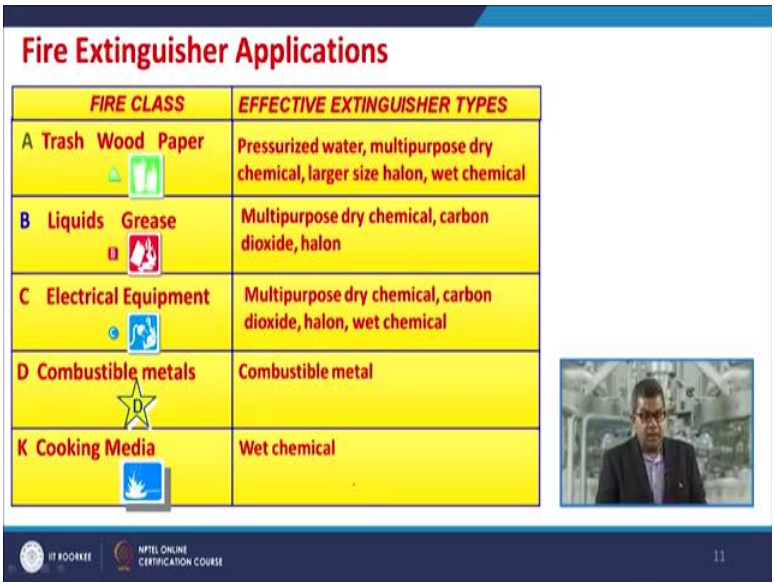


Now, in a nutshell you can see in this particular slide that different class of fire and effective extinguisher types. That means you can have a look, or you can have a idea that what are the different applications of these fire extinguishers. So, class “A”, trash wood paper, usually pressurized water, multipurpose dry chemical being used, larger size Halons and wet chemicals.

Class “B”, the Liquid Grease type of fire that is multipurpose dry chemical and the Carbon dioxide, Halon. Class “C”, the Electrical equipment, dry chemicals, Carbon dioxide, Halon and the wet chemicals. The combustible metal in which you can use the metal as a fire extinguishing media. Cooking media you can always use the wet chemical extinguisher, but do not use the water based things because water may things. So, these are the advisories usually they are supposed to be put on the data plate of the fire extinguisher.

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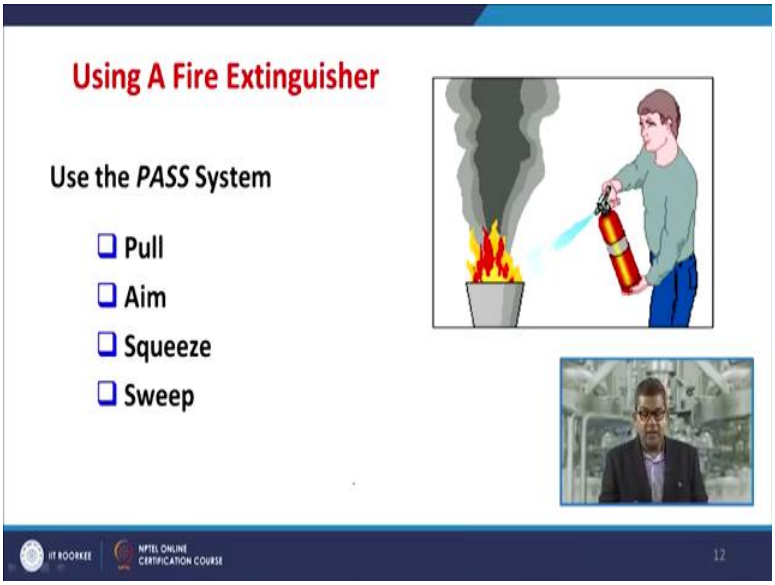


Now, how to use the fire extinguisher? Usually we may follow the PASS system. Now PASS system says Pull, aim towards the fire, Squeeze means you just put the liver and sweep away like this. So, your industrial workers, etc must be trained for this type of PASS system.

