Electronic Waste Management - Issues and Challenges

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Lecture – 15
Recovery of Metals from Electronic Waste (Contd.)

So, welcome back. So, this is the last module for the 3rd week. So, we have been looking at the different ways of extracting precious metals from electronics. So, if you remember from the beginning we talked about what is the an E- waste we get the definition.

So, in terms of E- waste the definition we looked at the us definition the North American definition European Union definition and all that. So, and then we also talked about the health effect what are the different contaminants there what are their health effect we looked at little bit some of those contaminants in slightly more detail as well and being done that then we started looking at how things could be managed properly.

What is the map and in terms of management recycling is of course, one of the major stuff in terms of E- waste, that is the most favored option in terms of managing and when we try to recycle, one of the goal is to recycle, these precious metal because one of the major reason why even this course we have look you are taking this courses because of potential environmental impact from these rare earth and heavy metals and certain organics and in terms of the rare earth and the heavy metals most of them are costly.

So, we want to recover these metals. So, that it becomes a profitable business in terms of electronic waste management. So, we looked at some of the methods of how to do the recovery we started with how to get it from E- waste to this liquid phase and from the liquid phase finally, to the solid phase in the pure form the concepts are very similar to what a typically you will do in a mining and metallurgy for iron ore like a for gold, copper, silver and others which are they present in electronics.

So, we had looked at variety of technologies. So, the last if you remember from the last few minutes in the last video we were talking about a hybrid technology. So, let us start from there which is essentially a combination of both biological as well as a chemical we looked if you remember in the previous video I talked about that biology in bias option

and then we also talked about certain chemical methods in before that. So, hybrid is kind of mixture of the 2. So, let us start from there.

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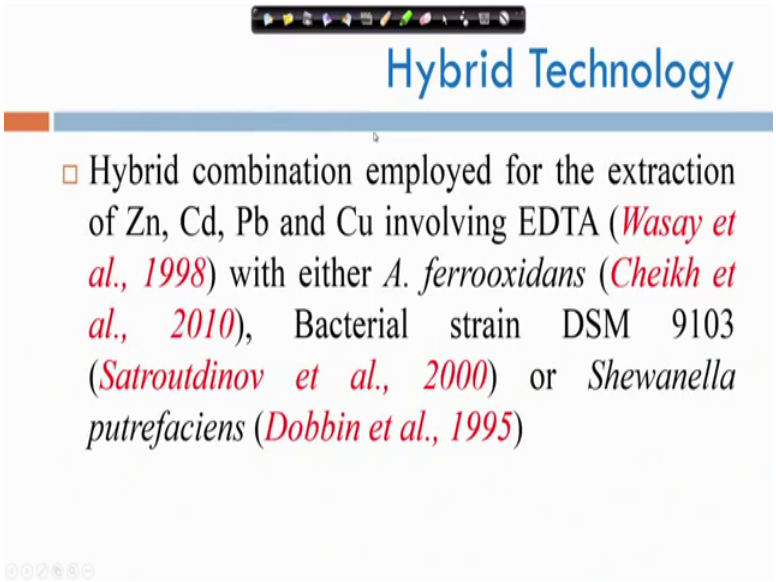

So, hybrid it is a we do use hybrid technology using this there have been like a zinc cadmium lead copper these had been had been shown that using EDTA and certain bacteria, which is a Ferro oxidant bacteria Ferro we can be used with a certain bacterial strain and things could be recovered.

So, here we are using both we are using EDTA which is a chemical and we are using group of bacteria so to make up the job for us.

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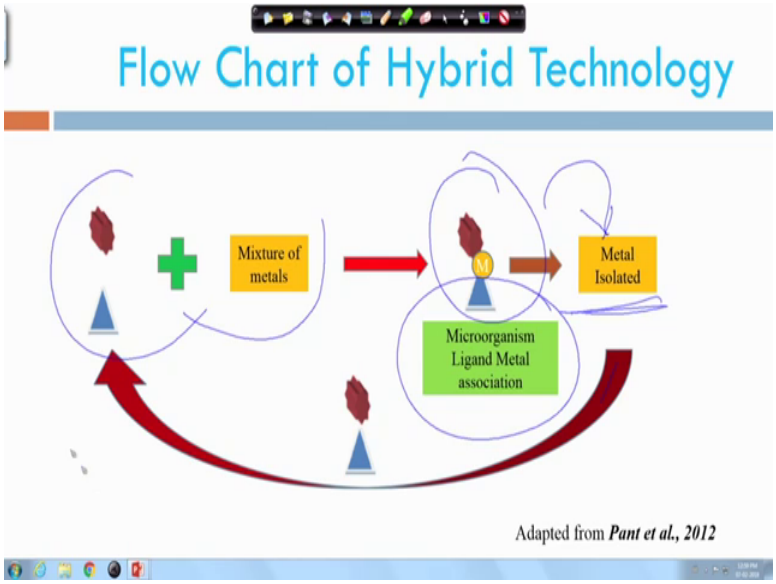

So, in terms of how it will typically work. So, you will have in terms you have the mixture of metals, you have the microorganism's ligand metal association. So, things will like if you if you think about in here. So, you have this mixture of metals. So, met metal has been isolated. So, you have like a we have certain reactions going on with the microorganisms then you have mixture so this plus mixture of metals.

So, we have some bacteria and other stuff in terms of in terms of the mixture of metals then we will have some metal is still left, but whatever the targeted metal we can have it isolated. So, and then we can repeat the process again for the next metal and for the next metal. So, this is how typically it can be done. So, and for that we can use different types of bacteria different strains of bacteria who which can do better for which metal. So, luckily like a Mosay if you think about the Mother Nature all has lots of solution already inbuilt for us.

So, these bacteria's are naturally found bacteria. So, we have to just like identify them may strain them and then try to get them to do the job for us. So, it is a. So, solution is there we have to only look for the solution and then we can we can target different metals and recover those. So, this is typically how you can do it in terms of flow chart for that hybrid technology.

