Course on Integrated Waste for a Smart City
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Module 10
Lecture No 50
Construction and Demolition Waste Management (Contd.)

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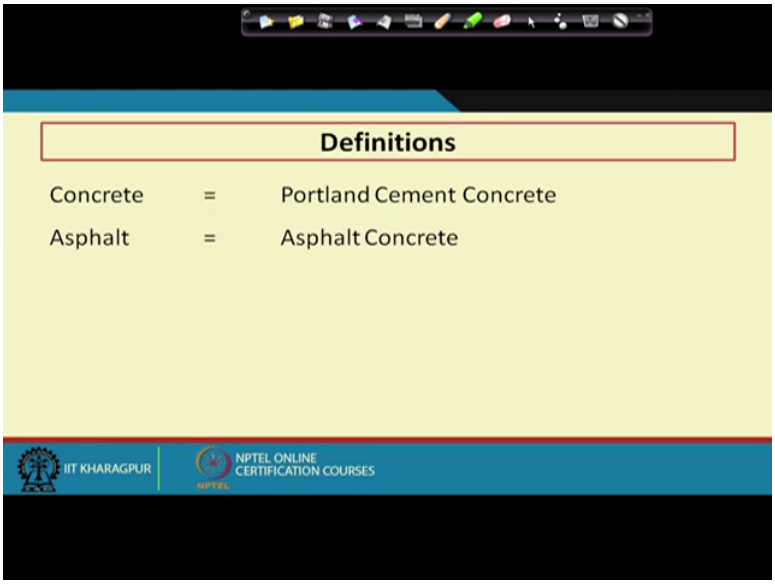

Okay so welcome back so will continue our discussion on C & D waste management that we have been doing in last for the last 2 modules we have this is the third module on C & D waste. So we were at this particular slide in the last video if you remember and so we were talking about different components C & D material so we have concrete, we have asphalt.

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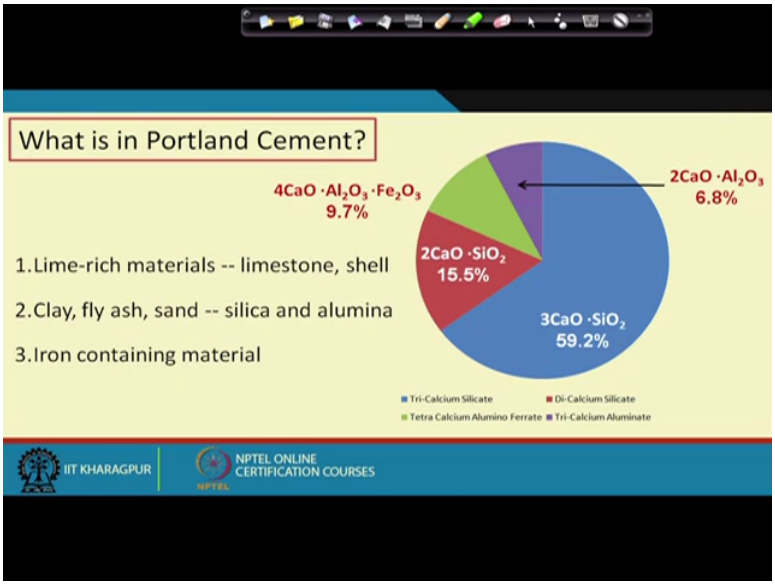

And so in terms of concrete, what is concrete? So what is many times we use the word Portland concrete or Portland sorry cement what is cement and then we will talk about concrete. So in terms of the cement, cement is essentially what? Cement is tri calcium silicate, die calcium silicate so essentially it is calcium, aluminium, iron, so these are the three major components and off course oxygen, so these are the four major components which is there in a cement. So it is a lime rich material, so it is a limestone, shell, clay ash, clay, fly ash and so those are used silicon, aluminium and it also has some iron containing material. So these are the major source major element which is present in a Portland cement or in a cement as we call it.

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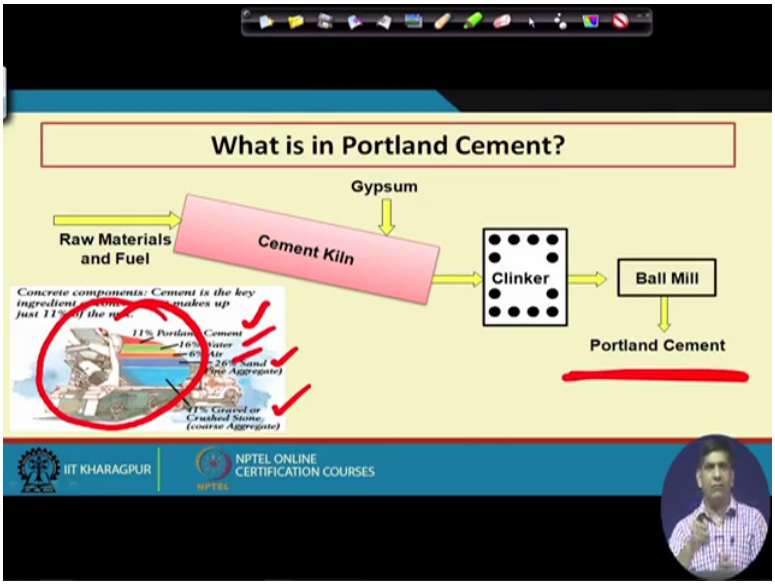

So in terms of how we get this made? You have the raw material and fuel, you put it in a cement kiln, you sometimes you also add gypsum which is calcium sulphate. So concrete component; cement is the key ingredient of the concrete, so we but mixed up 11 percent. So 11 percent in terms of the concrete first let us look at the cement, you put some raw material that you saw in the earlier slide so those are different silicate material, you put some calcium sulphate which is then you go have it through the clinker then go through the ball mill which makes it finer particle and then you have your Portland cement being made out of that.

So using this Portland cement we make the concrete, so in concrete we have the Portland cement, we have some water, we have some air, sand which is a fine aggregate and gravel and crush stone which is the coarse aggregate. You may have seen this kind of machine these days at even in smaller construction sites where you put although is together and it rotates and it mixes it.

Earlier we use do it by hand as if in your if you are civil engineer, in your concrete class, in your concrete lab class you may have made some concrete using cement and different components in terms of sand and then you may have done the particle size distribution as well, gravel and all those kind of stuff, so that is how we get the concrete made and test our cubes every like 7 days, 14 days, we go up to 28 days usually.

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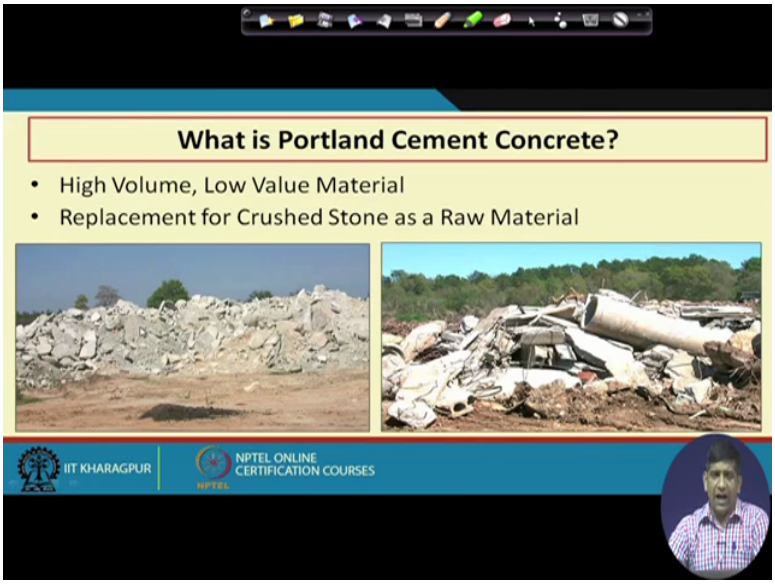

So this is in terms of cement and the concrete, so we talked just the once the concrete, once the concrete is made that can be laid into different shapes lot of pipes, pipes are used like walls and construction sites, so lot of cement concrete is used. Then it is a high volume material and low value, usually in terms of cost is comparatively not as high as some of the other components and it is a replacement for crush stone as a raw material. So it is it can be used for a replacement for crush stone as a raw material.

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So we see kind of lot of Portland cement concrete, concrete is used a lot in any of the many of the construction today if you have go around and see in your area you will find lots of concrete in any building that is being constructed, lots and lots of concrete work. So it is used

as a fill is very common. Use as the filling in low-lying area and in terms of what is so that is on Portland cement and Portland cement concrete.

