**Fire Protection, Services and Maintenance Management of Building**
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**Lecture - 14**
**Fire Safety: Detection, Suppression and venting**

So, you know we can now look into advantage of suppression, say that is what I was just mentioning.

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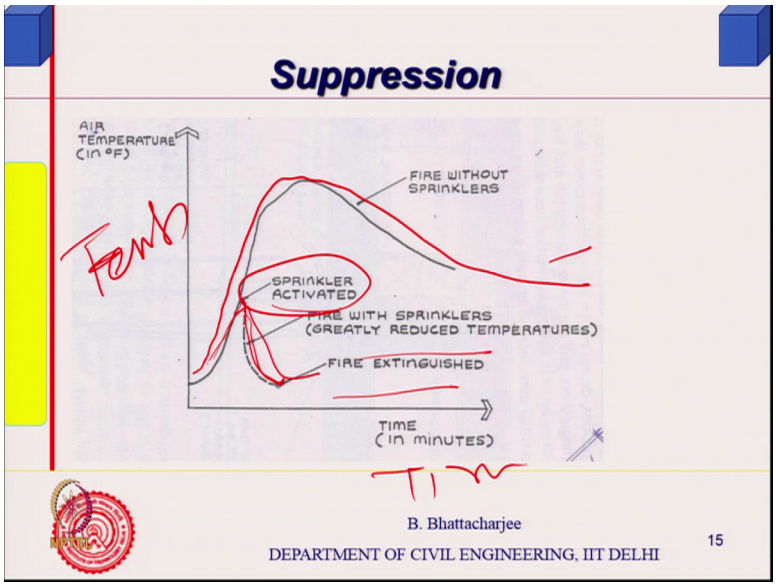


So, advantage of suppression is, if you did not you know, if there are no suppression system available, then it the temperature rise might occur like this. We have seen that, time temperature curve time; I mean temperature versus time.

So, fully grown fire, but if I have automatic firefighting system, then something like say, let us say sprinkler automatic fire plus firefighting system. If it is get activated, then it would get suppressed straightaway here. So, because you know, it will be put off right. So, this is what it is. So, fire extinguished very quickly. So, there is a safety.

Now, just one more one point I want to mention here; one point I want to mention here, how do I do how do I extinguish fire.

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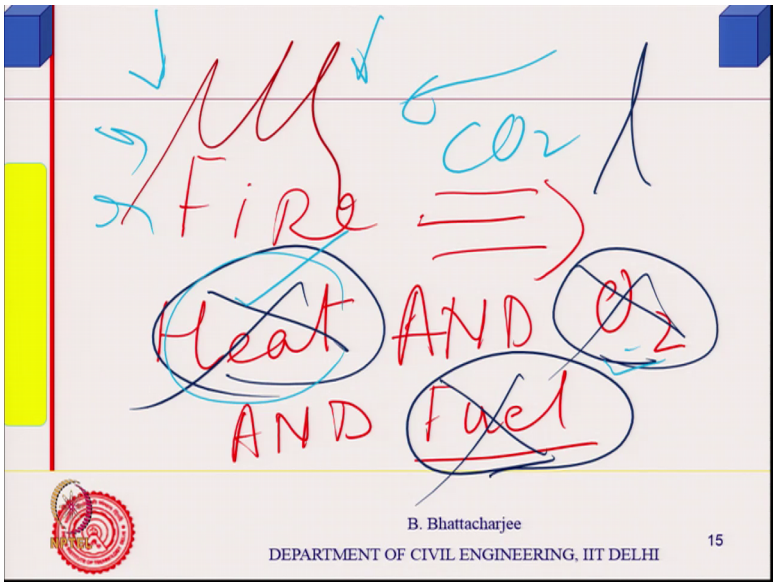


You see there, fire was 3 things fire required 3 things essential things 3 things are.

Student: (Refer Time: 01:21).

Heat, oxygen and 3 things I needed fuel.

Student: (Refer Time: 01:40).

Right fire load. Now, if I cut off any one of them, cut off any one of them, cut off any one of them, you know cut off any one of them, any one of them. So, if you cut this, fire will get extinguish. If you cut this fire will get extinguish and if you cut this, this will get extinguished.

Now, it is difficult to cut this. I really cannot cut it because, fuel is the part of the building itself. Fire loading is the part of the building itself. I can actually cut this as well as this. So, generally, when you have carbon dioxide for example, if you instead of oxygen, if you supply carbon dioxide from all sides to the fire; so, there is a flame. Let us say, there is a flame; there is a flame and you supply carbon dioxide from all direction. Just for the understanding part of it, carbon dioxide comes from the wrong direction.

Let us say, then fire will be extinguished or some other similar sort of gas or solid, for example, if you put sand, even simply sand from all direction. So, you block the oxygen

supply temporarily cut off the oxygen supply. The moment you cut off the oxygen supply, fire gets extinguished.

Then, it has to ignite again if it has to start. So, water does this job 2 jobs actually, water removes the heat as well as. Cuts of the oxygen, but it should be put in such a manner for example, you put water in one corner, then it is not going to happen, but it must come completely over an umbrella from all sides and.

Student: (Refer Time: 03:30).

Yeah, cut off also the oxygen supply. Suppose, you put a full bucket over the whole fire, then it gets suppressed because, it cuts off the oxygen. But water has got high thermal capacity specific it is high you know. So, this would actually remove the heat as well and it has got latent heat of evaporation.

So, it will actually absorb the heat and then evaporate. So, a lot of you know it can absorb the heat as well and remove oxygen. So, therefore, water is the most common fire extinguishing element, I mean agent. And that is why you have wet riser or dry riser etcetera. But you can have carbon dioxide in some other places, even automatic sprinkler system want some with water only largely and it is easily available. Not costly; you do not have to produce them nature has given us water.

While carbon dioxide you have to actually percentage is very little in air, you know. To separate out or produce it yourself in some manner, you know by reaction of calcium carbonate with acids and things like that. So, that is what is related to suppression. If you do goods quick separation, it would actually save you in the sense that fire would not continue for a long period of time.

Now, let us look at a little bit, let us look at little bit now on to the detection system. Let us look at now on to the detection system right, a little bit more. So, ionization detector as I was saying, the principle is something like this.

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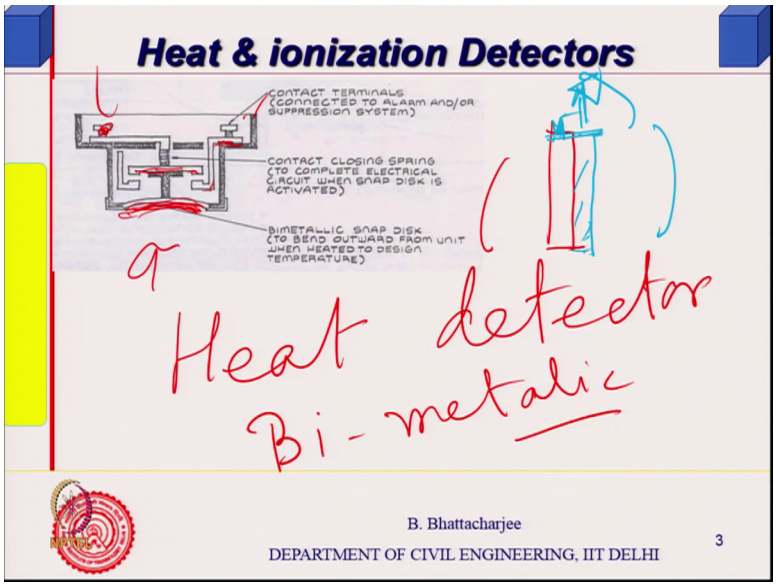


Basically, this is the, First let us look at heat detector. Let us look at heat detector.