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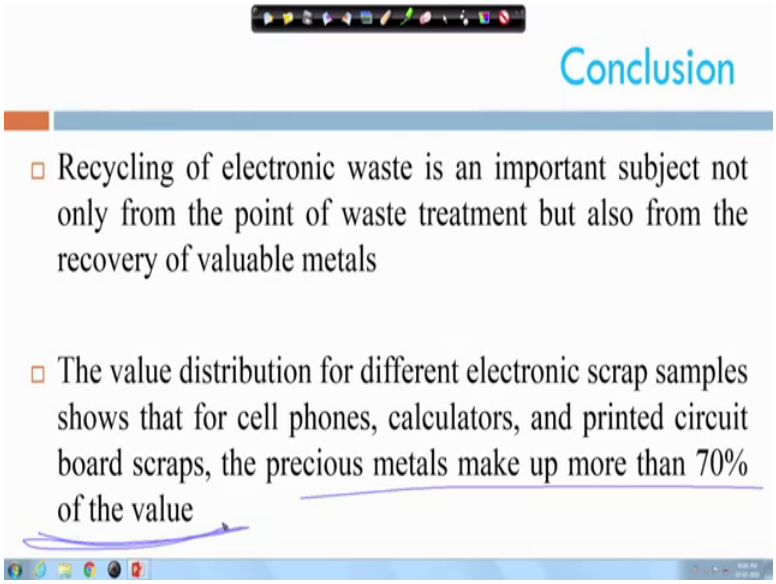

So, in terms of it is in terms of recycling it is not only from the it is a important subject not only from the point waste treatment, but also from recovery available material as I was trying to say the value distribution from different electronic samples shows that for cell phones calculators printed circuit boards the precious metal make up more than 70 percent of the value.

So, in terms of cell phone calculators and printed circuit board scraps the precious metal that is there it makes up more than 70 percent of the value, which is there in terms of the amount of precious metal present. So, that is a lot in term and then that that should be recovered and that, but only many times it is just a lack of technology.

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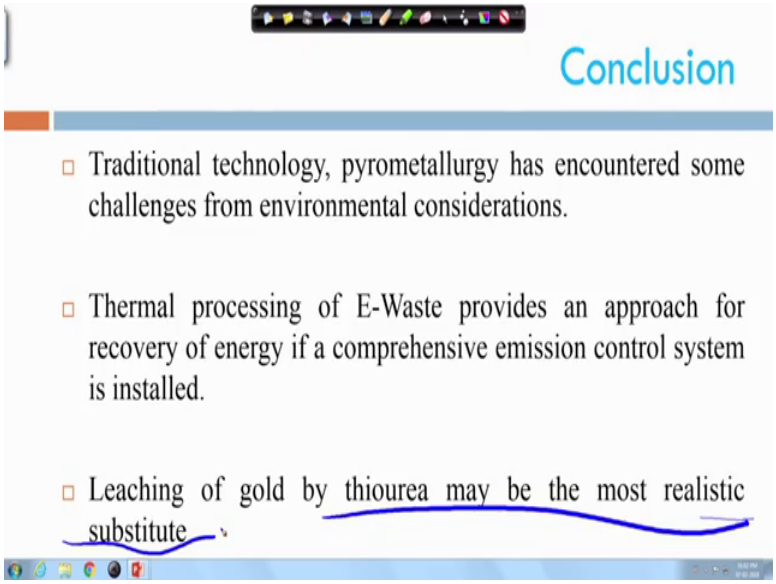

And so traditional technology Pyrometallurgy has encountered some challenges when you are trying to use pyrometallurgy with the waste that is produced is a problem, thermal processing of E- waste does recovery of energy, but mostly we it will apply, but will burn is your plastic, but you need to have a comprehensive emission control as well, because plastic when it burns has lot of air pollution issues leaching of gold by Thiourea was found to be most it has been as per present research see. These are all based on present research things may change because if you some of you can do a come up with a better mechanism of these extraction of course, that will be incorporated in the literature and things would change.

But as of present condition Thiourea was kind of considered to be a good option there biotechnology has been one of the most promising technology in the metallurgical like a bio leaching biasorption, biosorption number of advantages low operating cost, minimization volume of chemical biological sludge needs to be handle. So, and then the scope of hybrid technology is still being studied.

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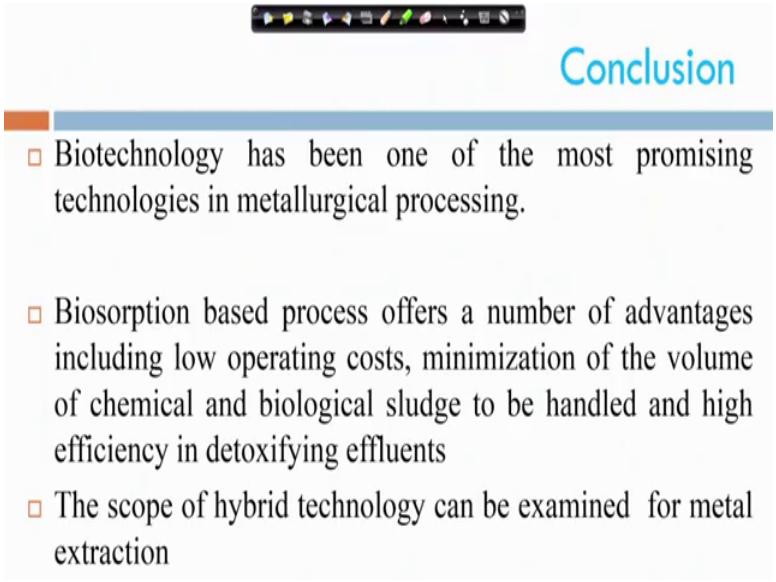

So, those are what we have looked at in last video and slightly in this video as well.

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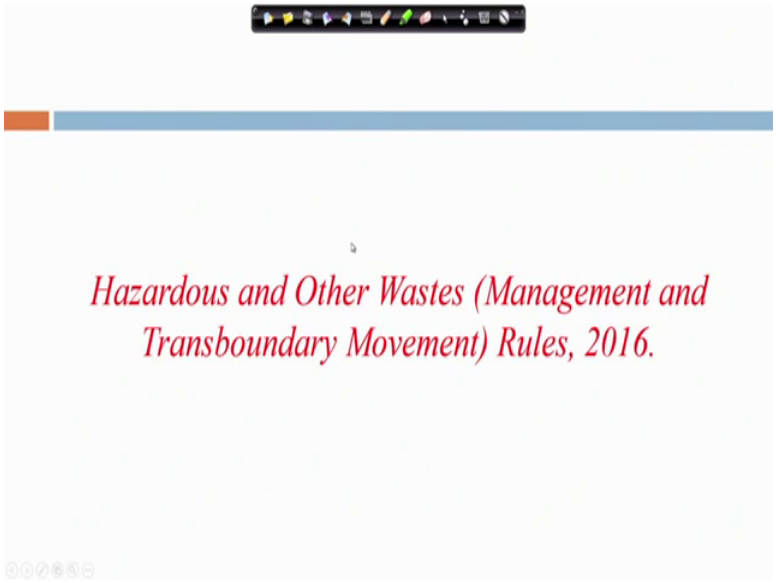

So, being said that we will talk. So, we have kind of covered about the extraction part now will talk about a little bit on in terms of the hazardous waste management rule and then the E- waste management rule 2016, where the management and the trans boundary movement. So, in terms of the hazardous waste it which is started on October 2016 we will also look at will quickly look at this and then we will talk about the E- waste in E-waste rule potentially in the next slide next video.