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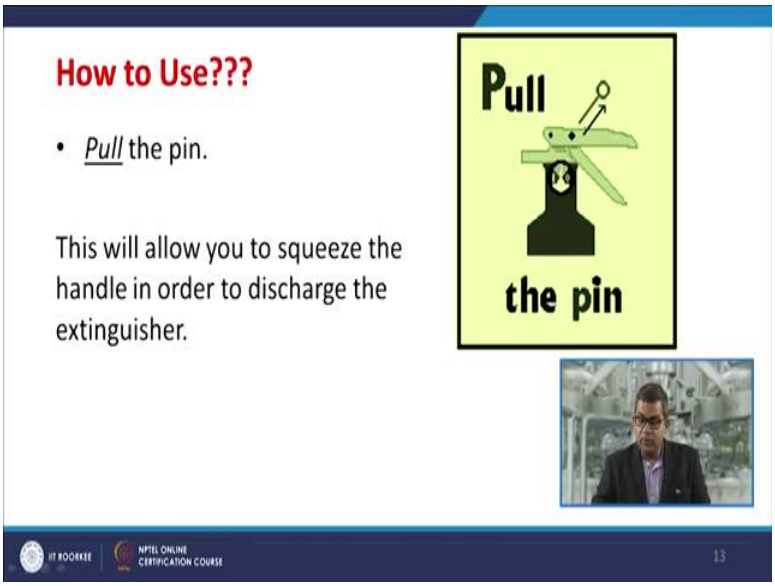


Now, first thing is that how to use it? That is the pull the pin, as I showed you in the anatomy of a fire extinguisher there is a pin. So, you need to pull that pin out. This will allow you to squeeze the handle, these handles, in order to discharge the extinguishing media towards the fire.

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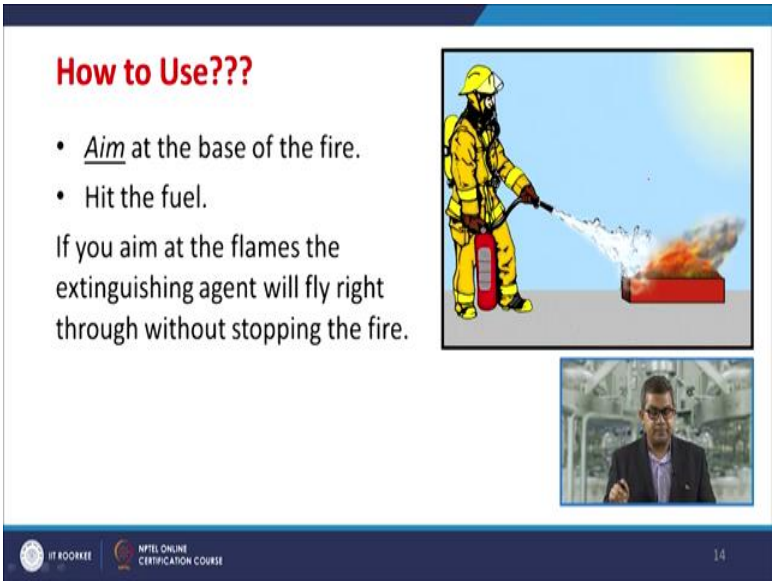


Then you need to aim the fire extinguisher like this, it is shown in this cartoon, that aim at the base of the fire and you need to hit the fuel, if you aim at the flames the extinguishing agent will fly right because of the density difference, without stopping the fire. At this particular point you may experience the density difference. So, if you aim it towards the fire you may definitely experience that it will fly right away. So, it will not impart the desired result, so that is why you need aim at appropriate place.

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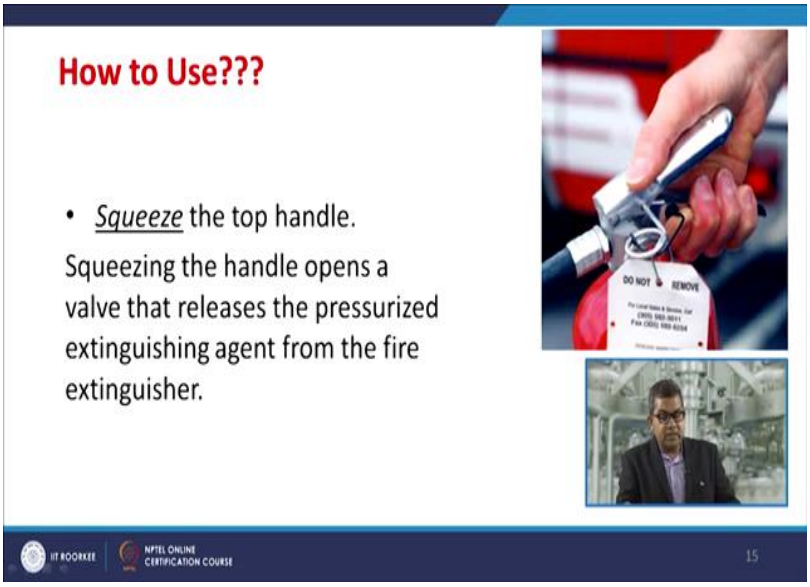


Then you need to squeeze the top handle so squeezing the handle opens a valve that releases the pressurized extinguishing agent from the fire extinguisher. So, this type of advisories always put on the fire extinguisher.