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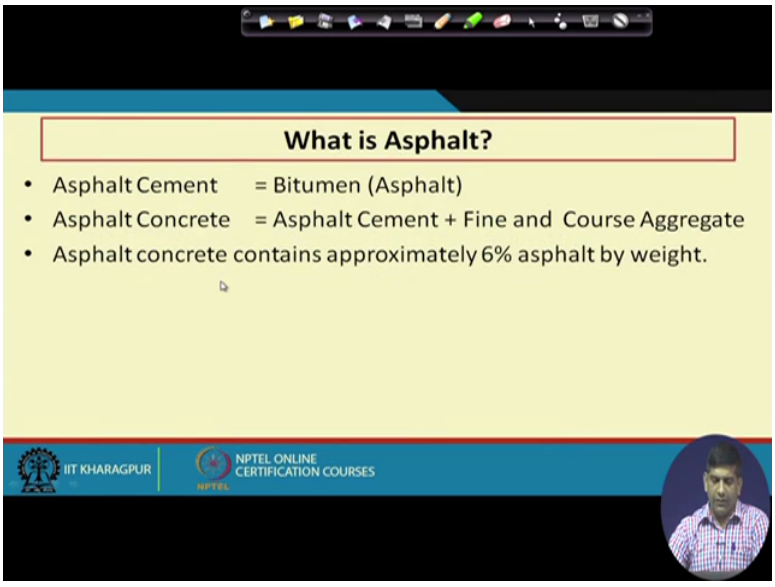

In terms of the asphalt concrete, it is a asphalt concrete is basically the asphalt that you see for the road construction. It is heavily recycled new hot mix asphalt and we have asphalt cement, which is known as which is actually bitumen, we also in western world is called as asphalt. Asphalt concrete is asphalt cement is the bitumen plus fine and coarse aggregate, so and asphalt concrete contains approximately 6 percent of bitumen or 6 percent of asphalt by weight and there are this fine and coarse aggregates which goes in there.

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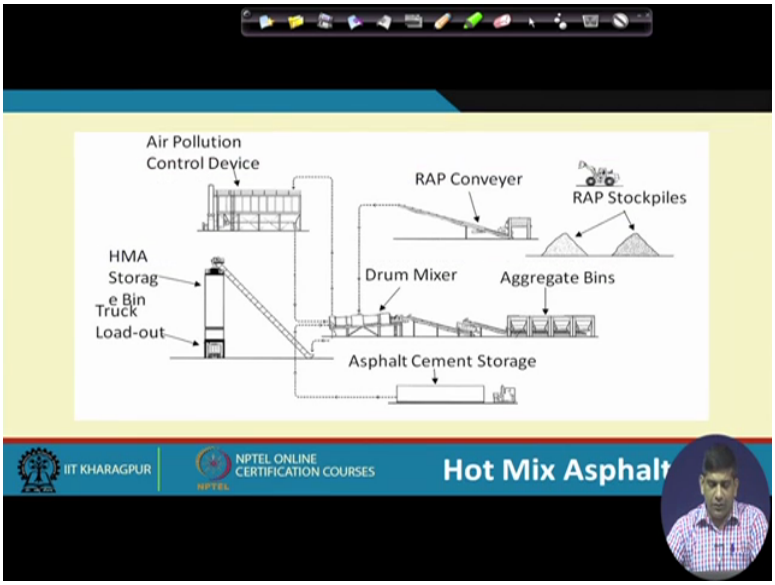

So again you have how it is done? You have asphalt so in terms of reclaim asphalt pavement, you can use reclaim asphalt pavement as well. So it is a hot mix asphalt storage bin and truck load out so this is the hot mix asphalt being made, truck is actually taking it out and that will take it to the laying of road and then you have to make the new material to make the new asphalt you have the aggregate bins, you have a drum mixture which can make the new asphalt off course you need some air pollution control device you do not see that much in the Indian context or in like a developing countries.

But in developed countries this air pollution system is kind of a must and it should be there. And then so you can also have RAP conveyor which is the reclaimed asphalt pavement, you can have a RAP stockpiles reclaimed asphalt pavement stockpiles and then this can be used as a ingredient to make new asphalt pavement. So this and the asphalt cement storage is there, so this is like a typical layout of a hot mix asphalt plant.

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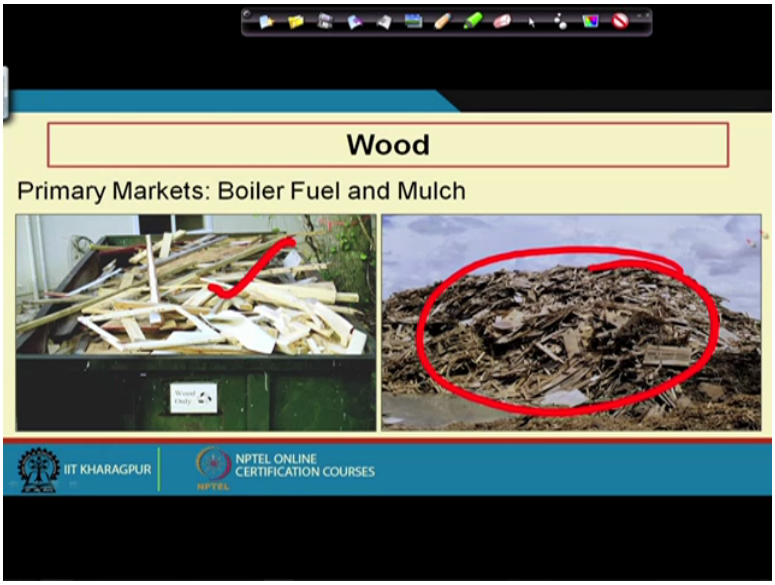

Then the other one we had the wood which is the boiler can be used as a boiler fuel, can be used as a mulch. Mulch is when you basically make small-small pieces of a like a chips of wooden and that can be used in a playground as a bedding material. So it is kind of cushion material, we also use as a bedding material for animals and all that so that is it is used there.

So here you see the clean wood kind of material and in this picture you see a construction and demolition waste like all these things are mixed up together. So it is not that clean material but here again if you make a mulch out of that make a boiler fuel concerned with boiler fuel is some of the heavy metal containing substance may be present here, same thing with the mulch if you have a heavy metal containing things that may create leeching issues or like your soil contamination issues when you use this mulch.

So but do there are issues of heavy metals. So it is a real issue from the lead-based paint, it is also from treated wood especially in the hot humid weather of in Florida and those kind of states where you people are people use lot of pressure treated wood and that helps prevents its decay prevents find those termites but since it has chromium and arsenic and as well as copper they do leach out in a when it contact with moisture or even in the soil.

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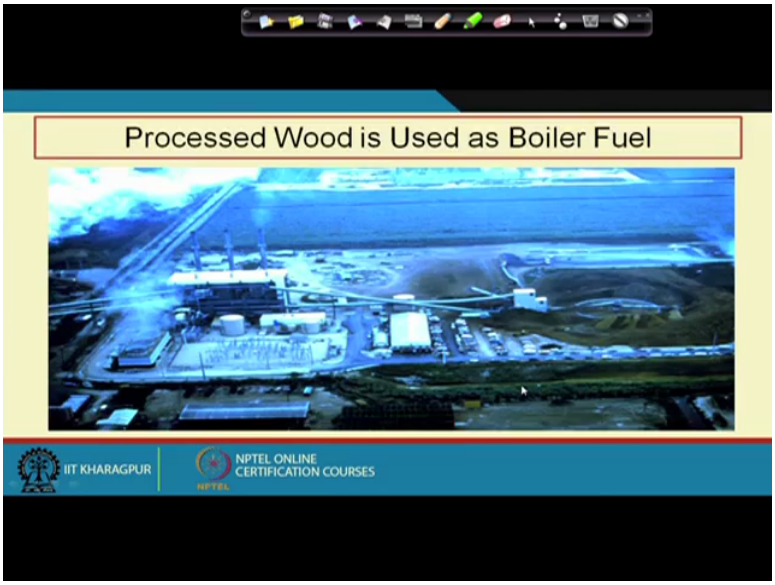

So processed wood is used as a boiler fuel and then sometimes boiler fuel processed wood has some sort of heavy-metal contamination your boiler fuel the acid is produced you will see slightly higher elevated like a slightly higher elevated this like a elevated concentration of heavy-metal in those ash and that ash some could potentially be hazardous waste as well, it can be depending on how is the concentration.

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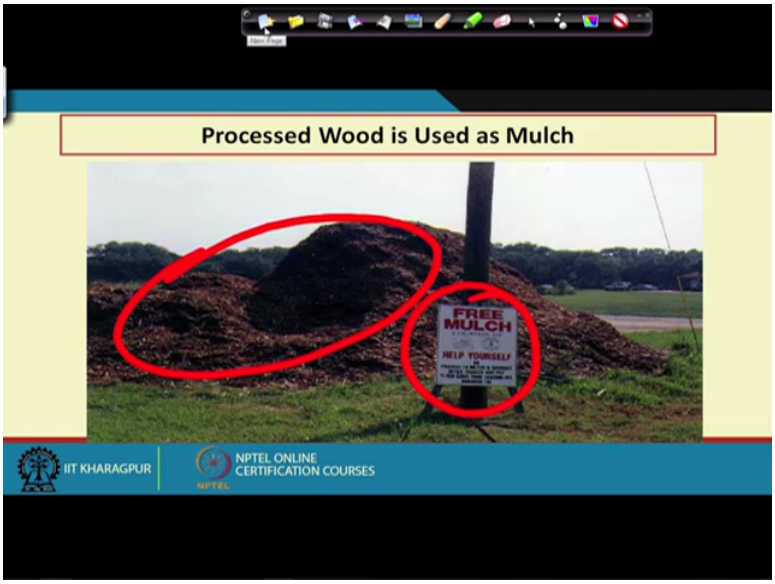

Then mulch which is basically the chipped wood as you can see over in the picture behind this all this is like a chipped wood. Here again if you have a and many times it is given out for free, even if you have some heavy metals that make some leeching. You see the red colour red colour of this mulch this red colour is essentially coming from iron oxide, so iron oxide is

used to treat that and the reason for iron oxide being used is iron oxide actually helps binding of arsenic.