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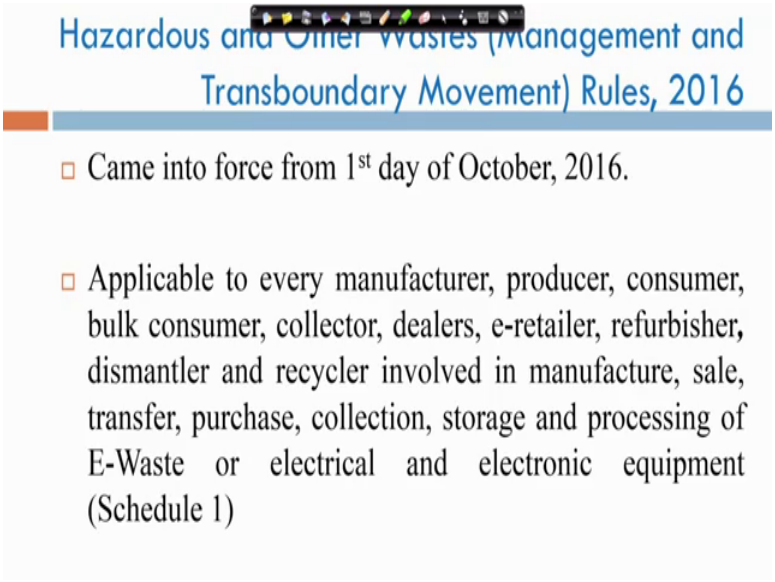

So, it is it came into force in first of October 2016 it is every manufacturers produces bulk consumer collector dealer retailer publisher. So, they are they have to do it a processing of E- waste electrical equipment.

So, this is it has to be used. So, it is in terms of electronic waste management.

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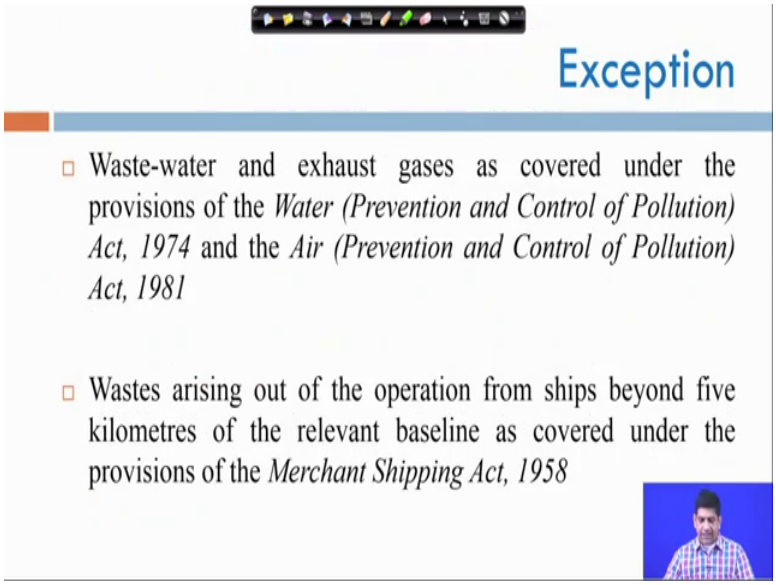

Exception is that wastewater on exhaust covered under provisions of water act or the air act. So, wastes arising out of the operation from ships, and other stuff is there not included.

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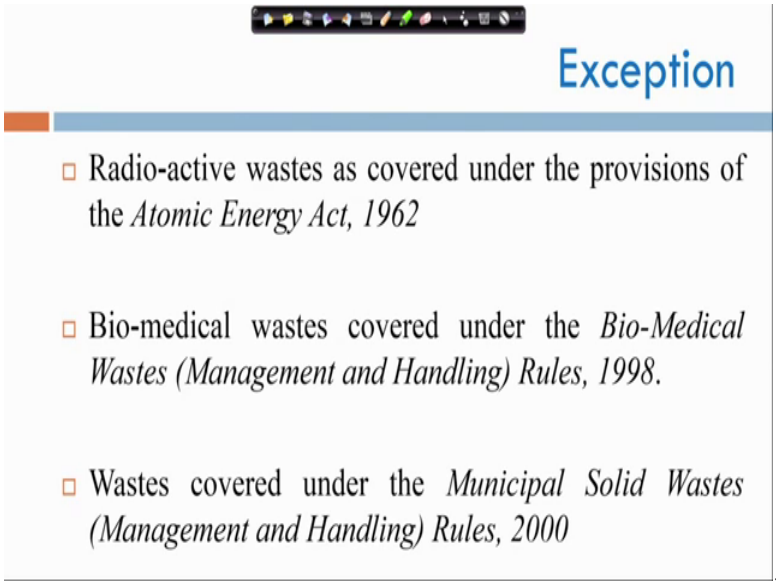

Radioactive waste is not included biomedical waste covered and the municipal solid waste tools is also not included. So, these are because they are handled separately.

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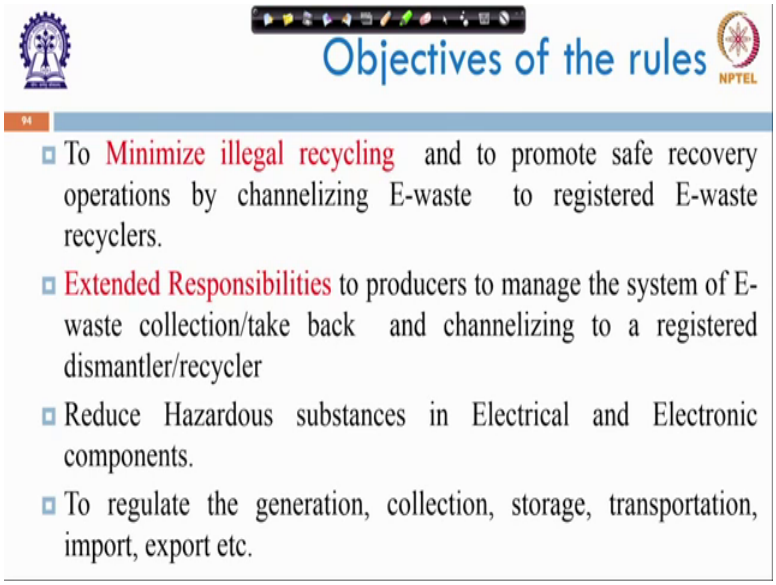

So, the objective of the rule in terms of the electronic waste so what we were kind of talked about the UA quick overview of hazardous waste because there is a hazardous waste management rule, there is a separate E- waste management rule, in terms of the US management we the goal is to minimize illegal recycling and to promote safe recovery operation by generalizing us to registered E- waste recyclers, we have the extended

producer responsibility to manage the E- waste again that is many times it is difficult to implement because it is a it is in terms of extended responsibility to produce to manage the system of E- waste collection.