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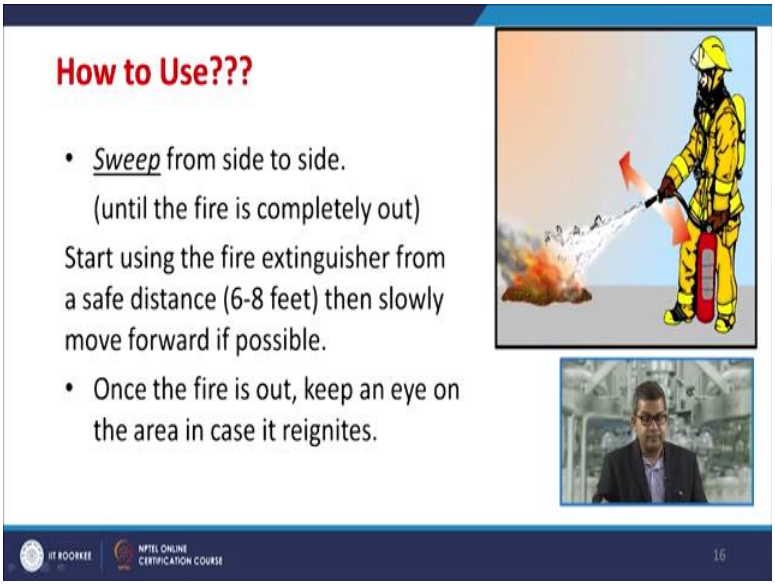


Then sweep from side to side like this, you can go like this, you can go like this so that you can generalise the things. You sweep side to side and you keep on this particular process until the fire is completely out or is completely extinguished. So, start using the fire extinguisher from a safe distance because your safety is prime around 6 to 8 feet, it all depends on that what kind of fire, if it is excessive fire then you definitely you would not be able to reach 6 to 8 feet because of the generation of excessive heat.

Now, after approaching to the safe distance slowly move forward if possible, sometimes if you see that the fire is extinguishing in this zone then you may take the liberty to come little bit forward to approach towards the fire. Once the fire is out, keep an eye on the area in case it reignites. Again, reignition of this is a dangerous situation because in that particular case you may not have supporting things with you because sometimes your fire extinguisher may be exhausted.

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So, you can again have a look different type of extinguisher, then works by, then effective agents which you can use that pressurized water, it works by cooling, Carbon dioxide smothering, multipurpose dry chemical is smothering, Halon based smothering, combustible metals they again smothering and the wet chemicals cooling and smothering so different types of effective agents.

Now, the purpose of this particular table that it can be placed at different location of your workplace so that your plant workers, your industry persons they must be acquainted with what kind of fire it is and what kind of extinguishing media they need to use because I am repeating it again that it is a very case sensitive thing.

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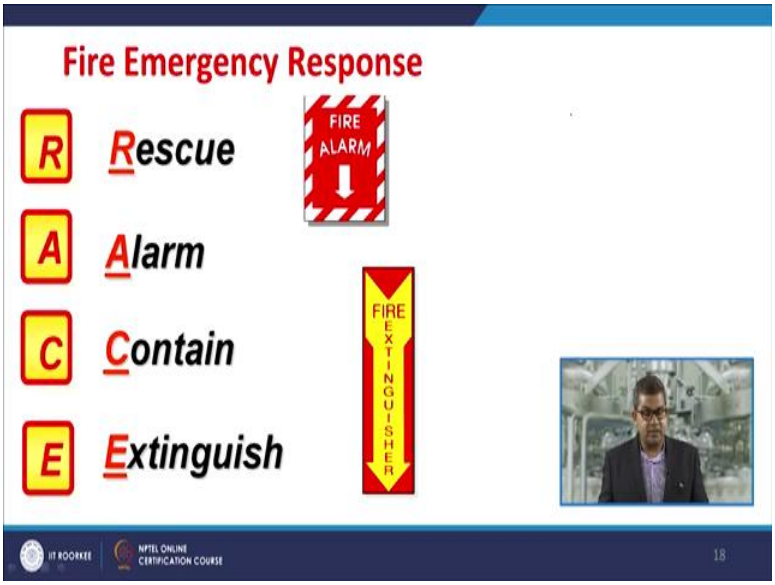