Now, commonly used ones are bimetallic strip principle. You can have other kind of sensors as well; bimetallic strip principle. Now, if you know, you know if I have one metal and another metal, they are glued together. Let us say, glued together one metal and the other metal and they have different coefficient of thermal expansion.

If I heat them, what will happen? One having more coefficient of thermal expansion who tend to you know tend to actually expand, but it will be restricted by the other one.

In fact, depending upon the heat coming from which direction, there will be a bending action. It will bend because, one would be one would be you know the force here would be more compared to the other one. So, net effect is, there is a bending action along this direction, one is trying to expand more. It is not being allowed right. And other is trying to expand relatively less.

So, there is a difference in forces, axial force difference should be there. And you know, they are basically from their center, from the center you know, from the centroid of the section, there will be a bending moment actually acting. So, they will get bent. So, that might bend depending upon the situation.

So, it might form like this or it might bend in the other direction as well. Depending upon the situation when it is cooled and things like that. So, it might bend from depends upon

which you know, if it is a angle from in heat from all direction. So, it might bend if you are it heating it or cooling it, depending upon the coefficient of expansion of the 2 metal strip.

So, bimetallic strip thermometers in fact, bimetallic strip thermometers works in this principle itself. Now, you can have a coil in case of thermometers or temperature measuring devices. Earlier you have to use still used in some places in the still use might be there. So, if you have a coil, it will actually coil further or uncoil if you were coiled spring like coil spring with 2 strips. So, 2 strip make a coil spring plate together bonded together you make a coil spring.

So, as you heat it would like that you know it might coil depending upon how you have designed and if you cool it, it will uncoil. So, therefore, there can be an analogue arm etcetera. But that is not our point. Here, you have a bimetallic strip; this one is a bimetallic strip, this particular one right. You have a bimetallic strip and you have a electrical connection. Through this, you have a electrical connection; through this right.

So, you have electrical connection through this. It is connected external this contact terminals and this there is a gap existing here. There is a gap existing here right, gap. So, this is a bimetallic strip plate here right, bimetallic strip plate here. Here is a fire can come from this side bimetallic strip plate here. So, when fire comes, this strip takes a position. When in case of fire, when the heat is sufficient at sufficient sorry it is sufficient heat.

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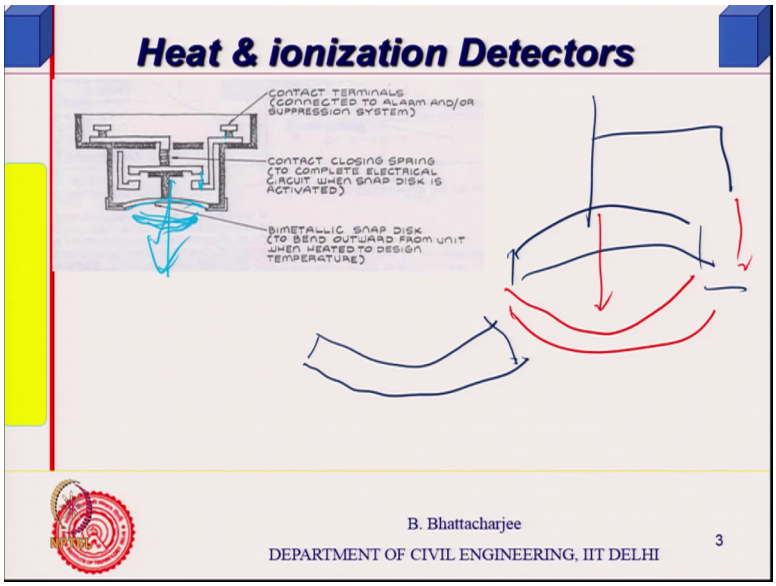


This might take a position like this it might take a position like this instead of this strip being here. It gets heated up bends in the opposite direction and this will result in this. Does not you know this will to come down which means that this point will get contact? There will be a contact established.

So, this terminal gets the contact is established. Basic principle is something like this; you have a strip of this kind right, strip of this kind in sorry strip of this kind other way around strip of this kind in the beginning and this is the connect connected connection to you know that there is a connection from this one somewhere here. Initially it is disconnected, right.

Now, as the in case of fire, in case of fire, what will happen? In case of fire, this will bent in this manner. So, as a result, this one will come down and this comes down and connects. So, this strip will come down and the connectivity will be established through the contact points as soon as it reaches a specific temperature it is designed for that kind of situation.

Now, this electrical contact will establish the alarm system. It will trigger off an alarm trigger off a now this is a basic one of the basic principles. There can be a other ones; for example, you might have these days, there are other kind of temperature sensing devices which might be which one might use to actually. So, basically temperature rises up to certain point. It should trigger off the alarm.

So, it should send the signal when the specified temperature has reached which could be something like 400 500-degree centigrade depending upon the sense. It is so, but you can see that, it has to get heated up first. First heat has to generate and heat generated later in the fire. So, they are not as sensitive as the other ones are, right.

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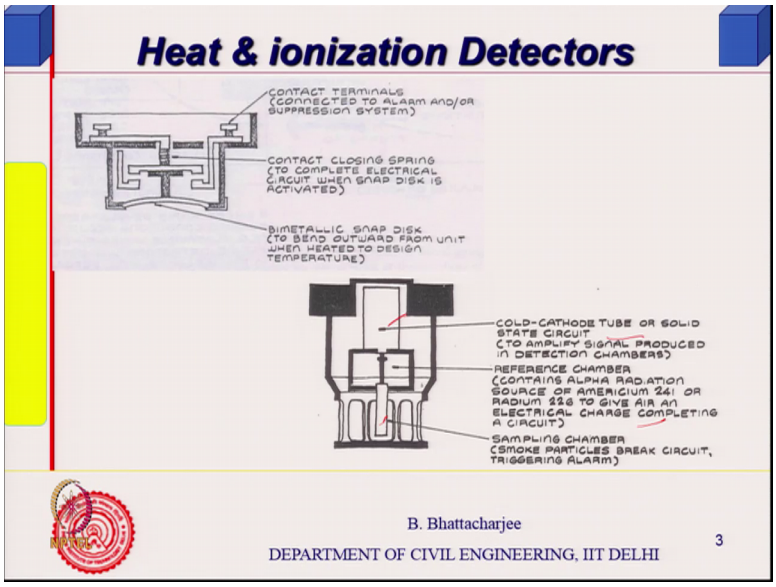


Now, ionization chamber, what it does? It has actually a basically a sampling chamber. It has got a sampling chamber and it is it the gases that comes in you know this the gas that has that comes in the smoke or gas which comes in. It ionizes you know, it gets ionized actually under certain static electrical potential. So, there are cathode tube or some solid state circuit would be there to amplify the signal that you get.

Now, in a reference chamber, some you know radiation would be there. Some radiation source will be there right or some kind of source should be there. So, what it does? it is ionizes the material that comes in some the you know particular of gas that comes in and when it reaches, when you know, when you get that specific type of gases this actually triggers of a signal.

So, it detects the product of pyrolysis and samples it continuously and when this samples, this smoke comes in it, breaks the circuit. It actually breaks the circuit by ionizing allows the current to pass and that can be you know that can be actually detected I mean that can be you know signal alarm can be activated alarm can be activated. Smoke detectors as I said there can be photo detectors.