So, first we need to have E- waste registered E- waste recyclers there is a list out there and there is also, but many of those are not in applicable 100 percent operating conditions and then for every city or every city we need to have some sort of place where the producers have come up with a waste collection or the take back approach. So, we have we do not have those information's yet.

So, in terms of E- waste management rule as also even for MSW management rules just very recently if you remember a few couple of weeks back again the supreme court had a directive asking the center that why it is not being implement why the MSW rules are not being implemented, as it should be although the rule has last more than 2 years ago. The reason for that for these many of these and the actual the initial rule was passed in 2001 the 2016 is it is a revised version of that so, but it is still to implement it the infrastructure needs to be developed same thing with electronics, here also we are talking about extended responsibility. What is the extended responsibility; that means, the producer is responsible for the electronic waste disposal and management?

So, it is a Nokia, Sony, LG whoever is the producers they are responsible, but what is happening is if you have this individual companies do the all these things by themselves there is a lot of duplication and the volume also goes down the economy of a scale probably may not work, in many smaller cities may work in Delhi, Bombay and all those metro and semi metro places, but in the smaller cities like where I am sitting right now in Kharagpur, it may not work.

So, why not we need to have some sort of collaboration between all these industries and that collaboration has to be facilitated ah in my view through some sort of government intervention, if you look at because when there is a government intervention the chances of person listening is more, I am not saying government should get into it because always when we try to in try to have too much of a government it becomes a problem in terms of efficiency in terms of corruption and all that.

So, to avoid that we do not want to go that route, but at least have some sort of facilitator role that 1 government office has to provide, in terms of bringing all these industries

together to set up a system in place. So, that we can really do this extended producer responsibility otherwise it will just be on the paper will not be able to do that. So, there, but that is a where we need to have the recyclers we need to have the registered collects collection collectors and if you have a tact Dickbag program how that is going to happen all these things has to come and another objective is to reduce the hazardous substance in electrical electronic components regulate the generation collection storage transport.

So, this some of these part is very similar to what you have seen in the hazardous waste management rule as well if you have had a chance to look at it, all these rules are available online it is you can go on Google and just say E- waste management rules India you will get the PDF hazardous waste management rules India get the PDF. So, all these plastic waste, medical waste, like biomedical waste, municipal solid waste, all these rules are available in public domain and I if you are interested in the waste management sector, as since you are taking this course I and I assume that you do I would strongly encourage you to download those rules and then look at them.

Many times the rules are not very interesting to read they are like boring like a, but we need to know them we have no other option because we have to know them at least the big picture of the rules to. So, that we can make sure that things does get implemented as per the rules of the land.

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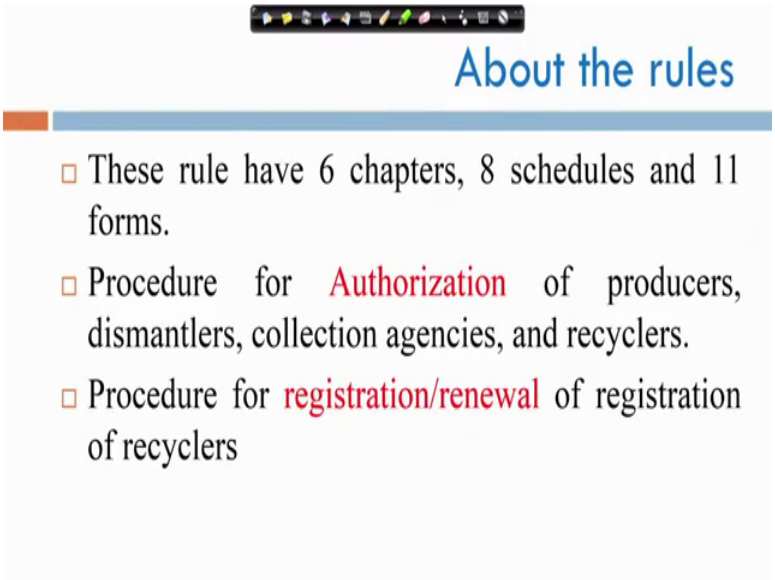

So, that is important there are 6 chapters in this rule 8 schedules 11 forms again we are not will not go into nitty gritty detail because as I said it does get boring, but we will just do a quick review of what the rule is all about and there is a procedure for authorization of producers dismantlers collection agencies and recyclers. So, if you have to get the authorization you have to take the licenses for these purposes and you have to register you have to renewal of registration of recyclers.

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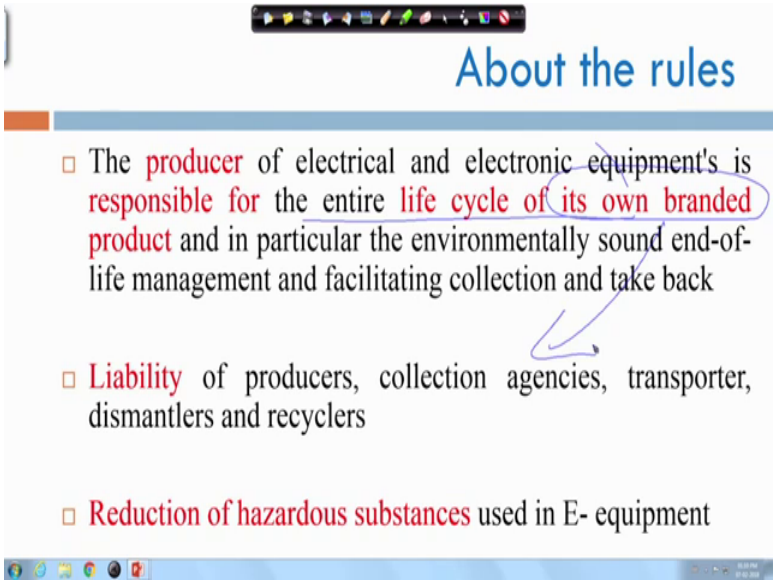

So, the producer is responsible for the entire lifecycle of it is own branded product that is where, I have I agree with that idea that is a great idea, but in terms of implementation of this idea it is a little bit of that is what I was trying to explain you that somehow the government has to come together and facilitate.