So, whenever we use this fire extinguishing protocol, then you must have a RACE protocol, that is Rescue, Alarm, Contain and Extinguish. So, first thing is you need to rescue yourself then you put an alarm so that everybody is aware that there is a scenario of fire, then you must contain the fire extinguisher with you and try to extinguish the fire.

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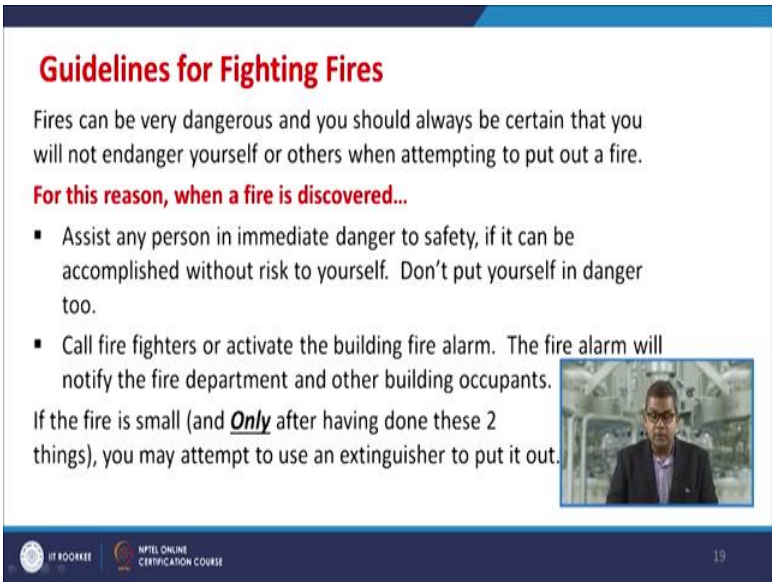


Now there are certain guidelines for fighting of the fires, so fire can be very dangerous, and you should always be certain that you will not endanger yourself because if you are your himself is endangered then you would not be able to extinguish the fire as well as you would not be in a position to safeguard other people.

So, for this reason when a fire is discovered, assist any person in immediate danger to safety, if it can be accomplished without risk to yourself. Do not put yourself in danger too. Call the fire fighters or activate the building fire alarm. The fire alarm will notify the fire department and other building occupants. If the fire is small and only after having done these 2 things you may attempt to use an extinguisher, appropriate extinguisher repeat appropriate extinguisher to put it out.

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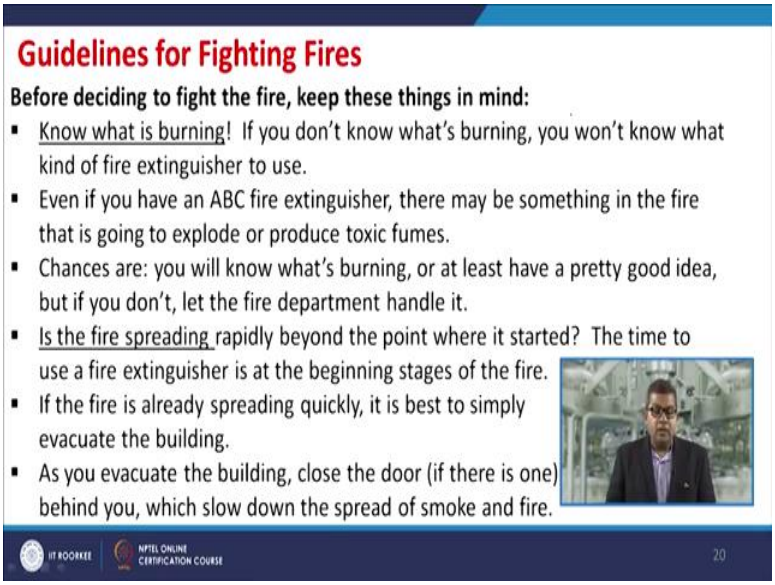


Now, before deciding to fight the fire, keep certain things in your mind. You must know what is burning, so based on your engineering knowledge, based on the knowledge of your 5 ingredient cup of tea you must know that what is burning. Now if you do not know what is burning you would not know what kind of fire extinguisher is to use, so that is why proper display and proper knowledge of that particular process is essential.