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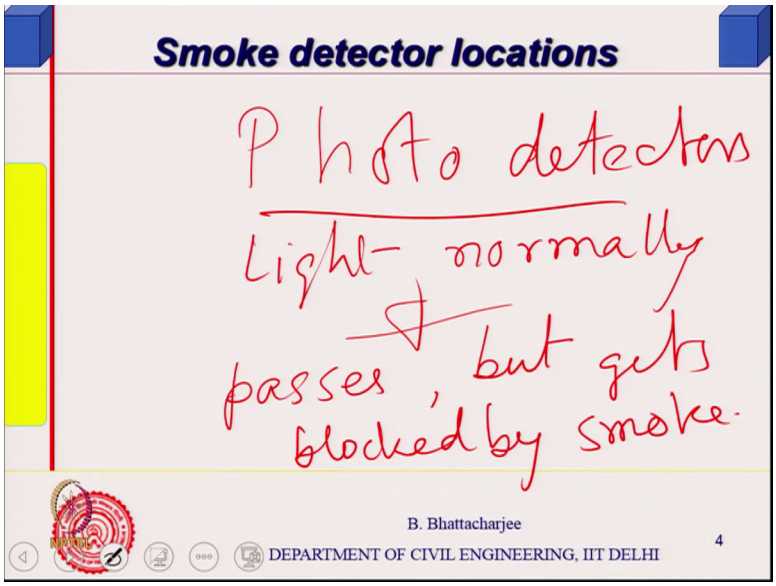


Photo detectors, smoke detectors can be photo detectors as well. So, what is what is there? Light would be normally passing through the sensing device. Light would be normally passing through the, but when smoke comes, it does not allow light to pass in. So, you know light photo detectors actually light normally light passes through it, but gets blocked by smoke.

So, they are you know there is a as the smoke comes, the light does not pass. There is an alternative path through which actually you know the photo detector or the you know it will it will trigger off. If the light does not pass through this, it will trigger off actually kind sort of you know these are essentially photo detectors.

So, basically photosensitive light sensitive devices which if the smoke comes, it will not it will be look block the path. So, alternate through the alternative path the signal will be actually activated. So, this is other type.

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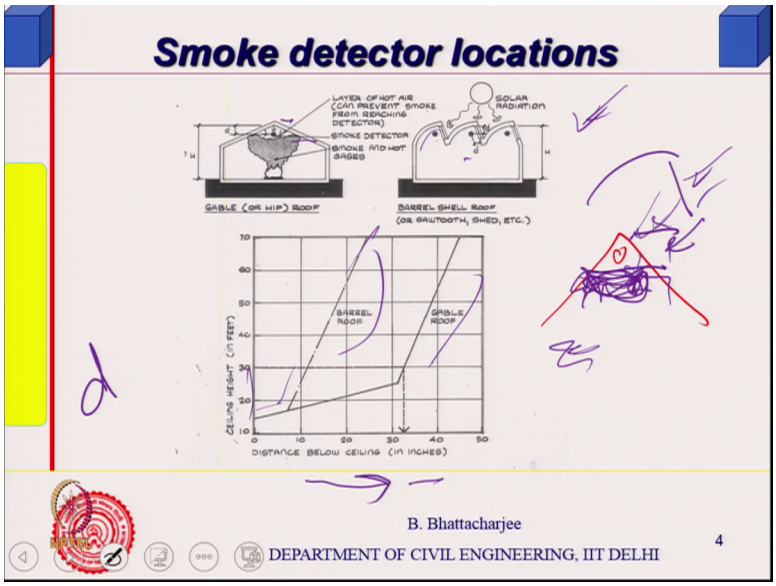


Flame detector as I said here flame detectors are infrared sensing devices because, heat basically radiation. Heat radiation you have to detect. Because, flame have lot of infrared radiation or red radiation should be available. So, actually these are nothing, but radiation detectors.

Now, one has to be cautious while putting on smoke detectors in. If you put it on crown, here hot gases tend to accumulate. If you recollect, hot gases will tend to accumulate hot gases, smoke etcetera tend to accumulate here.

So, if your detector is above at the corner, it may not be able to detect the smoke at all; because, smoke will not reach to the crown. Also, there can be other effect. If the suns radiation is coming, solar radiation is coming, this will heat up the air. Here maximum hot air will be accumulated the crown to crown itself. So, hot gases may not allow the smoke to reach there early. It would take because, it has to have sufficient temporary, but gases here air here is cooler than the top.

So, if the solar radiation, you know can also hinder the smoke detectors performance. Besides it would take a longer time to reach. Further, you know the corner the smoke has to reach something like this. It would have a tendency to accumulate here because, the solar radiation or pattern of the you know basically pattern of the smoke movement. So, if solar radiation comes in, there is a problem. I mean normally, it would be exposed to the solar radiation group.

So, there has to be a minimum distance below which you should put the smoke detectors. So, minimum distance below which you should. So, this distance let us call a d and this will depend upon the height of the building. So, basically, distance below the ceiling this is given, this is for this is you know this is sort of curves are available all right. You know curves are available for barrel roof.

This sort of roof or for gable roof, these curves are available. So, these are this is a you know these distances minimum distances and it depends upon ceiling height, higher the ceiling height you need more?

Student: Distance.

More distance, higher the ceiling height, more distances. So, that is kind of guidelines are available actually. So, basic thing is that putting the smoke detector, one has to be one has to keep in mind if this type of building where you have industrial building, particularly gable roof or barrel roof sort of you know barrel roof sort of shells.

So, you have to be careful in putting them because, we use what is called north light roofing in industrial structures. So, north side light will come from this side, but this will also receive heat from the other side as well. So, light comes from this side. So, this is one precaution one needs to take and one can find out how much how much you know depth below what you should put in.

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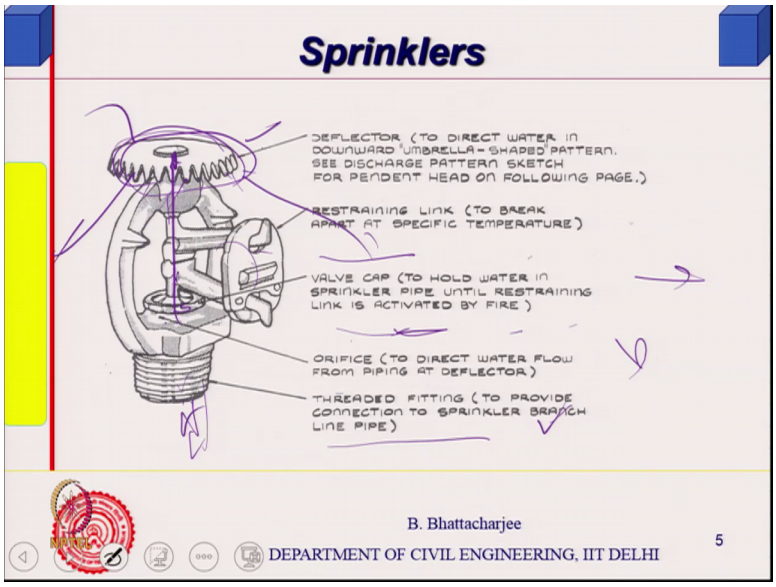

Then coming to sprinklers; so, this is related to detectors, automatic detector system. I talked about the manual detector system. If every people are there in all corner of the houses, all the time people will detect in this fire. But, that does not happen some places. Mostly it happens the fire occurs when they are numbered normally. So, automatic detector system actually can detect it and we pass on to the alarm and you know people can move about right to the safe places that is it.

Sprinkler system is automatic firefighting system, we had dry standpipe, we have wet standpipe or combinations right. So, where actually you will be using the hose pipe somebody has to use it, manually somebody has to extinguish the fire using the hoses, but the water supply is the ensured; that is what is that, but an automatic sprinkler system detects the fire and starts operating on it is own. So, that is an automatic sprinkler system. So, if you have such kind of a system; obviously, fire gets extinguished much faster.