One example I would like to give in many countries in other provinces in Ontario they have a Ontario stewardship program Ontario E- waste stewardship program for example, where they charge certain amount of money for every electronics sold, by the producers and of course, that money gets transferred to the consumer ah because it somehow it will, but anyway.

So, it is a you have a pool of money because you know how much TV of Sony is being sold how much TV of Panasonic is being sold or LG or whatever different companies are out there. So, based on that we can get the pool of money the result it is a semi government body which oversees the whole process and then they can set up the

collection events the recycling irrespective of the brand. Because if every brand has to say if they have to rather than they do the entire lifecycle of it is own brand, if all the different brands come together, if the different brands come together and do it together it is much better, but how they will come into how they will come together, how they will do it together, for that they need advice guidance and also oversight by certain government body.

And then it becomes economy of a scale to otherwise think about place like Kharagpur where we are right now how many TVS of Sony will go bad in a day or in a month maybe few for the wholes town and then if. So, you have there is Sony has set up a place where they are collecting these material they have to put a employee there the employee has to get a salary and they have to find a place they may have to put a rent for that.

So, things may not be that much profitable for it then that case what the company will do the company will try to find a shortcut they will try to see if we cannot do it and still survive somehow either hook or a crook or a bribe or whatever.

So, to avoid that it is better to let us bring all these different electronic manufacturers together and set one facility where you have a and depending on this like if you in a big cities there could be multiple facilities, but in smaller cities at least one facility. So, that people can go and drop off their old electronics. So, that it is not becomes a problem in terms of the environmental impact.

There are certain liabilities has been given in terms of the producers collection agencies transporters dismantlers and recyclers. So, those are every everybody has certain liability certain rules certain responsibilities reduction of hazardous substance removal of anything, which is like a mercury led other things we need to kind of get rid of them from time to time.

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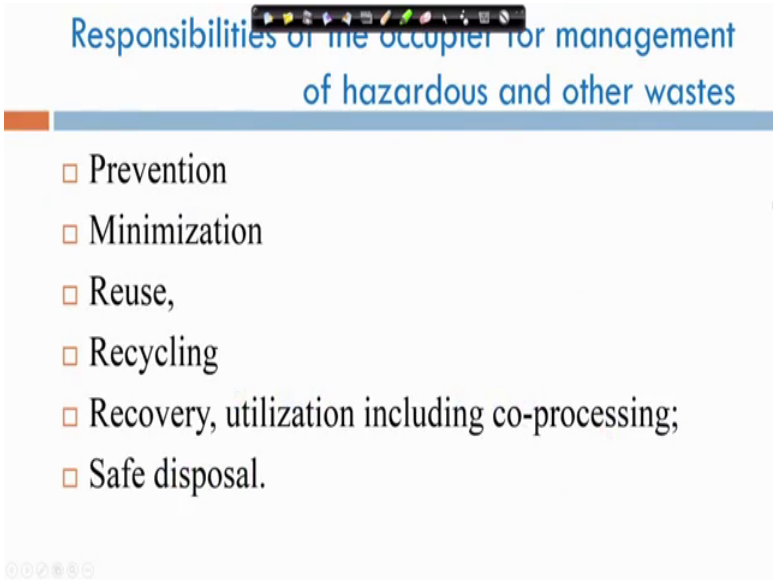

So, in terms of responsibilities there is a responsibility of occupier of a for the management of hazardous and other wastes like including it is a prevention minimization reuse recycling recovery safe disposal.

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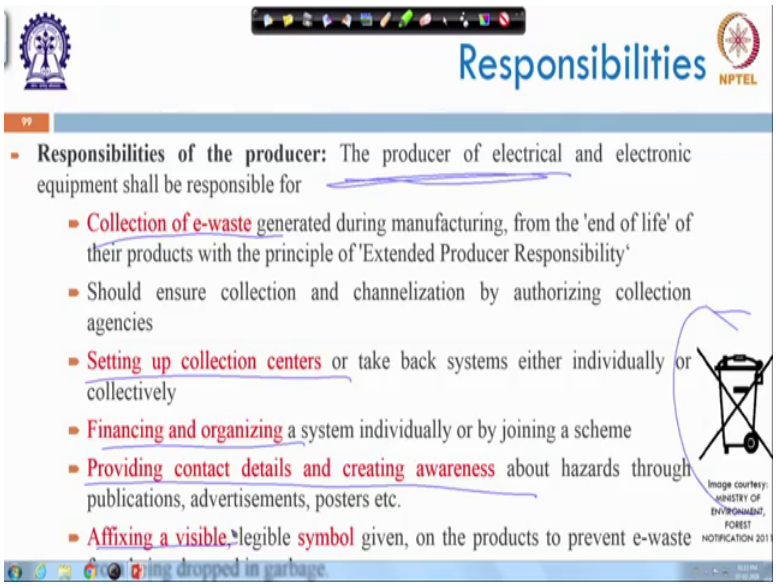

So, in terms of E- waste responsibility; responsibility of the producers again we all not read all that you have to make sure that read you can read that this PDF will be provided to you these have been taken from the rules directly. So, you can read the rule as well. So, it is the same thing just we have taken a summary of the important point of the rules.

So, the collection of E- waste is it in generated in the manufacturing and collection has collection and generalization has to be by authorized collection agencies.

So, first of all we need to make sure the authorized collection agencies exist setting up the collection centers and financing and organizing. So, providing contact details creating awareness, a affixing a visible legible symbol on the product to prevent E- waste from being dropped in garbage. So, like something on the or what you see on the right hand side. So, those kind of label could be done for now for the producers say if some you electronic producer has to look at the collection of E- waste setting up a collection center financing organizing providing contact detail creating awareness affixing a visible.

So, some of these they can do, but for some of these in my view they need help because we can just not because that is not their expertise these companies are good in producing electronics, they are not good in managing electronic waste well whatever say unfortunately we do not have we can say that in India we do not we have no probably not many places we have the expertise for managing waste may be true.

But at least the ULBS are doing it whatever with the all the challenges and limitations that they have they do most of the ULBS have the intention at least to serve manage their waste properly. Because since there are lot of drawbacks there are lot of bottlenecks which they have to do with deal with on their day to day basis it is many times from outside you do not get that picture when you talk to them, when you listen to them when you go and spend a day with them you all realize that what challenges they face. Why our waste is not being managed as good as we would like to because there are lot of physical challenges as well there is a way infrastructure challenges.