Even if you have an ABC fire extinguisher, there may be something in the fire that is going to explode or produce toxic fumes so you are providing a remedy to one problem, thereby you are creating another problem and toxic fumes are sometimes extremely dangerous and you cannot avoid the generation because if fire takes place at working place you may have a process apart from the process you may have certain other things like furniture, you may have a pen, you may have papers, etc. So, these things may produce some toxic vapor so be aware about this type of toxic fumes.

Chances are you will know what is burning or at least have a pretty good idea, but if you do not let the fire department handle it because they are acclimatized, they are trained, and their equipment are well designed to handle such type of system like if there are toxic fumes then they may have a mask, etc.

And one more important thing is that in case you are using the fire fighters or a fire department then you provide adequate information to them so that practically they may be aware, they should be aware about the scenario. Now if the fire is spreading rapidly beyond the point where it is started, you must know.

The time to use the fire extinguisher is at the beginning stage of the fire because whatever we studied in previous modules as well as in this module the fire extinguishers, they are used for small fires. Now if it is beyond control then you definitely need to call the fire department or fire brigade, etc because they are seasoned to handle such type of situation.

Now, if the fire is already spearing quickly it is best to simply evacuate the building so that you save yourself as well as employees of your unit or department because you would not be able to do much because the small fire extinguisher will not do anything in that particular scenario. Then you need to follow the let it go policy that means the fuel, consumption of fuel may end up the fire, and sometimes the heat liberated may end up with the fire so best policy is to simply evacuate the building.

Now, as you evacuate the building, close the door, if there is one, behind you, which slow down the spread of smoke and fire the reason is that it will cut short the supply of Oxygen so at least you will be in a position to remove one arm of fire triangle, the other arm can be removed by adopting the let it go policy that means burn whatever is there.

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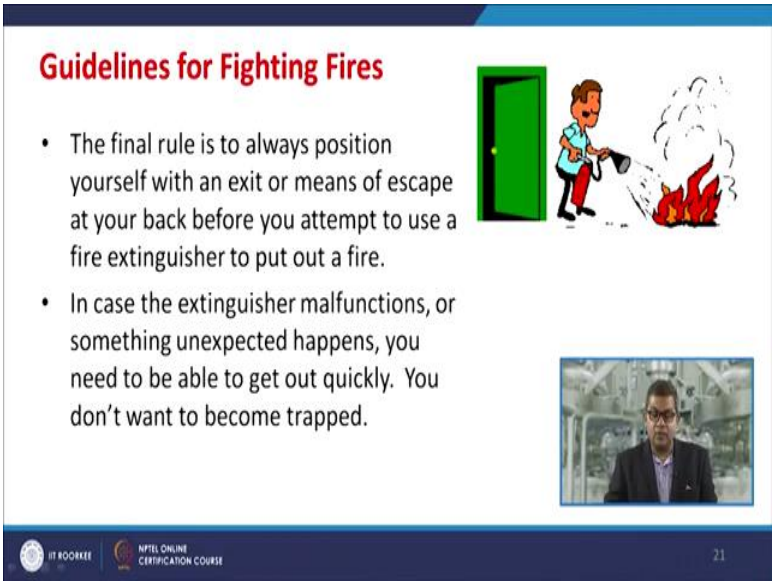


The final rule is to always position yourself with an exit or means of escape at your back before you attempt to use a fire extinguisher to put out a fire because sometimes it may lead to some technical problems so that in case of any problem you may be in a position to evacuate the things.

In case of extinguisher, sometimes it may happen that extinguisher malfunctions or something unexpected happens, you need to be able to get out very quickly. You do not want

to become trapped and one more thing is that in case of the propagating fire then there may be a chance that the environment may become Oxygen deficient, so you may feel the suffocation so if you are near the exit then definitely you may be in a position to handle the situation effectively.