So iron and arsenic chemistry is very interesting chemistry, so, if you look at the iron chemistry and you see that how iron actually help bind arsenic and so that although arsenic is there but it does not actually leach off. So, we had a I would like to share one small project with date regarding this few years back almost several actually several years back now where we had this coloured mulch which we put it on the roof and let it go through a season.

So of when the first season it could hold onto arsenic and it was a arsenic contaminated mulch which we knew, so in year one during the season it could we could see that it could hold onto arsenic but from year two whether it was a coloured mulch, coloured mulch is arsenic like iron treated basically you are using iron oxide as a there. So it is a whether it is iron treated or whether it is not iron treated that difference was not statistically significant difference.

So, with that kind of one season maybe maximum to like a if you make certainly more treatment it may be probably go for two season but after that the protection of arsenic leaching goes away. So that is a we wanted to know how much, how long this iron oxide can hold onto arsenic, so, that is we came to know about that it is slightly more than year but not too long and then .

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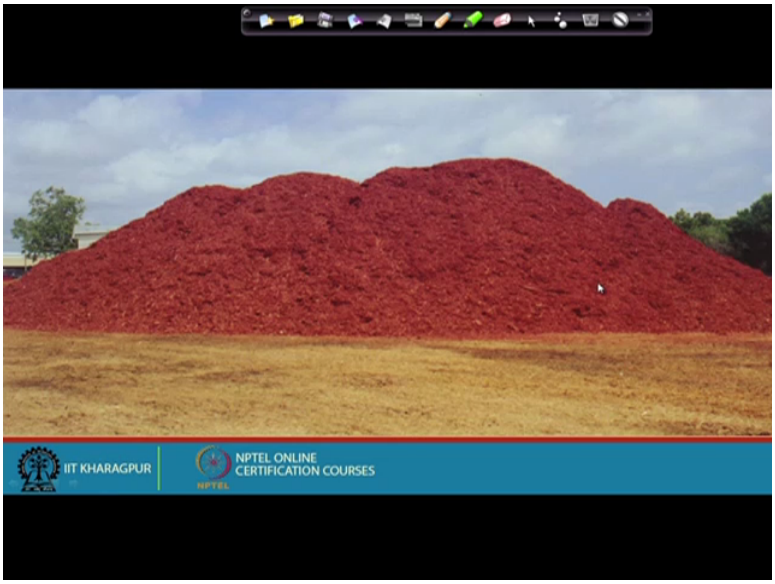

So this is another picture you see where this is very nicer nice and nice slight red colour. So whenever you see this red colour mulch one thing it tells you off course iron it is iron treated.

The second and most important thing it tells you it is looks like it is coming from a recycled wood it is not the fresh wood. Fresh wood they will not colour it because there is no issue of any contamination and also things looks nice and similar. But in the weathered wood like the old wood as you can see once you have the weathered wood things some of them may be silvery grey colour, some may look black colour.

So even the mulch does not look very good so as you know as the marketing one thing for one thing to get people excited to buy is the is the presence, how it is presented. So it is that is why people do lot of even study on how to present something there is whole interior designer or there are lot of degrees out there it is based on how to keep the same stuff in a that gives it a very good look or kind of people are more excited about it. So here with this red colour people will get excited about this mulch and then that helps it market as well.

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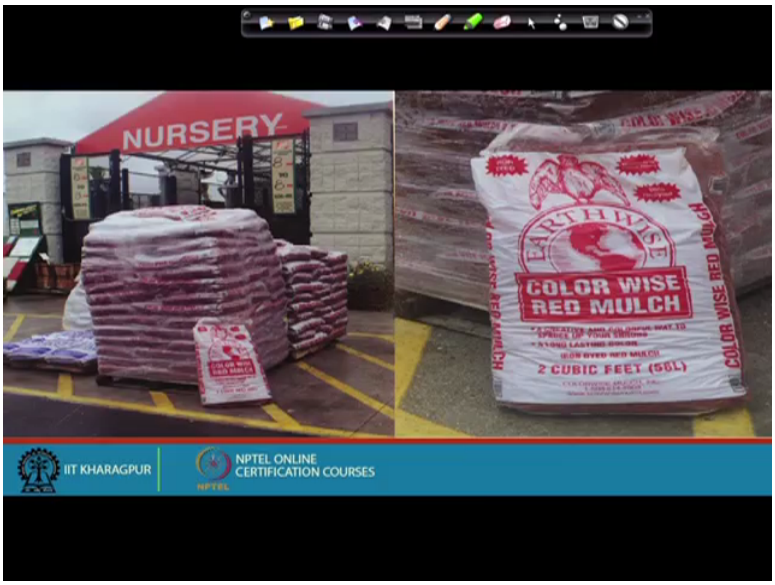

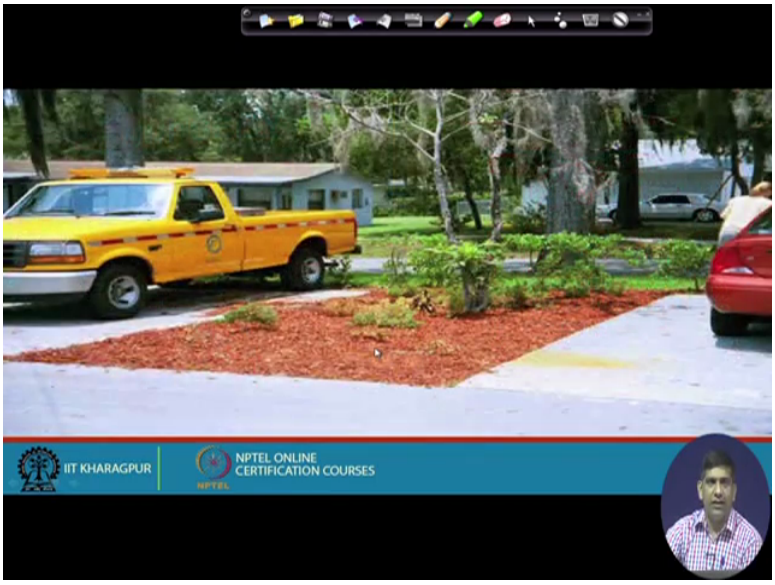

So mulch gets sold off in this kind of bags, so that is used coloured mulch. You can see on the parking lot, you can see in the area this is your red mulch right there. So and many times when you see all this red mulch you can always spot, if you look very carefully you can always spot some recycled wood there, so it will it is actually a mixture of both.

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Then asphalt shingles you can see all those singles coming out of the roof. It can be recycled into new hot mix asphalt. Not currently practice in some states in so this was basically we are talking about these things in US, some states do it some states do not do it, but it can be done many of the Western European countries do it and in India we do not have that practice because we do not use that much of asphalt shingles. Anyway but we do have a practice

doing that asphalt from the road, so road it gets recycled, we do have a practice of reclaimed asphalt pavement these days.

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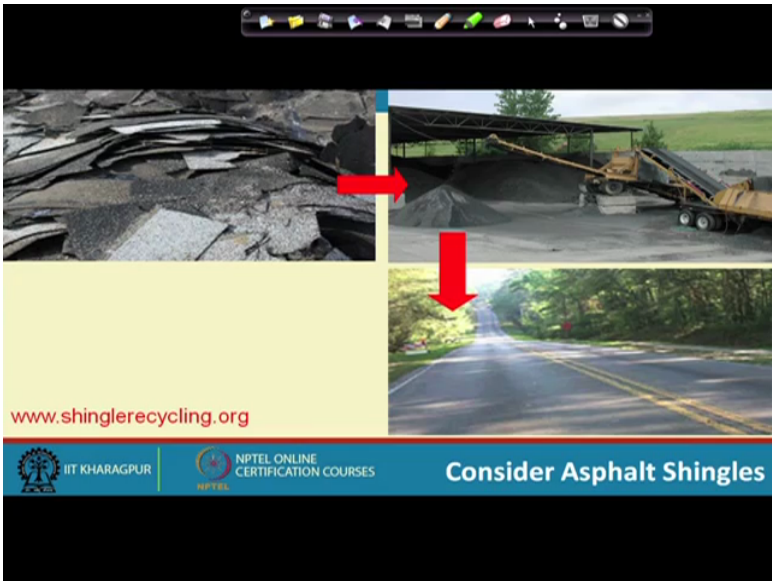