I essentially hope that as part of all these Swachh Bharat mission and all will have lot of infrastructure build up, capacity build up physical infrastructure as well as the intellectual capacity. Intellectual capacity is also needed most of the ULBS they do not have people who really understand the waste management as what it should be as of today's context the people are not trained in this area.

In fact, to make the Swachh Bharat mission really a success what we need is a lot of training center, when I am talking about training center the real ones not just having a one day an event most of this training half a like first one enough first morning half like

half of the morning, will just go in having that inauguration and that all that flower exchange those are not needed at as such just a little bit of that will be enough and then that validatory session why we need that I many times I do not really understand just focus on the issue, having to be we do lot of extra things which is not needed and restrain and then mostly the focus is and what is the food who is the caterer.

So, those are important I can have good food at home, but let us focus on how to manage the E- waste let us talk about that why you might be it maybe let us say out of context, but I personally had some experiences where I have gone for giving the training program where initially I was told that it is actually a 6 hours training program. So, I had the material made for 6 hours, but when I reach there I realize that the first one and a half hour will be just used for that inauguration function where all these big people will come and give a speech I do not even understand why that is needed and then they do not stay they just go because they are. So, busy these people they cannot stay and listen to this E-waste management issues.

So, why they come even for the inauguration function, why they we do we need them do we really need them I need the people who will really work on the field, I just want those people to listen to me who will do the day and then day out work on electronics or municipal solid waste, because they are important to me this hi hi fi vips are they can come just maybe a little bit 10 minute function that is it and have cup of tea and they can leave and then focus on, because out of that 6 hours I ultimately I got only 3 and half hours to do it because they had a valedictory function also at the end which was which took another gift exchange thanking each person to another person I sometimes I do not get all those clue.

But we need to change those things does not happen outside India it is maybe in some other the less similar countries, but most of the western world and other places they do not waste those hours doing those just formal formality, I do not those things are not really needed what is needed is the real training program where the focus is on training not on these other accessories associated with the training.

So, coming back to our E- waste management rules so they are the in terms of there is a responsibility the producers are given certain responsibilities of course, the rules are there we need to follow the rules will have certain shortcomings and in my solid waste

course those of you who have taken maybe probably in the previous semester we talked about MSW management rules shortcomings too.

So, it is there and it is, but as we learn will improve it is not it is it is not that we should not as we learn from the rules we will we will keep on improving the rule because we will find out that these things is working this thing is not working. So, these are always these things are dynamic these are work in progress kind of stuff.

So, it is a do not take me wrong it is not I am not saying that the rules are not I am what I am trying to say is that certain things and the rules as of present conditions may not be implemented what we need to do is we need to develop the infrastructure, physical infrastructure capacity infrastructure intellectual infrastructure to support. So, that we can really implement these rules and that is true for all the waste management rule municipal solid waste E- waste and other rules as well.

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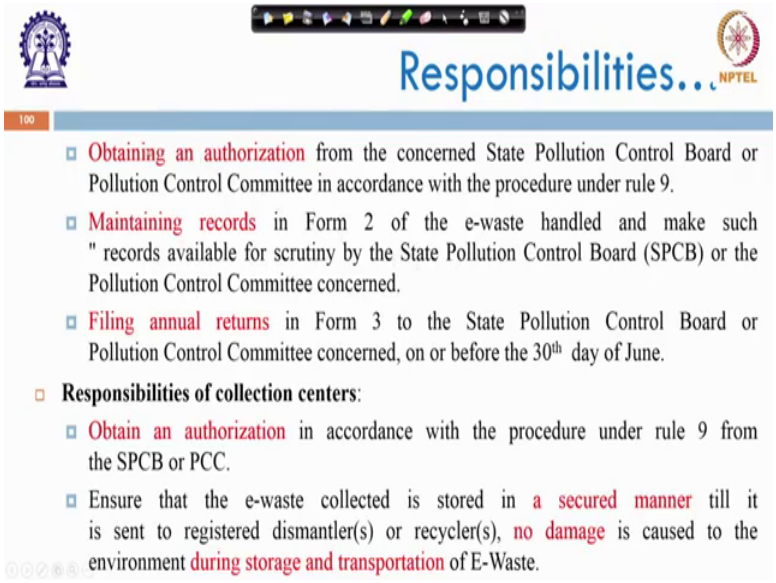

So, then for the then other they have to obtain authorization they have to manage they maintain the record fill annual returns. So, these things are very common for all the rules ill not you can read about that there is a form, different forms are there, then for the collection centers again they have to obtain authorization they have to look at the storage secured manner they have to collect the E- waste in a secured manner no damage is caused to the environment during the storage and transport there will be the see.

We again some of the language is also very scary no damage is caused to the environment sometimes we do not have things on our control. So, thing is that if the damage does happen we have to manage that incident properly, we have to have a proper management of certain spill and other things that is happening over there.

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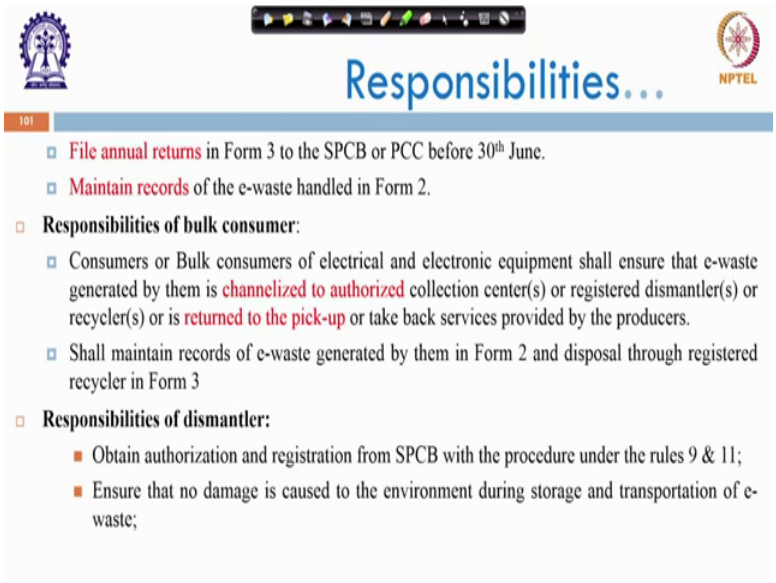

Then file annual return maintain record responsibility of bulk consumer is also bulk consumer is like a big companies and other places those are bulk consumers and then dismantlers. So, you can read about all these little records. So, there is nothing much in there.