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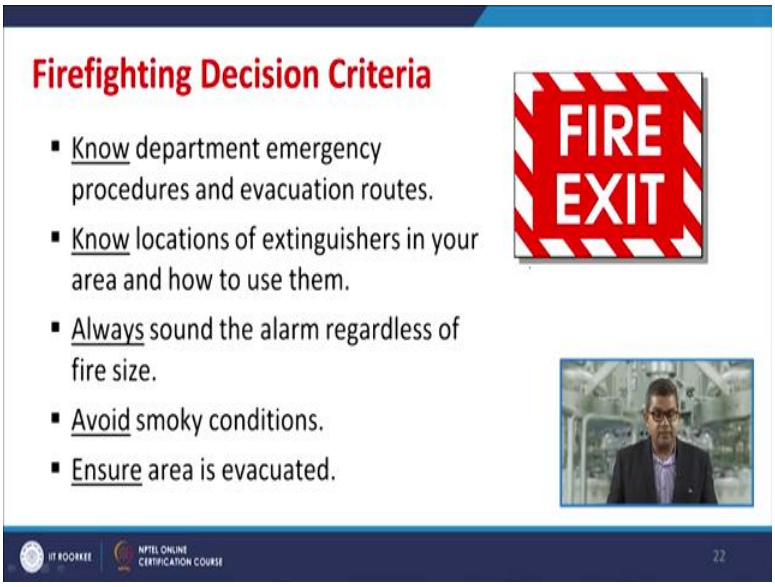


Now, we must know that what should be the criteria for fire fighting. So there are 5 different points need to be addressed. First point is that know department emergency protocol and evacuation routes and that is why if there is a public gathering or you are residing in a multi-storied there is a separate fire exit and if you wish to see the movie then definitely you will find that the light of fire exit is always there. So, you must know that the emergency protocol as well as what is the evacuation route in case of any eventuality.

Know the location of extinguisher in your area and how to use them as well as you must train the other person those who are working in that particular area that how to use those fire extinguishers because if there is any fire and if you do not have any clue that how to operate this fire extinguisher then definitely you will be trapped in the bad scenario.

Then always sound the alarm regardless of the fire size, the reason is that everybody should aware and in case of propagating fire then some other person from the different department may come forward for the rescue as well as to help you out from the destructive fire.

You need to avoid the smoky conditions because sometimes it may lead to the toxic situation as well as the Oxygen deficient environment and we have studied about the ideal “H”, the immediate danger to life and we are having the Oxygen concentration less than (19.5) 19.1

percent so you need to avoid the smoky condition because it is a health hazard as well as it may lead to the fatality.

Now, you must ensure if you are heading that particular department, you must ensure that area is evacuated so usually you may follow the head count process, you must know how many persons they are working in that particular process area and ask them to leave and assemble at open space or safe space so you may head count so by this way you can say that and you ensure that area is evacuated so nobody is entrapped within the plant.

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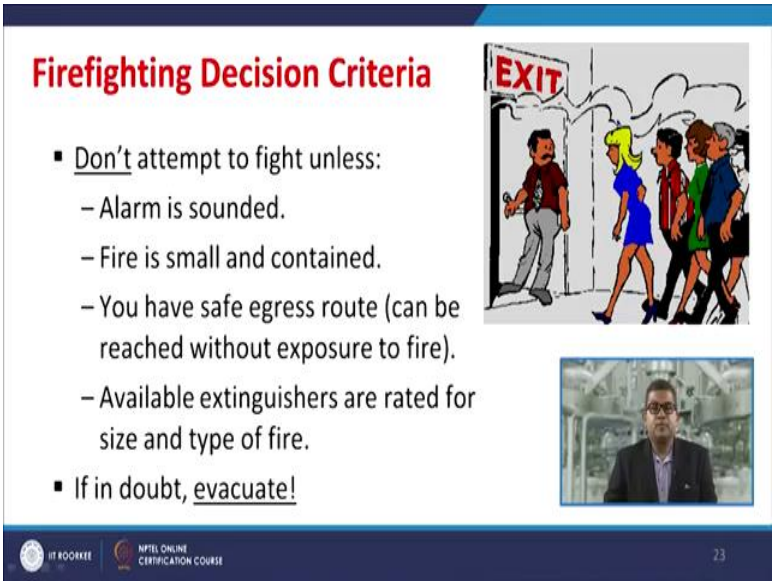


Now, do not attempt to fight unless alarm is sounded, fire is small and contained, you have a safe egress route and can be reached without exposure to fire, available extinguishers are rated for size and type of fire and if you are in any iota of doubt then you must evacuate along with your co-workers so you must evacuate the workplace.