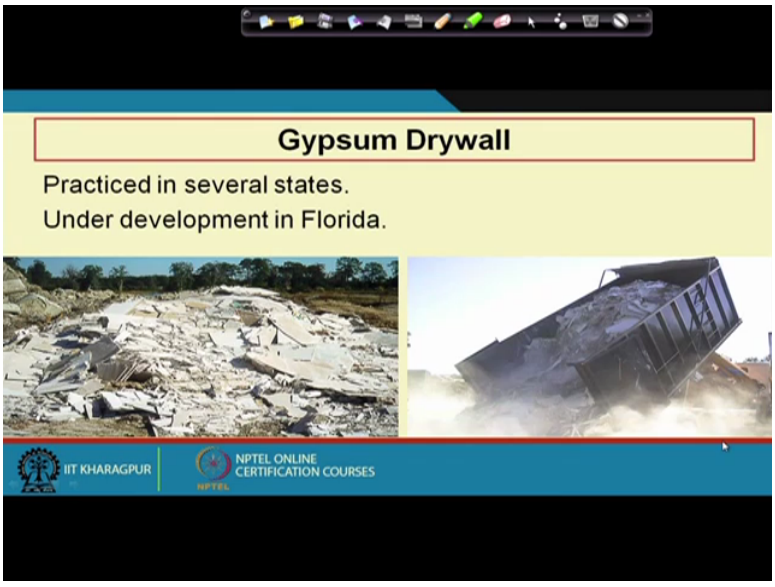

So shingles recycling is there, so shingles from shingles it can be made into like asphalt and from the asphalt that can go into the asphalt into the road construction so that is always is done. Gypsum drywall it is again not done that much popular the Indian context but from the global point of view if you look at it is a recycling of this is done and it is recycled into new gypsum, it is also recycle into made into a soil amendment. So the gypsum drywall you take the drywall you let it become a powdery substance.

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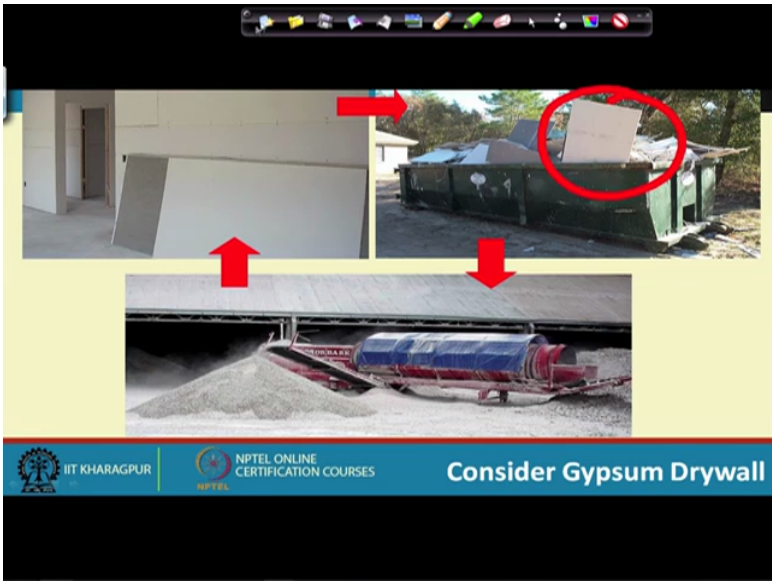

So gypsum drywall essential in the middle is calcium sulphate with 2 molecules of water and then it has a layer of paper on this side, so in the middle we have that and both of my hand is kind of layer of paper where the paper as on that gypsum board. So that is so paper acts as a organic like a paper is the organic present there. So but it is recycle used in a many times in in terms of recycling specially depending on what kind of application they will try to take this paper out.

If you look at very carefully in this particular picture over here you can see the paper on top of you can look at that basically what you see on that is actually paper. So both sides will have paper in the middle is the calcium sulphate, so you try to remove all these two papers and then take this calcium sulphate out and then try to make powdery substance out of which can be used as a soil amendment or maybe making a recycled gypsum drywall.

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The market in terms of new drywall, Portland cements production because calcium sulphate is also need in terms of production of cement. It can be used in agriculture can be used in a construction material, so there are different markets out there which could be used for the gypsum drywall.

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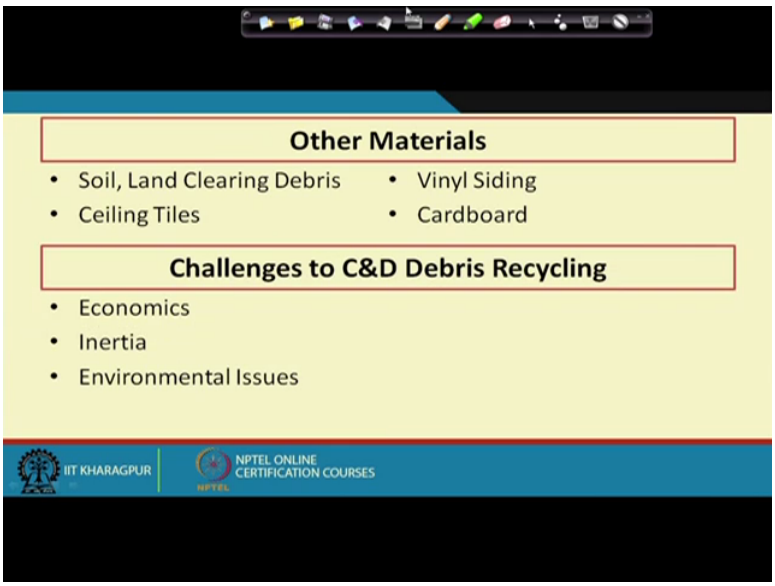

There are other materials out there in terms of the soil, land clearing debris, you have vinyl siding and this is use in India as a lot, cardboard, ceiling tiles those are these are out there. In terms of again as I said earlier in terms of the major things that we have to C & D debris recycling is economics, economics has to work, it has to make profit at least it has to be self-sustainable.

Inertia, inertia is that people do not want to change. Say if the material is available for example wooden or if you think about concrete or brick and other stuff, if the material is already available there in the market people think that why we should go for recycling, recycling means we have to learn about the new technology, so there is always a inertia to do something new, but that can be broken down by putting some regulation, putting some fees, putting some penalties, so that the inertia can be broken off.

But then we need to make sure that the economics work and the environmental issues taken care, because since we are using different types of chemicals and other stuff you need to make sure that it is safe to beneficial reuse it. So that is why we call it a beneficial reuse risk assessment, so beneficial reuse risk assessment is essentially you have a protocol in which you have you want to recycle certain construction and demolition waste or any industrial waste which could be potentially be used in a road in a construction project.

We need to make sure that particular product or particular compound or whatever we are trying to use will be safe to use in that from the environmental point of view whether there would be any adverse impact on health, whether it will go into the soil from soil to the food or like water or in the air phase, so we have to make sure that it is correct and it does not do that kind of a problem.

So for that environmental and then what we need is a it is basic as per now we have a C & D waste management rules, the next step where as we have the CPHE manual from municipal solid waste, we need a basically beneficial reuse risk assessment manual which for this C & D waste or any industrial waste for matter and that should have a structural component as well as the environmental component, because structural is important you have to make sure that the product have sorry the material has the requisite strength that is needed to design and to do anything.

But at the same time there is a environmental component which is also very important to find out that if we if it is a good structurally now we want to use it in a potential construction whether there would be any environmental implication of that whether it has some sort of contamination which will create some problem, so that is where the environmental picture comes in and that is the big area of work which has been done for several years in Western European countries, in US, Canada and other places.

In Indian context still we like having that guideline documents is very-very essential and I hope like we did have submitted something to DST around that line I hope that it gets funded, so that we can come up with a design guideline essentially the guideline document which will help the C & D waste industry as well as other industrial waste industries, like the fly ash and other material that is produced that can be to whether we can how we can do beneficial reuse risk assessment and this you can look at the overall picture of life cycle analysis those things along that line as well.

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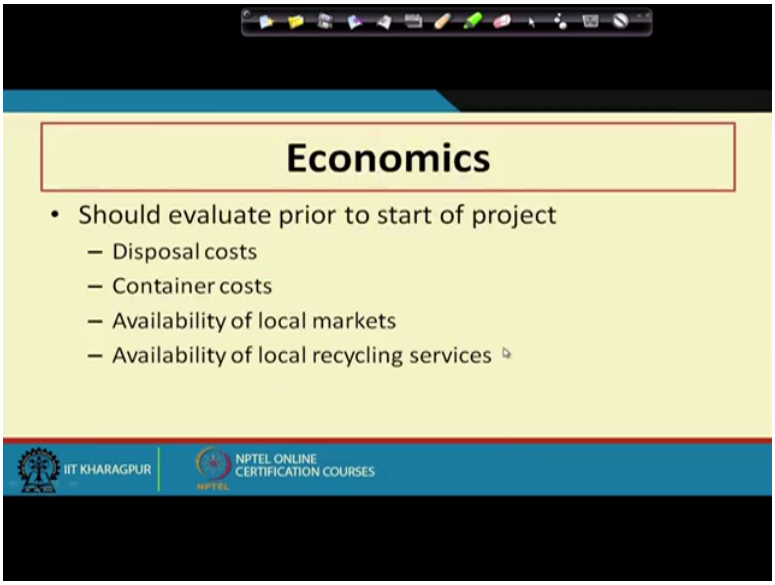

So economics, should evaluate prior to the start of the project, we will have to look at the disposal cost, container cost, availability of local markets, availability of local recycling services, so all these things and this may not be exhausted there could be some other factors that we need to look at it as well, but the economics has to work if the economics does not work you are not going to survive in that business for a long period of time.