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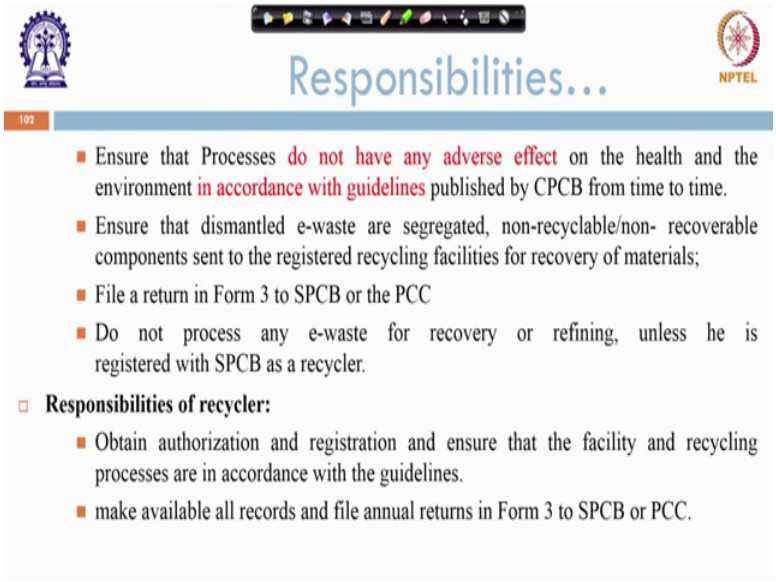

It is a pretty much straightforward reading it is a then you have the do not have end again no inverse in fact. So, all these get the why these rules are there to prevent the human health impact on the hint and the environmental impact. So, just to have since there are different stakeholders each stakeholder has to do certain things. So, those things have been explained in these particular sets of those some slides which is there and the same thing is there in the rule as well.

So, it has just been taken from the rule just like a small summary of the E- waste management rule is presented on this slide, I encourage you to read these material and there is it is all you can understand it, whatever the important point I am trying to cover over here and read it if you have any question put it on the discussion forum this is again this would be a very good I will be really happy if on we can have a really good discussion forum going on this E- waste management rules, what are the good thing about it, what is the what are the shortcomings, how the shortcomings can be overcome see you right we have around more than I think more than 4000 5000 students on this course something around that number and if there is a 4000 5000 brains working on this particular topic.

We may come up with some solution here, which could be much better than the other like a solution, which is there in the rules right now and that may help us to improve the rule.

So, use your look at the rule critique the rule and do it on the put it on the discussion forum see the honest critique is always good we are not criticizing any person here, we are just criticizing a we were looking at the rule and we are looking at from a different angle fresh ideas may come.

So, please do that as part of the discussion forum it will really be interesting and we will try if we can put a question here to help you with that. So, that we can has an additional assignment a question will be sent on. So, that you can use it have to make this stuff. So, I will we will try to get that questionnaire out so to help you with that. So, then we have responsibility of the recyclers SPCBS PCCS.

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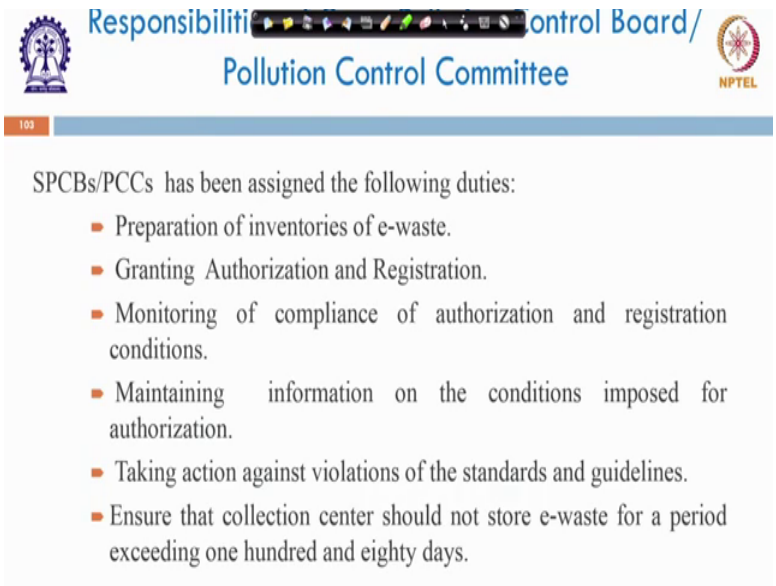

Responsibility has been given where they have to basically they have to collect all the information some different stuff they have to make sure the things are in compliance.

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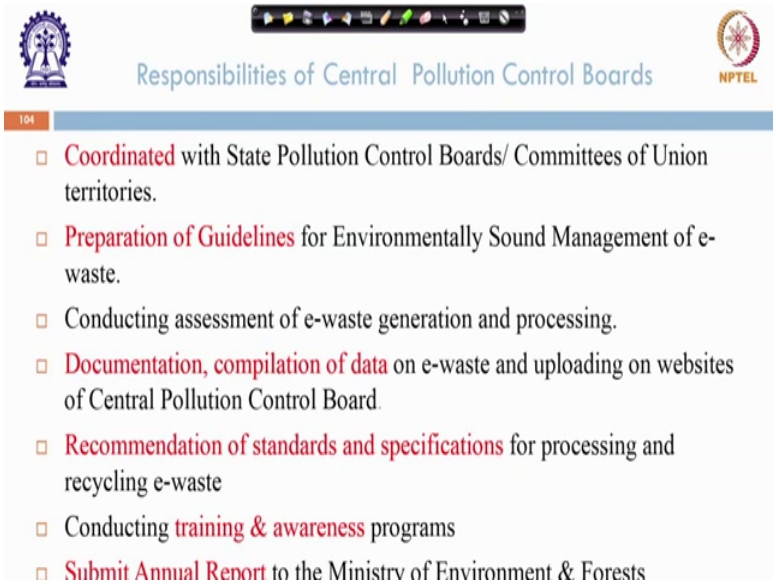

Then central pollution control board similar to SPCB where they have to coordinate this preparation of guideline, documentation, recommendation training and awareness program submit annual report.

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So, those are kind of some of the examples in terms of the management in India very quick if we can look at there are a lot of companies out there.

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And these are all self-explanatory I will just walk through this very soon very quickly.

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E- Parisaraa one of the oldest company is being used in Bangalore which is at working on E- waste.