Now, essentially it will have a kind of a fusible link. It will have a kind of a fusible link and this is basically a deflector at the top, you know you have a deflector at the top which will rotate and spread the fire. I mean, spread the water in all directions through this. So, the water jet comes over it and get spreaded in all direction water jet comes over it.

Now, for water jet, to start, you must have a fusible link here. When it when the temperature rises this kind of link will break and allow water jet to reach here and then sprinkle along all direction, right.

So, there is a restraining link which will now simple link could be simply water fill glass tube right or some liquid filled glass tube. So, when temperature rises expansion of the liquid causes glass to break.

Student: Break.

Glass seal to break and then water will start coming.

Student: Coming.

So, that is what it is. So, thus you know this is what it is. So, hold the water and sprinkler pipe until restraining link is broken. So, there is a valve cap. Then there is; obviously, the

orifice directly to the it would be connected to the pipeline water supply pipeline and you can have dry as well as wet pipe system connected dry. I will talk about this where we use the dry.

Normally, it would be wet water under pressure connected to water under pressure. So, this is a threaded portion. Now, this is connected orifice which is connected and there is a fusible link. So, the principle is you should have a fusible link which will break at the. So, it sends the fire and starts working on it is own.

Now, this can also be connected to an alarm system as well. It is you know it is opens up and it if this is this is also triggers off, some sort of a electrical signal by movement of some sort of an arm you know in an in a like, let us say, in a in a kind of magnetic field or something like that electromagnetic field it would possibly send some signal and then that can be sent. So, basic principle is something like this.

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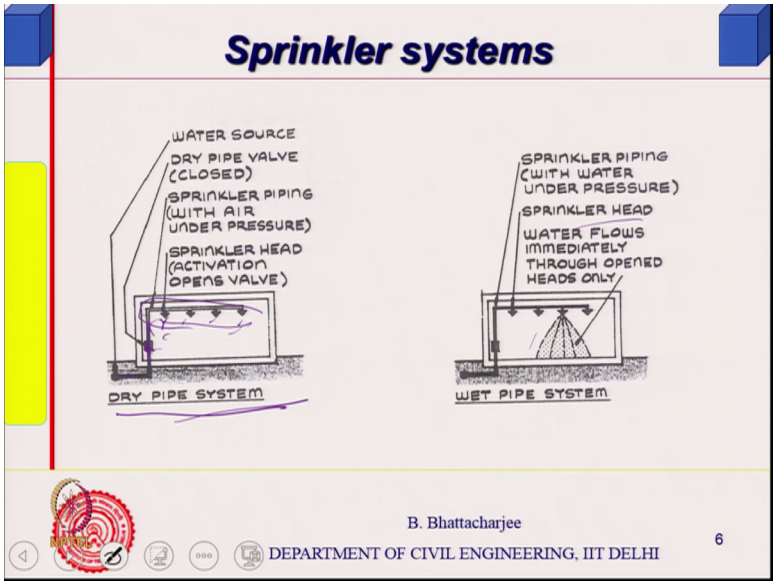


Now, this is how it would look like you have a drip stand dry pipe system this is dry you have got nozzles here sprinkler heads as we call them and this is a main pipe connecting to the sprinklers there is a valve here right. There is a valve here, this is connected to the water source. So, dry pipe valve actually so this pipe is usually dry, but in case of fire, this will get activated right. This will get this will get open, right.

So, here the air is under pressure. In this pipe, air is under pressure. So, actually it is a double extreme sort of thing in dry pipe system you use in such places where you do not want water to be present in the room itself.

For example, a cold storage room what are you freeze? You know some temperature is very low, in such a room, in a room where temperature is below freezing point, maybe in western countries, it might be quite common in some sort of places basement and things like that where they are not using heating system. People do not stay there, but it can cause fire and spread it.

So, you do not want water to be here. So, water comes only up to a certain portion and it remains water does not reach to ice and this portion as soon as the fire occurs, it detects basically the sprinkler head activates and this also gets you know independently activated.

So, once this is activated, the water turns coming by coming this side and then you know. So, the this 2 should be connected to an activation system or detection system which will actually. So, each one of them might start working, but there are system where all of them can actually start sprinkling water simultaneously, right. So, it is all also dry pipe system is used in such places where there is a scope or risk of freezing of water, in India possibility will be very little. Excuse me.

In wet pipe system, this is there is you know this does not stop and you have the water the pipe is always full with water under pressure. So, as soon as one of the sprinkler gets activated, it starts sprinkling the water; it starts sprinkling the water right. So, sprinkler piping with water under pressure sprinkler heads are there and water flows immediately through the open head which gets activated. So, this is a wet pipe system, dry pipe system and wet pipe system.

Now, at dilutes deluge system is one where all of them will get you any anywhere use it senses the fire all will get activated simultaneously.

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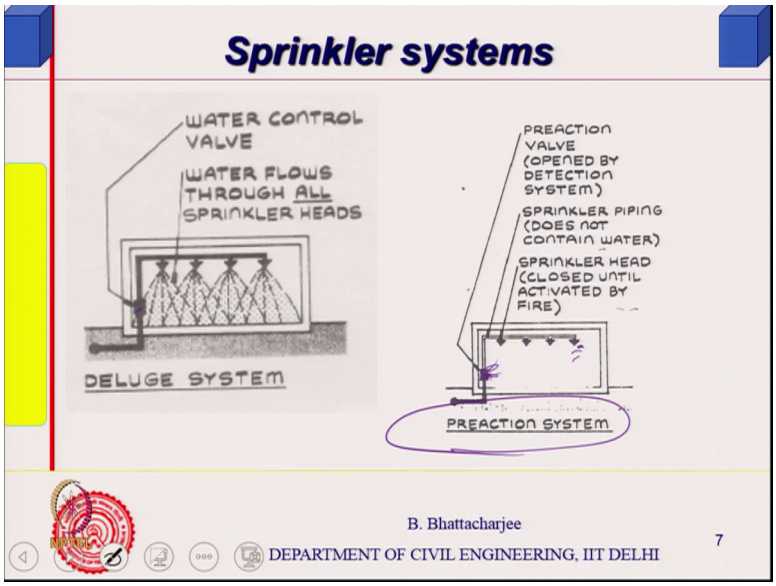


So, once because, it will flood the whole system, flood create a deluge onto the whole floor. The why risk of risk is very high and you do not have any risk of damage of the the articles in the floor itself or in the room itself. Then you use this deluge system. So, it will flood off everything in one go. It will flood off everything in one go. So, this is the water control valve and water flows through all the sprinkler head; all the sprinkler head simultaneously. So, this is a deluge system.

And then, there is something called a pre action system. Pre action system gives you some time there is a pre action valve right. It is opens and there is a delay between this and sprinkler you know, even if it is get activated, sprinkler is closed and once activated fire. So, there is a there is a gap between the water flow.

So, there is a pre action system right. There is a gap between the sprinkler flow. There is this, the difference between this is you may have a sensor here in case of dry standpipe system, you may not have a sensor here, but this gets activated simultaneously with this here. This gets activated later this get activated earlier.

To want the people first that sprinkler is also going to start operating. So, if you have to save something or do something, but the time gap is very small if nobody is attending; obviously, it will start automatically, but there are small time gap between so there is a pre action. So, there is a small time gap. So, until activated by fire and sprinkler piping

does not contain water initially like the dry system and this pre action valve starts operating.

So, there is a time lag existing this is the difference between dry pipe system and this one both has got here, but in that one here was under pressure. So, the moment sprinkler get activated water will start flowing right here there is an activation system here which would give a signal and tell you that it is going to start. So, if you have to do something remove something also, quickly if you can do, then you have to you know. So, this gives a time for pre action.