Inertia, like how do you change the statiscope, people are always like to have a statiscope. Need and we need to constant education on reinforcement, keep on telling why it is important to not have a statiscope and do something different. So and then need dedicated oversight, we need somebody has to have a close eye on what is going on.

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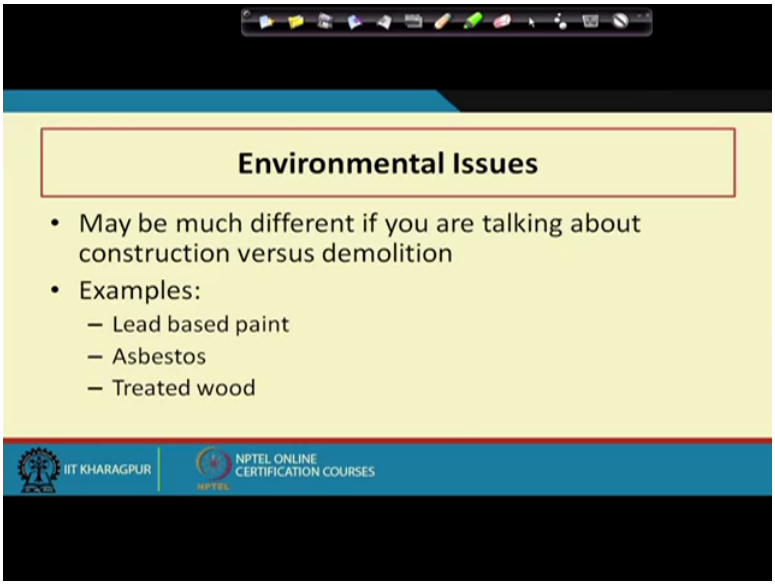

Environmental issues may be much different if you are talking about construction versus demolition, for example in the demolition we have lead-based paint, asbestos, treated wood all those things would be there. In the construction waste as well you can have some of these but not all of them and then they will not be mixed together because usually they are not.

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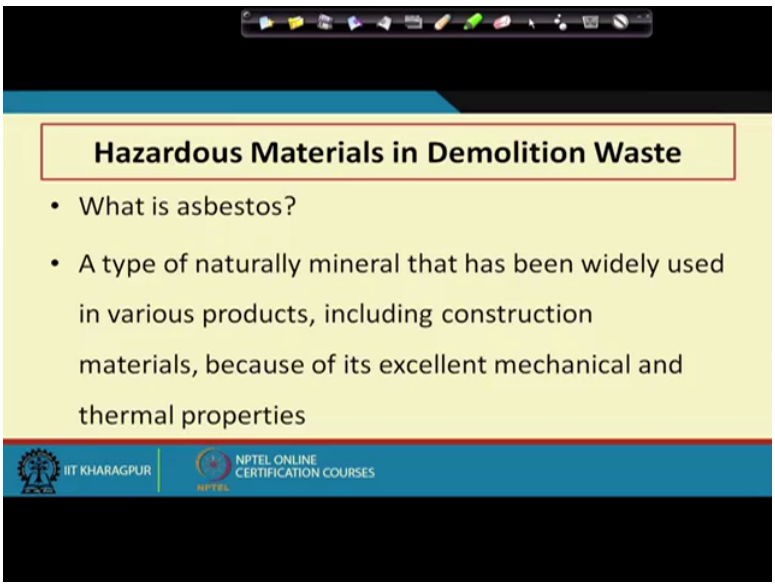

So in terms of some of the other material like asbestos, asbestos it is a hazardous waste into demolition hazardous material. It is a type of naturally occurring mineral it has been widely used in various products during construction materials because of its excellent mechanical and thermal properties. So, asbestos is used a lot but asbestos is considered as a hazardous material.

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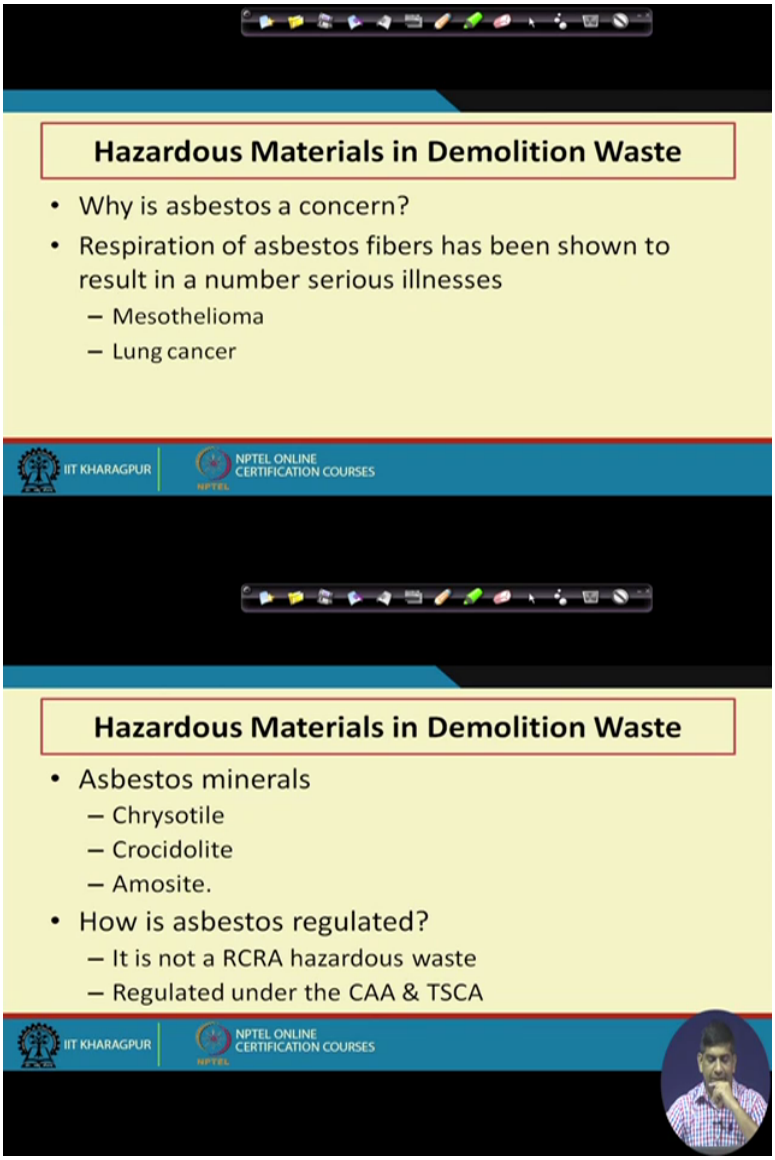

So why is asbestos a concern? because of the mesothelioma, lung cancer it is respiration of asbestos fibre has been shown to a number of serious illness so that is the reason why it is a hazardous material and needs to be looked at carefully and in terms of asbestos material you can have chrysolite, chrysotile, crocidolite, amosite, so these are some of the asbestos material. And in terms of regulation we do have this it is not a like hazardous waste but regulated under clean air act and also toxic substance control act, so those two acts actually had to work on asbestos.

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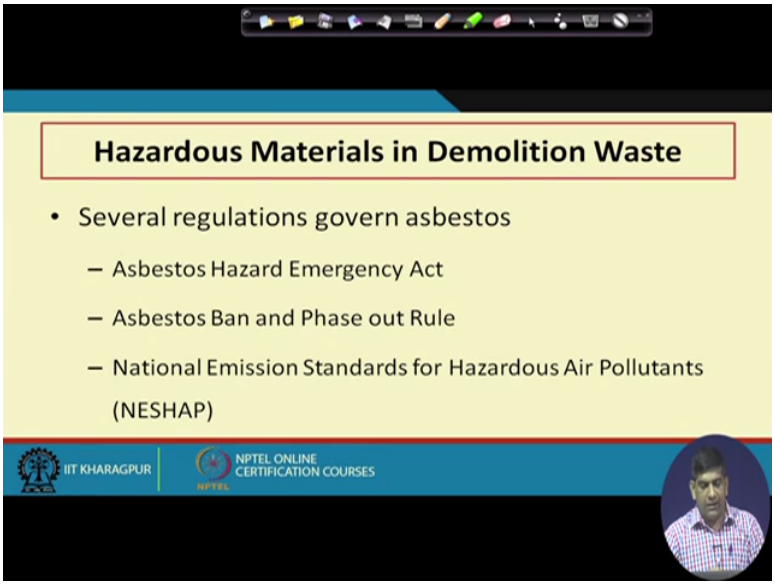