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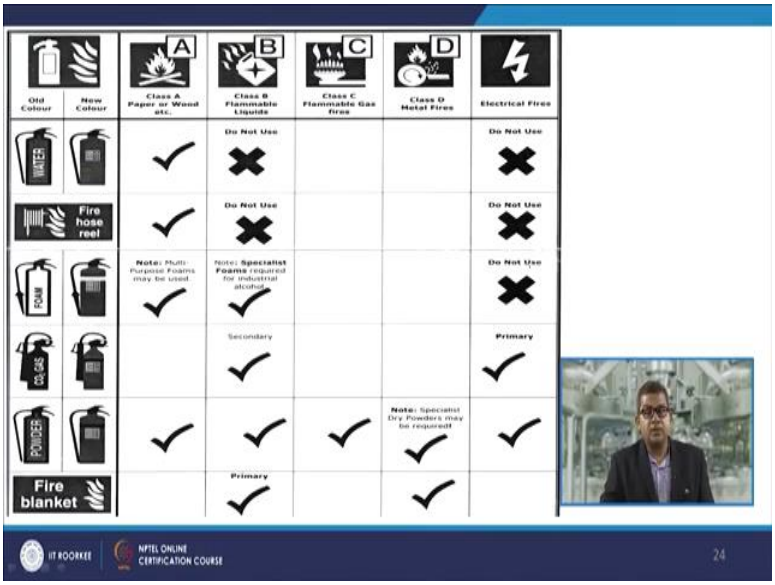


Now, again this type of chart or this type of play card should be placed at appropriate place that what kind of fire extinguisher available at your place, what kind of fire or what class of fire, you can use that particular fire extinguisher and it should be properly mentioned that do not use this type of fire extinguisher in such a class of fire.

Just for the sake of an example let us have a case of electrical fire, so it is always advisory that do not use the water based fire extinguisher, do not use the fire hose reels that is the supply of water, do not use the foam based fire extinguisher, you can use the $CO_2$ type of things, you can use the powder type of things.

So sometimes you may need the fire blanket so be aware and all the persons those who are working in the sensitive area must aware this type of chart, must be trained for this type of scenario that is a crucial thing.

So, on this module we have discussed about the fire extinguishing criteria, we have got the clue that what kind of different fire extinguishers available as on date and how to use them, what should be the protocol of fire fighting.

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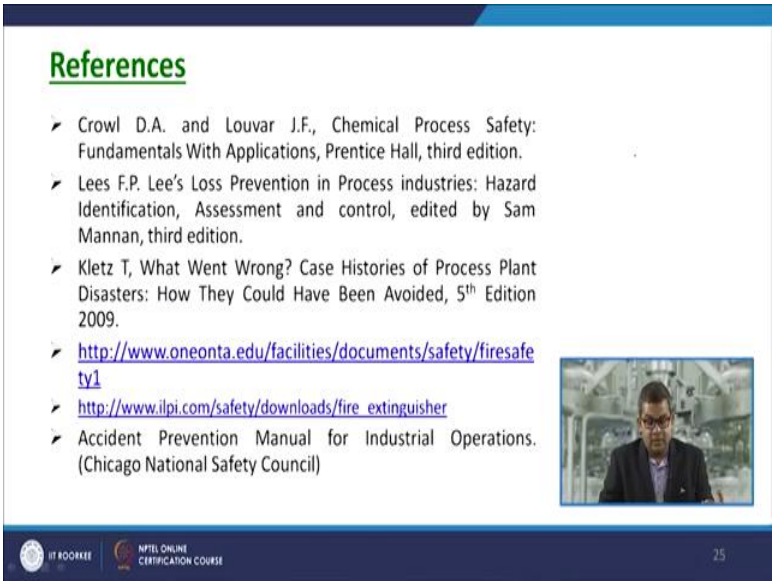


For more studies you can look of these references, those references are enlisted over here and if you are working in a system where you are the boss then definitely you must train all those workers, so by this way we are ending up this Fire and Explosion chapter as well as the module, thank you very much.