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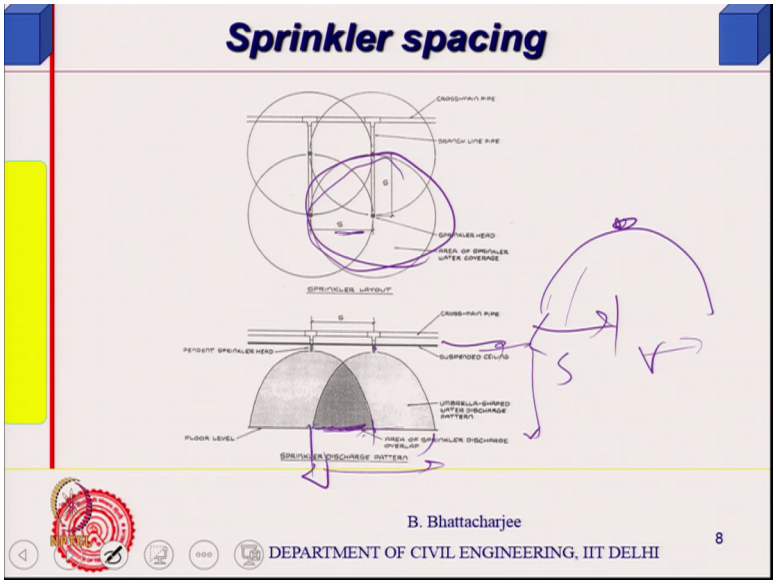


Now, spacing of the sprinkler, it should be you know one must know from the manufacturer what is the this radius. What is this radius depending upon the height from the ceiling? So, sprinkler head is here. Now, how much is this diameter one has to know, it should be such that there is a full overlap of the you know full overlap.

Student: (Refer Time: 25:18).

So, spacing should be same as the S should be same as the radius itself. S should be same as the radius itself so that, there is a full overlap right. So, basically it forms some kind of an umbrella from the sprinkler head water flows and you know it is actually sprinklers are more efficient; why because, it water particles are now of large finer size. So, large

surface area it can absorb a lot of heat and since a lot of water is spread, it can also suppress some amount of you know oxygen supply also it cuts off someone.

So, you like the sprinkler spreads the water and as very fine particles. So, absorption of water is high, but then, you need actually some kind of overlap and therefore, the radius spacing should be same as the radius you know this spacing and radius should be same. So, this is one thing the guidelines are available and it will depend up on the height because, if you know if it is if you know at what height water how much area it covers.

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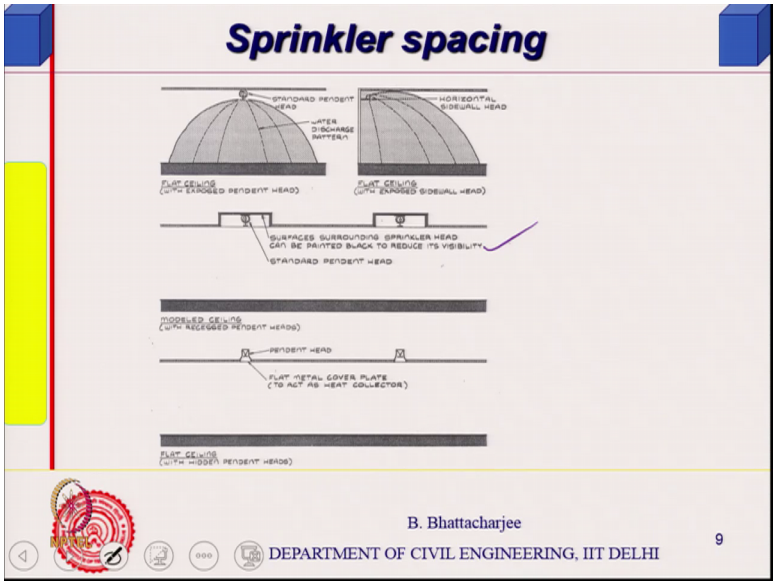


So, you can have concealed type of concealed type of sprinkler head do not see them normally at somewhat above level, all right. So, there are various kind of look is possible. Sprinklers are actually somewhat inside and some cases, it may be straightaway seen at the top and things like that.

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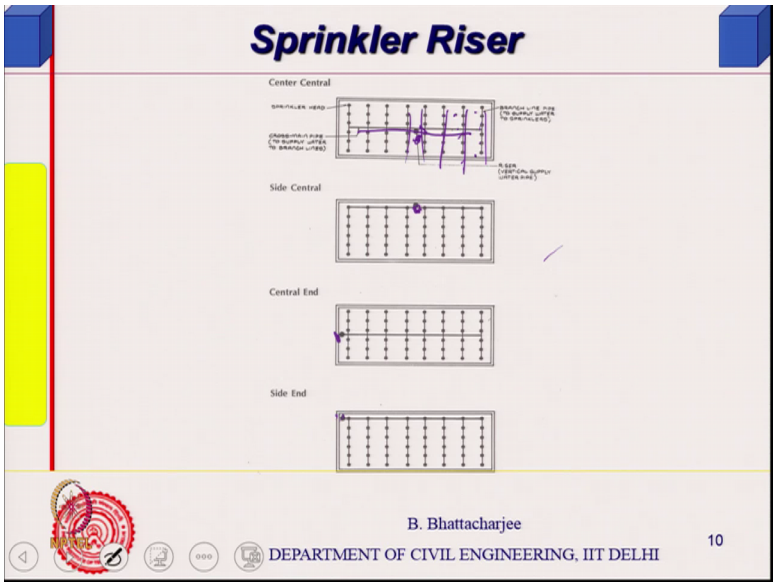


If I look at the sprinkler pipe riser, it could be here or it could be there or it could be there or it could be there that is the main pipe this is the ceiling plan. This actually is ceiling plan right as you see from the bottom and these are the sprinkler heads, these are the sprinkler head. The pipe that carries the water from the below is this one main pipe and then, this is like this. Then, this spreads in arms or I can have pipe in this corner.

We can have pipe in this corner, pipe in this corner or depending upon what is convenient and what is economical because, you have you know location of the pipe, it should be close to your other water supply duct and things like that. You cannot make a specific you know the cost has to be seen.

So, this is this arrangements could be various you can be having central or side centrals central end and side end corner etcetera. So, we still continue with fire suppression right and dip the extinguishing material you know what you for example, you use water. Some cases, you might use carbon dioxide as I said, but that depends upon your combustible material. So, there are classes extinguisher classes for example, on the basis of fire classification.

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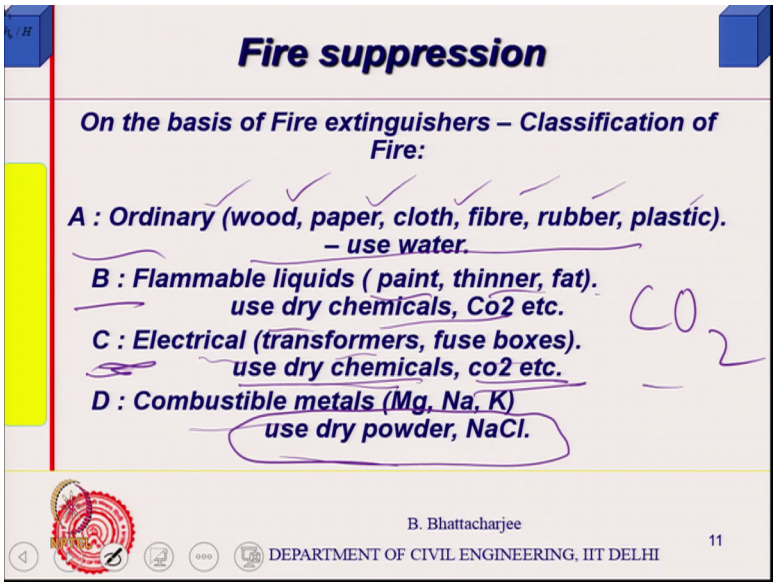


So, A is the ordinary fire where you have got you have got fire load, you know combustibles of wood, paper, cloth, fiber, some of the plastics and things like that and water is the best extinguishing agent.