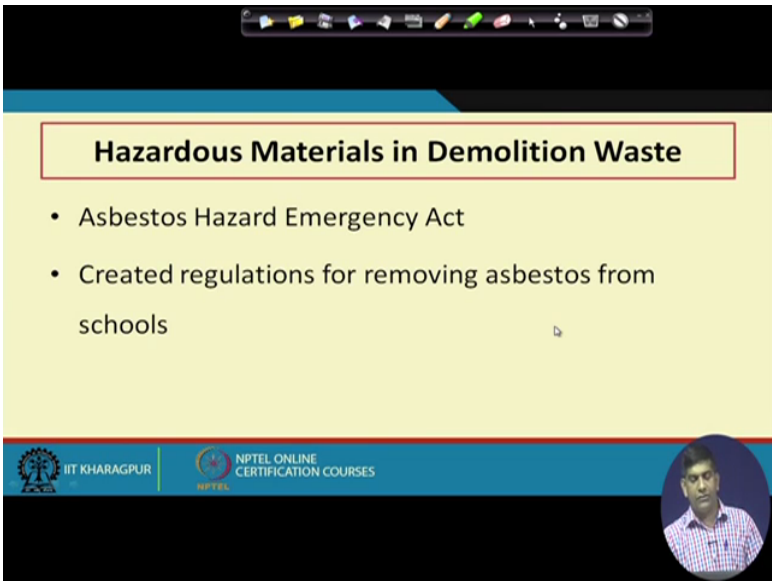

So then there are some hazardous material like several in terms of asbestos we have asbestos hazard emergency act, asbestos ban on phase out rule, national emissions standard so NESHAP, HASAP all those tenders are there. Asbestos hazard emergency act created regulations for a removing asbestos from the schools. So nowadays the old buildings still have asbestos, because asbestos was a very good installation, so that is why in old buildings in many parts in the Western world they still have asbestos. So when they try to take the building it requires lot of efforts because it has to be taken out in a way so that less and less number of people are exposed to it.

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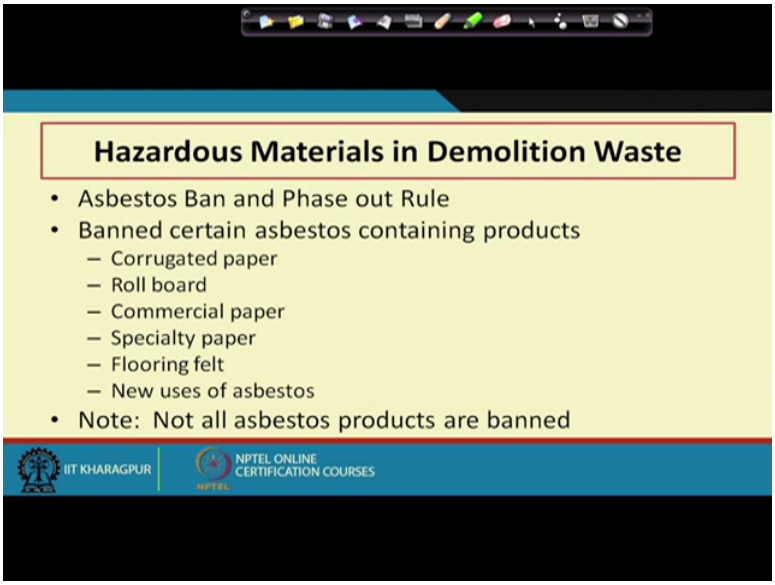

So asbestos was ban certain asbestos-containing products like corrugated paper, roll board, commercial paper, speciality paper, flooring felt, no uses new uses of asbestos, so all asbestos products not all asbestos product are banned but there are certain asbestos products which is not being used.

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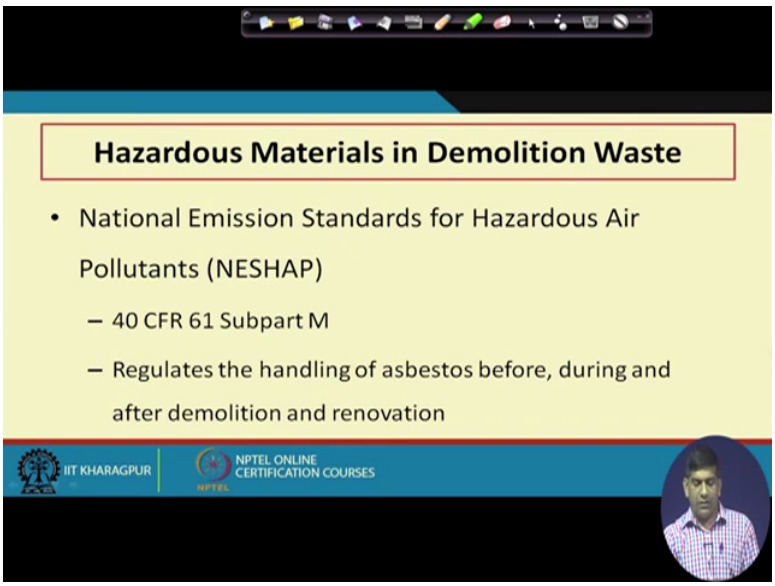

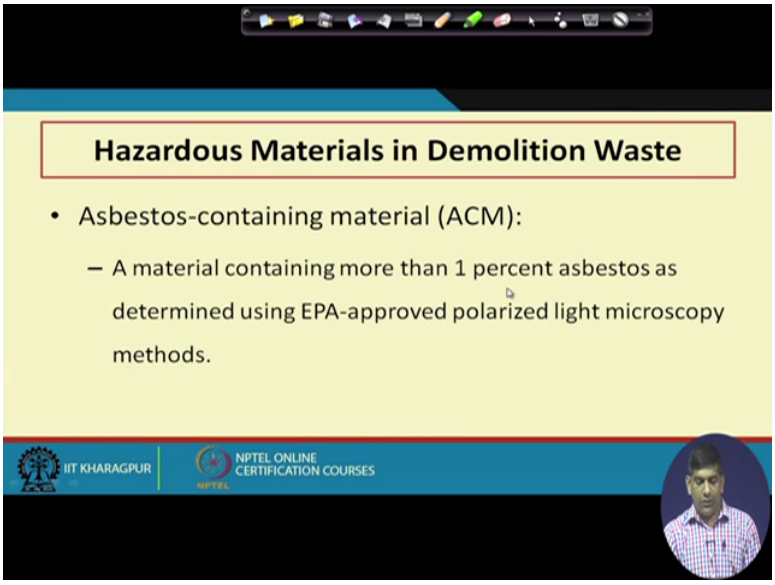

NESHAP is there which is one of the hazardous waste air pollutant rules as per the US rule part here as regulating for handling the asbestos before during and after demolition, so there are again asbestos containing material, if you have more than one percent asbestos using appropriate light microscopic method, so that is considered as asbestos-containing material, if you have more than 1 percent, if less than this percent you are fine.

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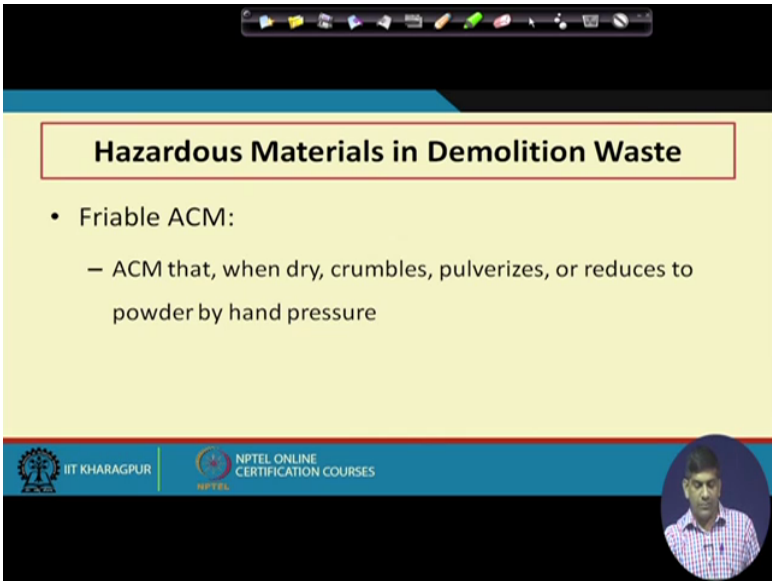

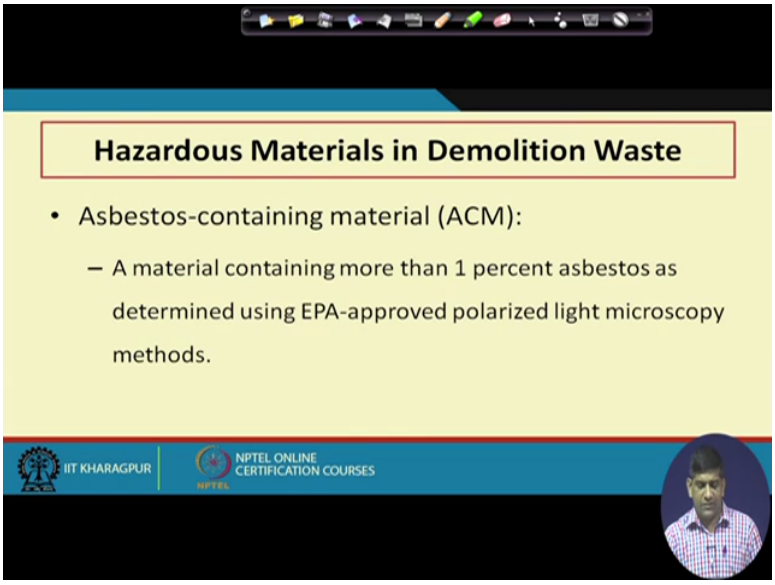

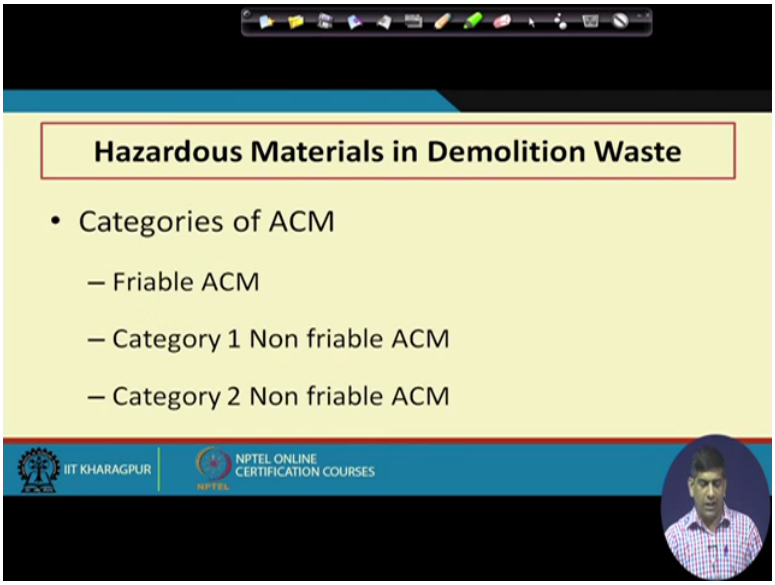

So in terms of asbestos material like when it is dry it crumbles, pulverises or reduces to powder hand pressure, so you can do that. Asbestos-containing material they can crumble and so categories of ACM like friable ACM, category 1 non friable ACM, category 2 non-friable ACM, so those are one which is used in terms of different types of material.

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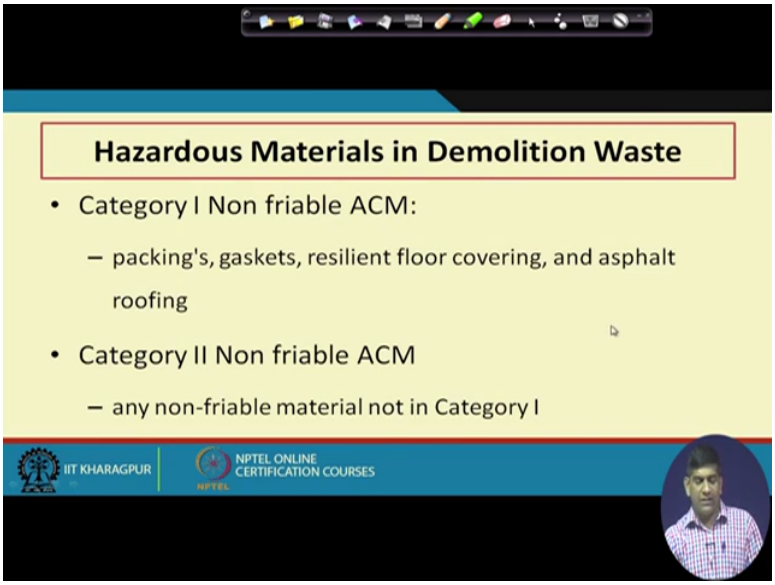

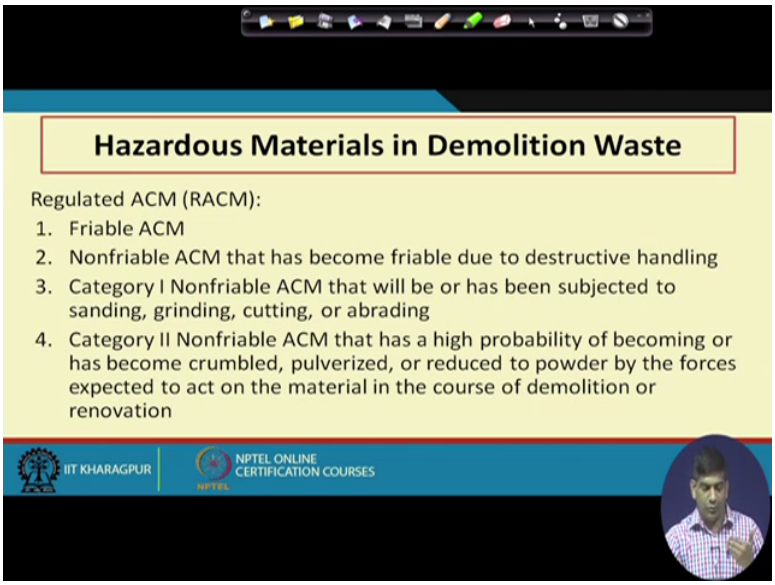

Non friable ACM like packing's, gasket, resilient floor covering and asphalt roofing non-friable another category is any non-friable element not in category one, so which is you can have friable ACM, non-friable ACM that has become friable due to destructive handling. Category 1 non-friable ACM, category 2 non-friable ACM, so those things are seems to be working okay. So that can be used in terms of it is you we have to be careful in terms of its recycling but there are based on its if you process it on those lines, it can be potentially be used.

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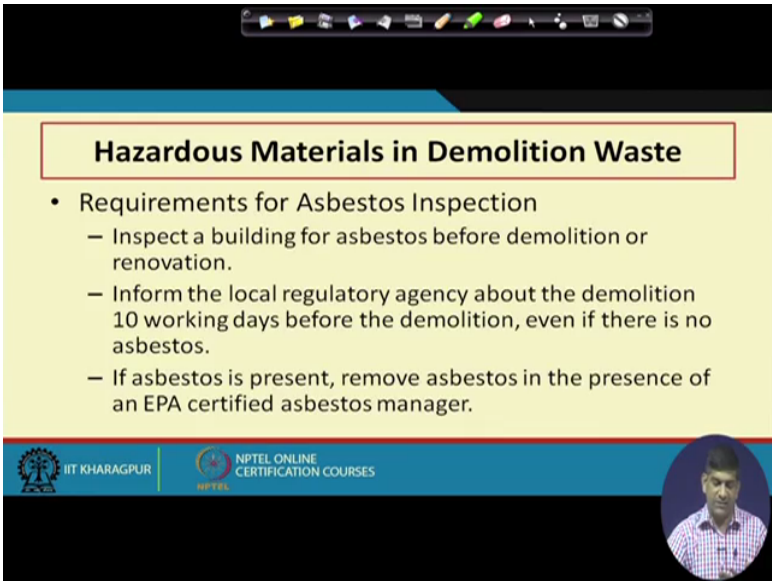

So it is we talked about this then requirement for asbestos inspection inspected a building for asbestos before demolition or renovation. Inform the local authority water demolition 10 working days before demolition if asbestos is present, remove asbestos in presence of EPA certified asbestos manager, so those things are there.

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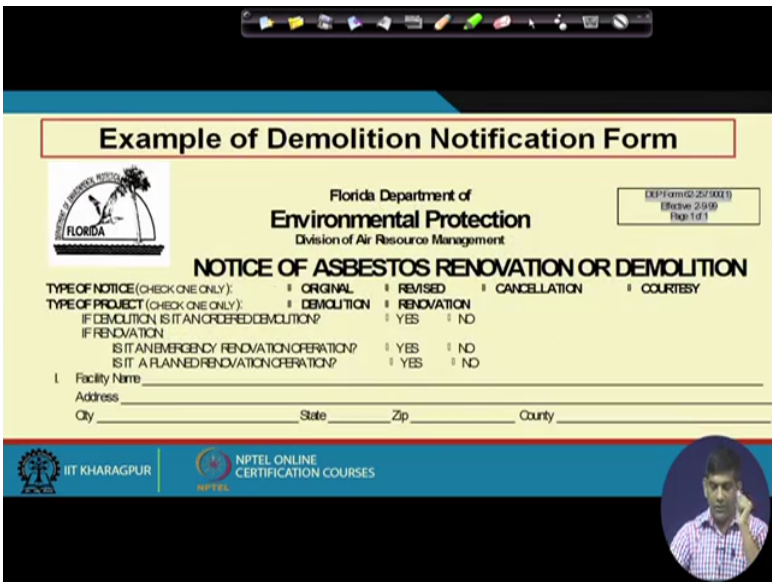

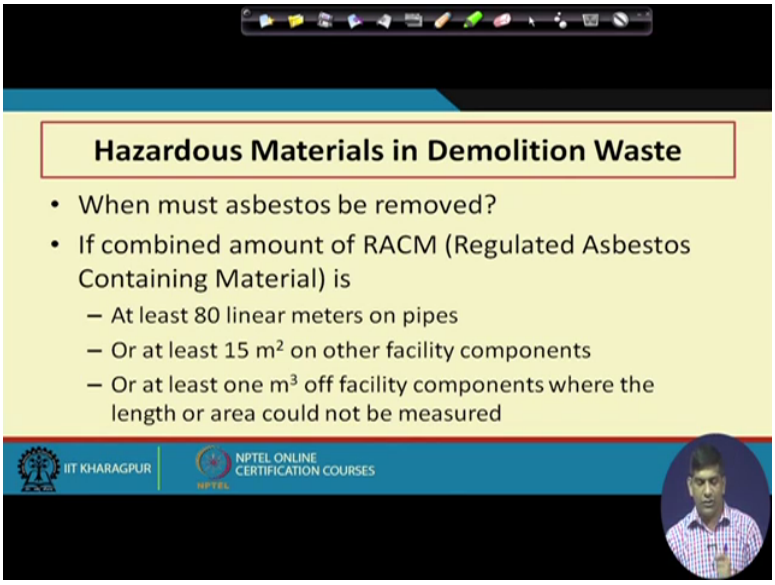

So it is a rule we need to do a notice of asbestos renovation, so if wherever you are working with asbestos is very-very important because it creates lot of lungs issue and other stuff. So when must asbestos be removed? If combined with regulatory asbestos-containing material, so you can have lot of like a you know so even you have if you have combine that regulatory asbestos containing material gradually we are trying to get rid of all this asbestos material.