Class B is flammable liquids paint, thinner, fat. So, there either use dry chemicals or carbon dioxide dry chemicals or carbon dioxide. So, if you have a kitchen not the you know hotel kitchen or something like that and not an Indian stuff much, but they use you know a big pan where they are using fat sort of it. So, fat can catch fire you know oil fats etcetera can catch fire. And therefore, there the water would actually create more problem than solving it. So, carbon dioxide is a best.

Then electrical transformer this is a class C type right, class. So, C class fryer fire would be an electrical transformer fuse box says carbon dioxide again. So, they are use carbon dioxide again dry chemicals or carbon dioxide and combustible metals magnesium sodium potassium etcetera. Sodium chloride is used or dry powders are used to?

Student: (Refer Time: 28:44) Dry powders (Refer Time: 28:45).

Dry powders chemicals actually or, but even you know it could be sand, fine sand. But likes whatever you know like sodium chloride sand or, but if you know such material that there you would have seen those old railway stations I do not know you see them now or not.

Student: 2 buckets are there.

They will have 2 buckets filled with yeah right water; one more empty bucket and rest all filled with.

Student: (Refer Time: 29:10).

Sand and things well yes. So, there are other dry chemical powders actually right, which I the no name is not known, but their specifications might be available in the code.

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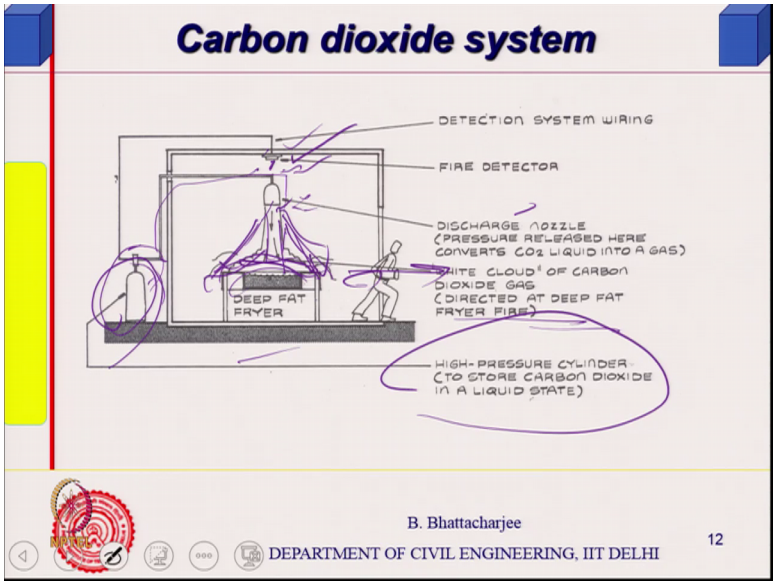


Then, you have carbon dioxide system let us say. Now, one problem with the, so, you have seen that carbon dioxide is used in many places except for the metals you can use carbon dioxide water; obviously, you will be using most commonly B and C type we use carbon dioxide. Now, one problem with the carbon dioxide is you have to have people removed people must go away o therwise, they will get suffocated. Fire will get suffocated, but the human being can also get suffocated.

Therefore, there must be an warning system. So, if you have no automatic carbon dioxide system, the tank is here. This is the fire detector system and this supplies the carbon dioxide right of top of the pan right. This is the fed you know; they are using fat for some cooking purposes or whatever sort of thing some processing right. So, deep fat, fire or something of that kind of a kitchen or some sort of things like that large one.

Now, the carbon dioxide must come from all direction. You know it should just come and it is heavy it is heavier than air. So, it will go and settle so, the moment you allow it to come it will come in settle here, spread here on to the whole thing, but there should be an time lag between these 2 this happening in this detection. Otherwise, the person here will not be able to move and you just you see a white cloud of carbon dioxide. It is not a colored gas.

So, this is the detector system right detector and warning system this is the tank and you know once we gets the before it starts, it gives you warning the person actually moves away. So, directed at you know this is carbon dioxide. So, person would be able to move away discharge nozzle is here. So, high pressure cylinder is kept here.

So, if you have carbon dioxide automatic carbon dioxide system, it has to have an alarm system which will warn the occupant and make them to move away move; make them to move away. So, carbon dioxide system looks like this. So, these are the kind of extinguishing system right. I think this is what we have looked into. So, far as far as alarm system and detection system is concerned.

Now, we look specific cases of multi storey building. Some issues like multi storey building, we look into some issues of and some into other issues of planning, we look into for examples, smoke mint venting, smoke venting is an very important aspect as far as long buildings are concerned, very big wide buildings are factory buildings.

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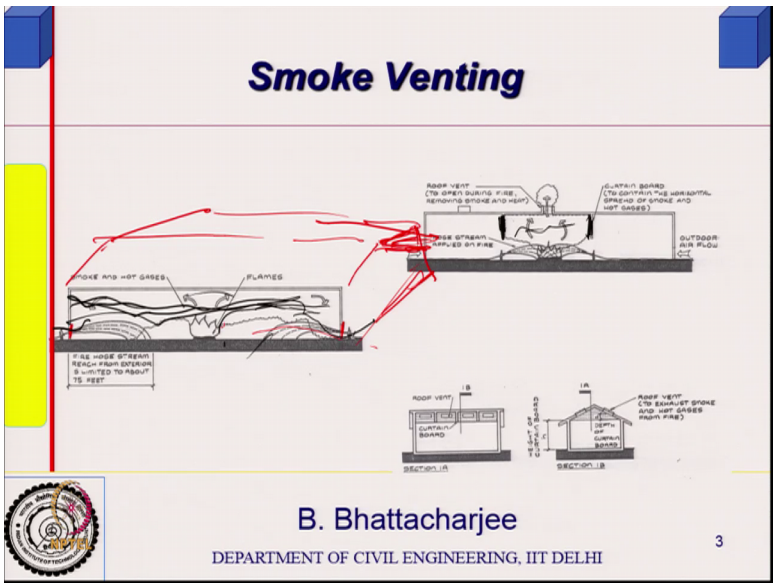

Now, this 3 diagram tells you, you see if I have a very long factory building, very wide factory buildings can be a flat roof or it could be gable roof also gable roof also, flat roof or gable roof. Now, gable roof would in this direction actually gable roof, it will look in direction in this direction you know what I am saying is. It could be something like this. This is sort of a building right, all right.

So, I mean something of this kind for building is so here it is. Now, factory building they are very large factory plus some of those many other storages for example, say fertilizer storage where the fire would be chances would be less, but there are many such situations.

Now, what happens is, if you have entry on one side, entry on the other side the when there is a fire, the fire fight you know this gets spreaded with smoke all the places. This gets spreaded with smoke, smoke spreads all over the place because of fire. And this then tends to come out through the door 50 percent top half of the door will be filled with smoke. Rest all (Refer Time: 34:38).

Now, firefighting people cannot enter here. They will be actually spreading the water until go reach no air. So, in a long building long and wide because, approach to the center may not be available for the firefighting people; so, in such case, what you do? You do what is called compartmentation; provide smoke curtains at the top ceiling.

Now, these curtains are nothing, they will only ensure that the smoke gets restricted here you know instead of getting spreaded here, smoke coming out gets restricted here only.

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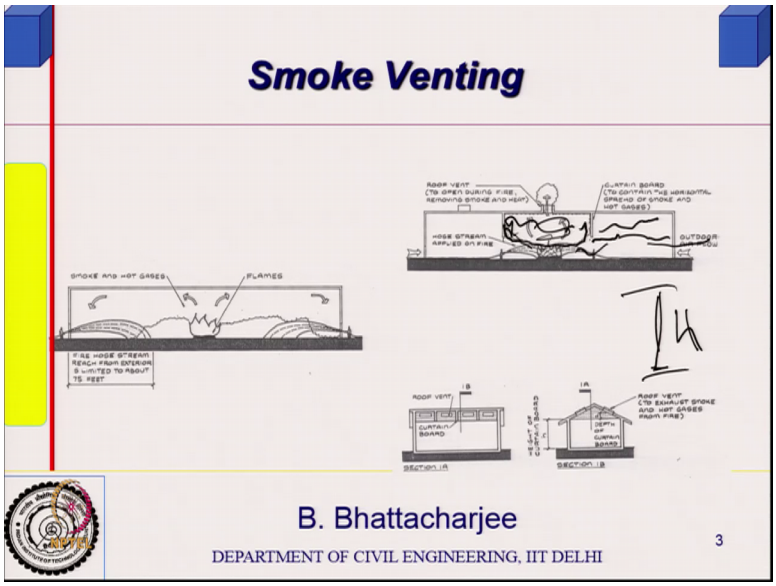


Right there sufficiently their height H if I may call it is sufficiently, they are sufficiently high. So, that the smoke generated here or here it would first accumulate here; cannot come fully when it gets accumulated in this space. Then only, it will try to get out through the below the curtain. So, first it has to or let me it make a bigger diagram, maybe something like this.

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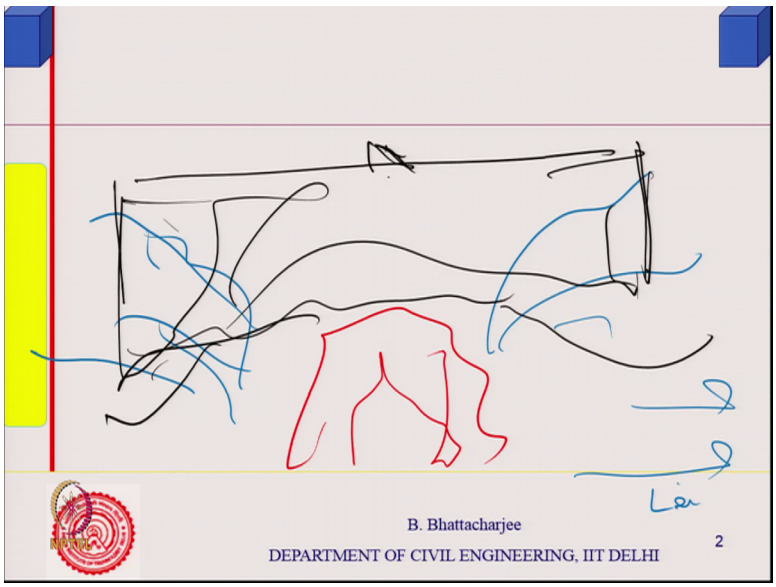


This was my ceiling. Earlier, in case of a fire, earlier in case of a fire, fire is here, the smoke would actually get spreaded all over the place. It will go you know, it will get

spreaded all over the place and finally, it will pass through the door where the length is very long length is high, L is high length is high.

So, it will actually get spreaded all over the ceiling, over the whole building. Therefore, nobody can enter there and since the door heights are not very high, this will be 2 meters. So, you can see that you know people also height is slightly more than the slightly less than the door.

So, firefighting people cannot enter, but supposing I provide a curtain wall, I provide a curtain wall right. A screen here, smoke screen here, barrier smoke barrier, what will happen is, first smoke will accumulate you know smoke will accumulate here only it will accumulate here only. It will get spreaded here only. It will not spread there.

Then, it would tend to go out and the firefighting people can come sufficiently schools. So, the spacing of an height of these are impartment. So, you can do what is called compartmentation in the ceiling level for smoke venting.

Now, you can do something more what is this you provide a vent here right, which will open up automatically when the temperature rises. So, this is this will ensure the smoke goes out. So, smoke venting, I can do I can vent, I can provide a vent which is normally closed like similar to something like a my fire damper, only difference is it is normally closed. In case of fire, it will open up it will open up.

So, the system has to open up is around. So, the smoke you will get accumulated within this those and smoke will also get out of this place. So, that says that is a, that is basically the you know that is basically the you know smoke venting system. So, you can look at this. This was spreading all over the place this was actually.

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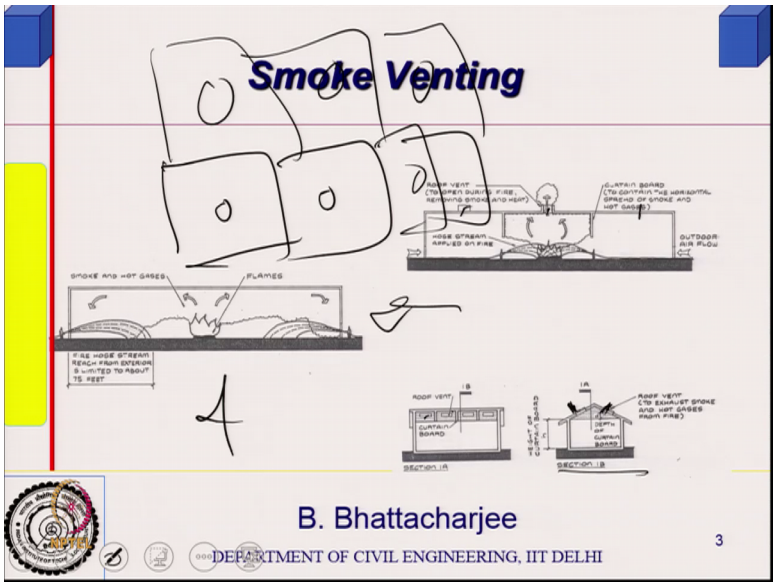


Now, there is a vent here, vent here and vent there and vents are provided on both sides of the roof, you know both sides. So, if you see this elevation from this side, if you are seeing, you will have vent on the gable roof on both sides right and if you are seeing from this side, when subspace along this direction.

So, compartments are made may be compartments and they have a vent somewhere their compartments and then their vents somewhere there you know. This is in plan or ceiling as I see from top. So, there is a I make up our compartments and vent should be there. So, this we have small and factory building or laboratory building for example, this is very important one more important thing which I think I did not mention so far people die more because of smoke rather than?

Student: (Refer time: 39:05 ).

Heat because, what happens is, smoke has got a you see the smoke can be toxic.