So if you have for example here we have 80 linear metres on pipes, at least the 15 meter square of other facility components 1 meter cube of facility components were the length or area could not be measured, so those are in terms of area for this asbestos thing that we are talking about.

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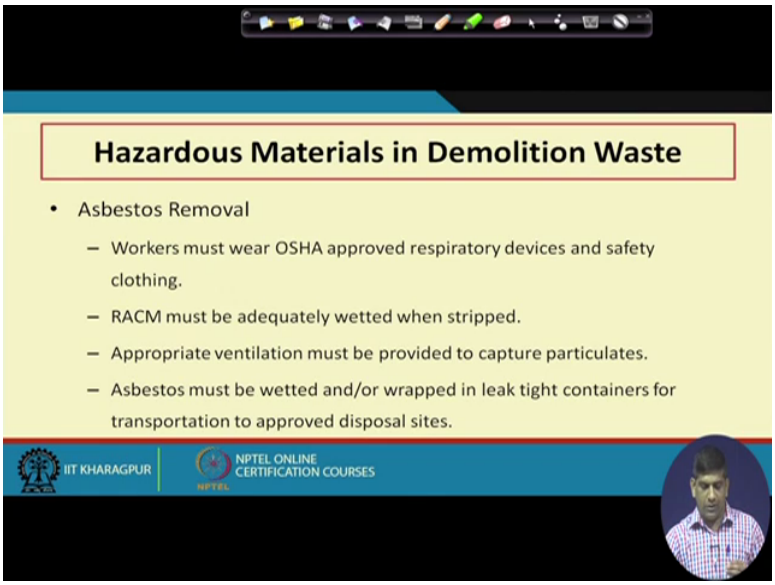

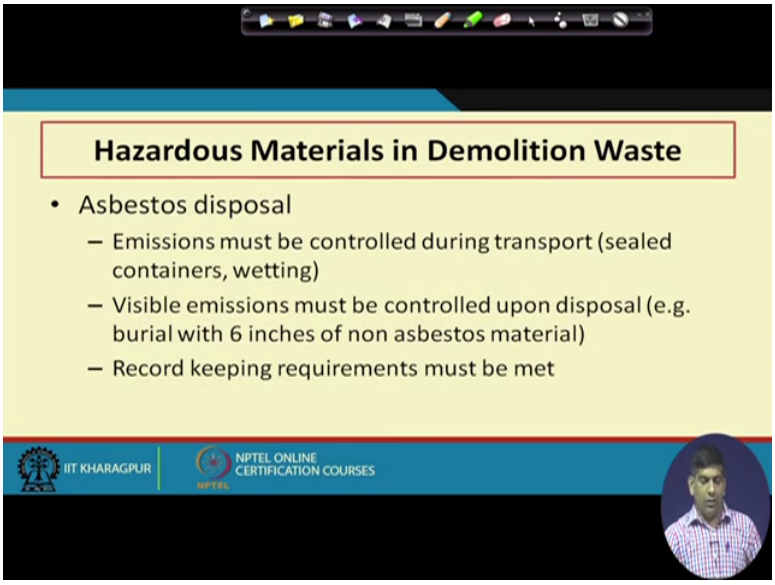

So in terms of removal workers must wear OSHA approved respiratory disease, RACM must be adequately wetted, appropriate ventilation must be there, asbestos must be wetted or wrapped in a leak tight container. So in terms of disposal we try to control your emission by sealed containers, wetting, while visible emission must be controlled upon your disposal, burial with six inches of non-asbestos material. Record keeping requirement is a must.

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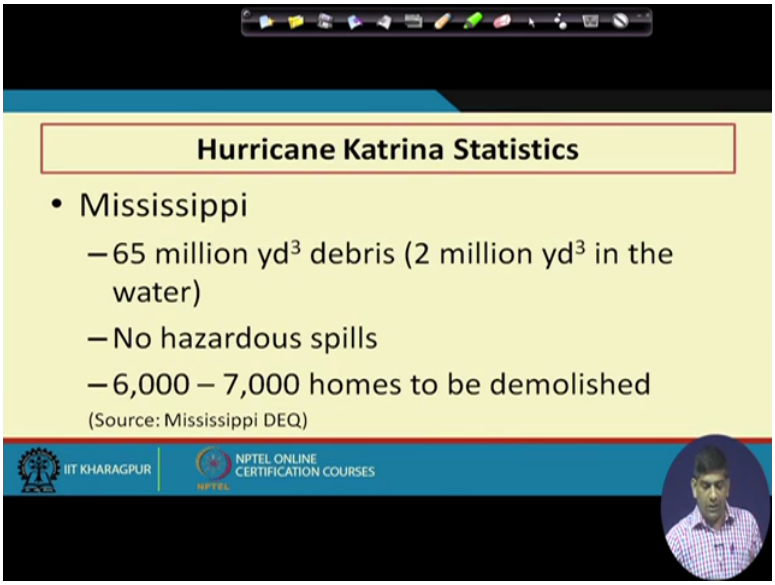

So in terms of other so this is basically if we have kind of talk to you about all the different types of material, so one of asbestos is one of the more nasty one. We do not use asbestos in our construction that much we do use asphalt asbestos tiles in India and there is basically asbestos mixed with cement and other stuff.

So asbestos tile as the tiles are not going to harm you, but if you are using and working in a plant which uses as a raw asbestos a lot in terms of making these asbestos tiles and you are exposed to that that is not very good for a long period of time. And the other thing is that like there are in terms of this what I was talking about that it is a since it is why it was being used? Because it was very good fireproofing material, it is a very good fireproofing material, it is cheap so with the insulation material, so that is the reason the asbestos is very popular.

So asbestos one of the thing in terms of construction and demolition waste when we talk about asbestos we do not mix it with other C & D debris keep it separate. So in terms of in Indian context when we have those asphalt sorry asbestos tiles, if you break those tiles make them fine powder and try to play with that off course you will get expose little bit of asbestos fibre, but otherwise you should not be exposed asbestos fibre unless you are working with asbestos fibre in a in that like industrial facility.

So that is kind of give you some idea about what are the different material there, what are the what is the C & D waste, how it is managed mostly recycling and of which cannot be recycled landfills **(())(25:31)**, so those are two there is no we are not talking about**,** e-waste to energy or those kind of stuff because which to most of the stuff in here does not have that like a calorific value and all that other than wood possibly. So that is wood is used in a boiler fuel anyway, so that is that is over there.

So in terms of this particular module we talked about we started with looking at different types of C & D material, we talked about the markets of them, what are how they are potentially recycled into what kind of new product. And so now we will I was telling you I think in the beginning of this video itself that I will try to cover little bit of project related stuff related C & D waste.

So we had one issue of in terms of hurricane Katrina and will talk about that and we will I will try to show you some pictures from Haiti as well and then if we it as part of like if you know like if you are from Hrishikesh, if you are from Uttarkashi and those areas or if you in wherever say recently we had issues in Bombay in terms of lot of rain on over a period of two-three days. So if you had seen some of this construction and demolition waste and if you are aware of how this C & D waste was managed in your area or is typically managed in your area, feel free to put that on the discussion board it will help each one of us, I will also learn something new.

But at the same time I would it is we are talking about construction and demolition waste, so that is this is on municipal solid waste there is a separate question there we already asked you about that if you have not responded to it please go ahead and respond and as I promised as I mention in the last video that towards the end of this course will actually make a summary of your respondent and then we will try to share that with you in the form of one extra video.

So with that let us close this and then in the next module I will try to go over some of this hurricane Katrina and I will show you lots of pictures basically next at least next module will be pictures and pictures and pictures and we will talk through pictures, because pictures actually it is very-very important in terms of conveying some of the aspect which is much easier to do it using pictures than other words.

So with that let us close keep putting your stuff on the discussion board and if you have any questions contact us through the discussion board will be more than happy. Exam registration, I think it is you may have already done, if you have not done still dates is there go ahead and do that if you are interested and so I think that is pretty much of it this particular video and then I will see you again in the next video, thank you.