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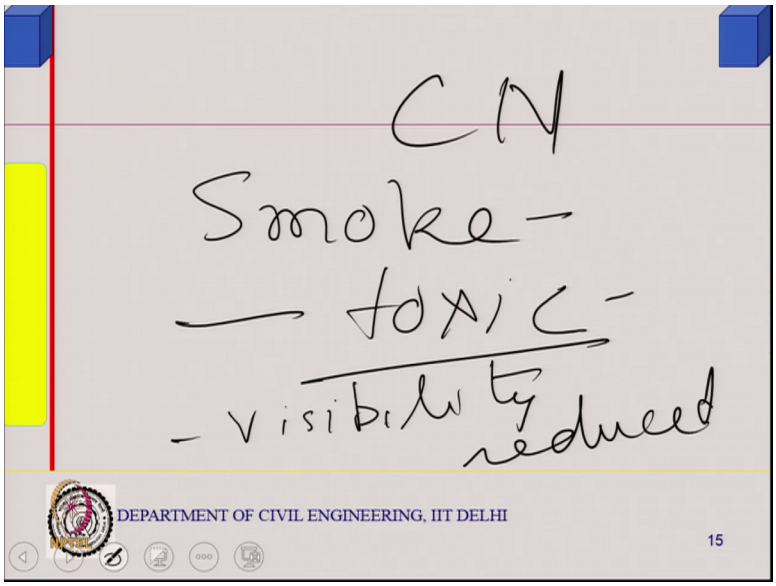


So, not only that, your visibility is reduced visibilities you know it visibility is reduced, it is toxic also. So, if you inhale the smoke, it affects some smokes can affect your nervous system. They are poisonous they can act you know they just can affect your nervous system temporarily make you almost you are not able to make any decision if your brain is not working; you cannot make any decisions.

So, instead of going away from the fire it might. So, happen that you might go towards the fire you know I mean just extreme cases besides that it can choke your lungs. So, some of those cyanide or nitrous guesses they can be poisonous. So, therefore, removing smoke is very important, removing smoke is very very important.

That is why, you need smoke venting besides helping the firefighting people, besides helping the firefighting people you know, that is what we were looking at so besides helping the firefighting people. So, smoke venting is important in multi storey building as well.

Now, in multi storey building, smoke can spread through the lift shaft. It can spread through the lift shaft as well as it can spread through you know any duct vertical duct, it is a stair cases. So, duct vertical shaft that is a they act like chimney, they act like chimney. So, what you do? One way is to do a compartmentation of the building in horizontal plane as well.

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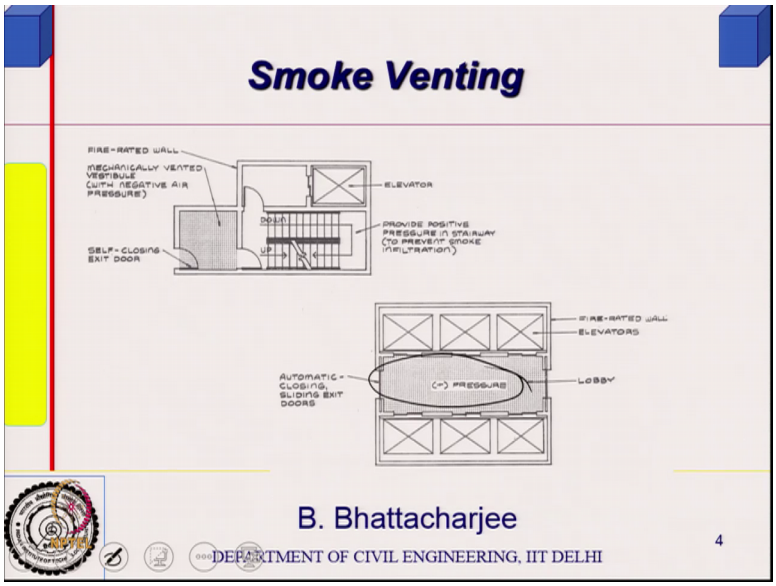


And particularly, the lift shaft you create a kind of excess pressure somewhere by having a fan from the top right, fan from the top because, in 12 buildings, one thing is you can make people to escape to outside stair and things like that, but you might provide some sort of places do a compartmentation in the horizontal plane play plan. So, that smoke does not spread from one compartment to another and you can pressurize a particular section where, smoke cannot enter if it is in the high pressure, right.

So, that is that is what you can do. And then, provide vents at the windows; vents at the windows right. Provides vents at the windows. So, that is what it is. So, this diagram shows, for example, this is a you know pressure this is a this is the some negative pressure created in the lobby and it might close that area because, the you know hot heat hot gases going out something like this smoke has a tendency to move in this manner.

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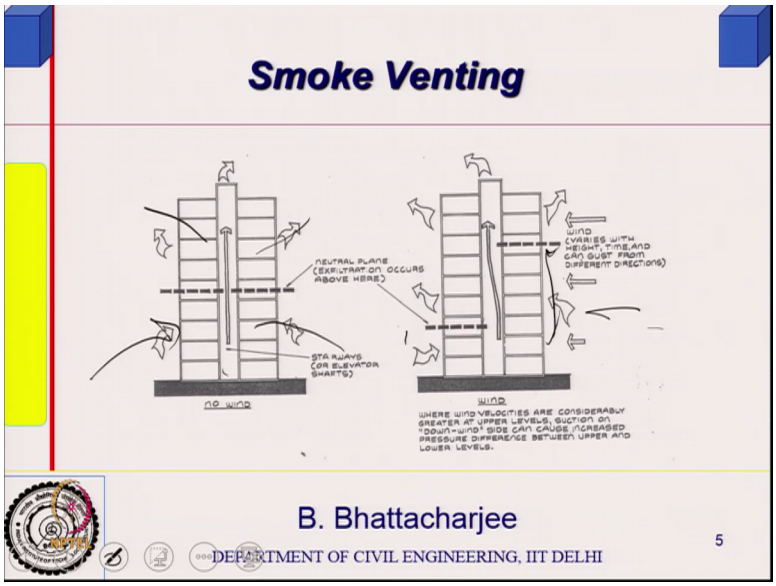


So, what happens is normal condition if there is no wind, somewhere there is a fire the hot gases will tend to go like this and fresh air will try to come from this side, right. So, there will be somewhere a neutral plane and if there is a wind blowing, it will change that pattern. If the wind is blowing from this side, pressure this neutral plane will get shifted there and they said yeah. So, there is a there is a you know this is what is it. Maybe next diagram, I will just show and I will stop for the day today.

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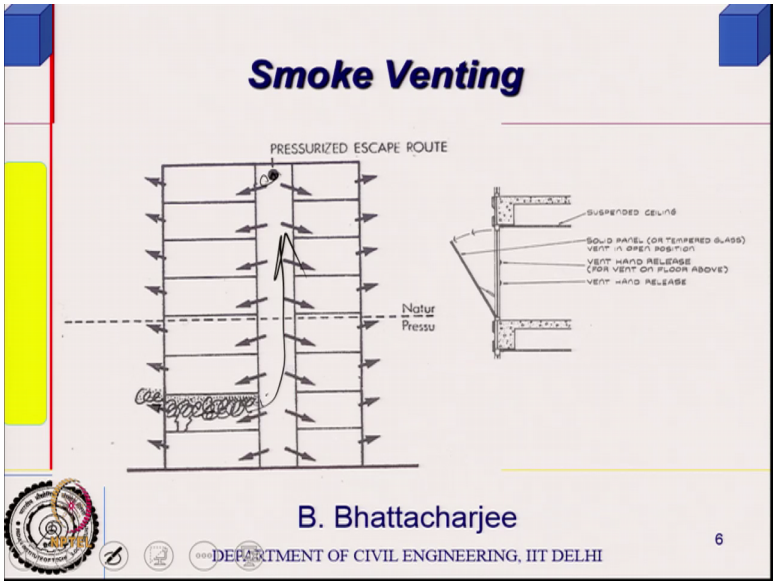

So, supposing I have got fire here, in this floor, basically you can have a pressurize this if you want, this as an escape zone. Otherwise, smoke will spread through this and you provide a vent. The smoke will go out, all right. So, I think we will stop here for the day and next class, we look into the smoke venting again and, like to address any one of your question if you have.