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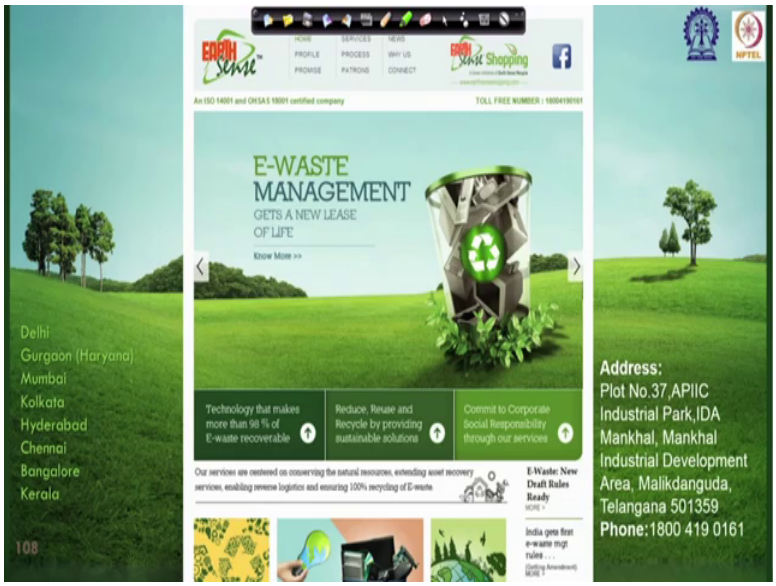

You can Google and you will find all these companies earth sense is the another company which is working on the E- waste area just wanted to list few of them, I am not saying these are the only ones and I am not I am not advocating any particular company.

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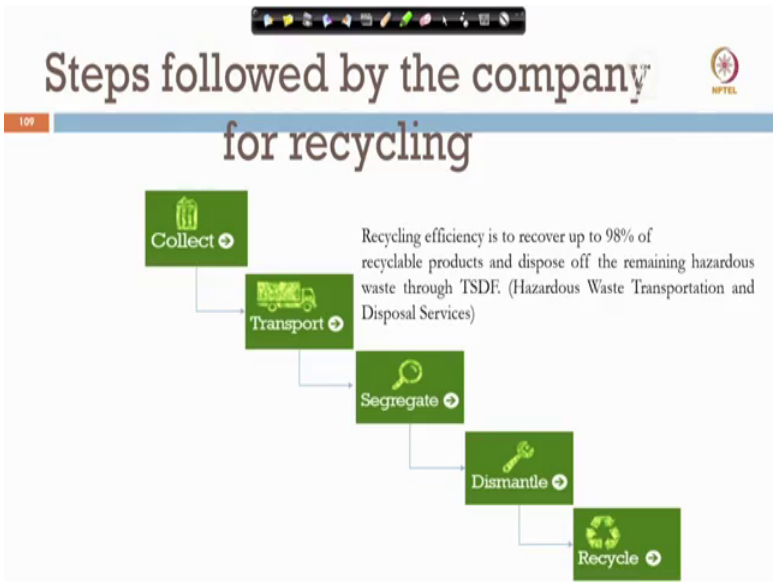

So, I will see I am a academic person I have no interest with any of these particular company just. So, do not think if you see certain company it is not that IIT Kharagpur is advertising for it no, it is just to give you an idea that what are the different there are lots

of companies already set up in India, in different parts of the India who are trying to work on E- waste management.

So, there are again they look at collection transport, segregation dismantle and recycle.

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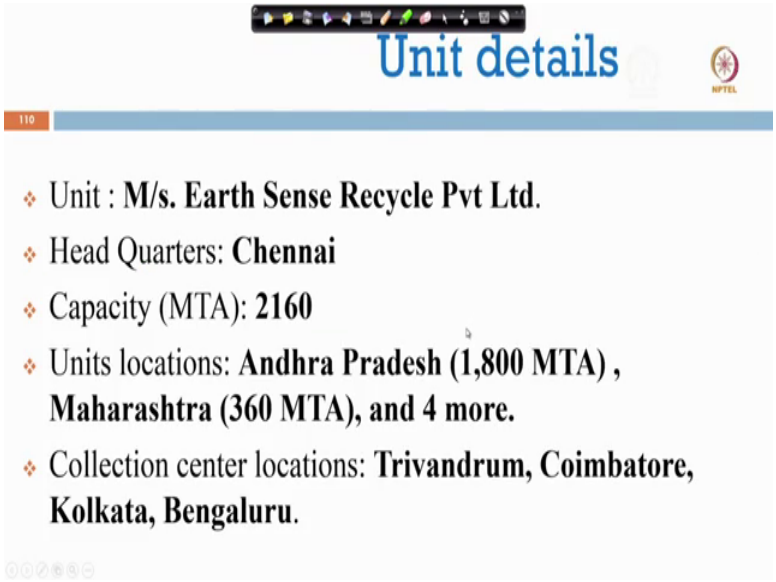

This earth sense which is in Chennai, headquarter local unit is in Andhra Pradesh and Maharashtra and they have some more being collection centers in Trivandrum Coimbatore.

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So, there are some people already working on they then seems recycling solutions Attero.

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Which is a very very famous in the northern part of India, you know I think they have in Roorkee and those areas.

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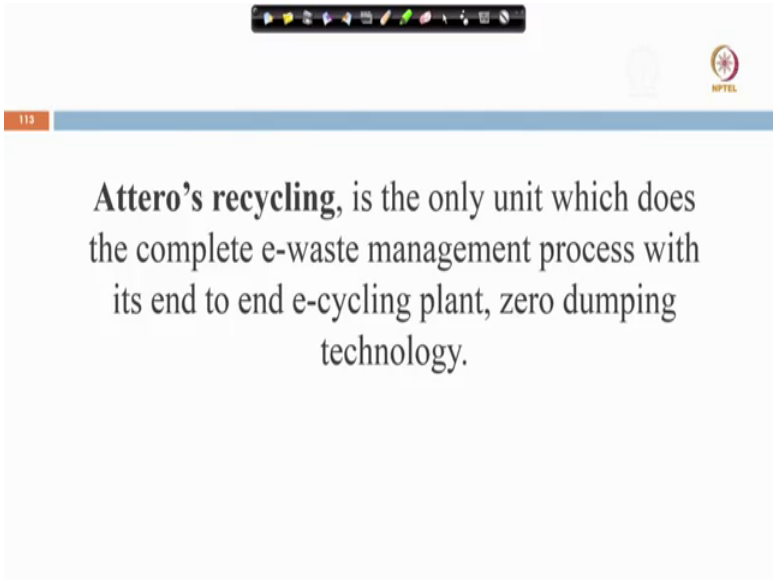

Attero recycling is completely E- waste management and these phrases have been taken from their website. So, you have to take it with a pinch of salt. So, it is a, but it is again atteros clean they have to.

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They can collect from the home they try to recycle it in as environmentally friendly as possible.

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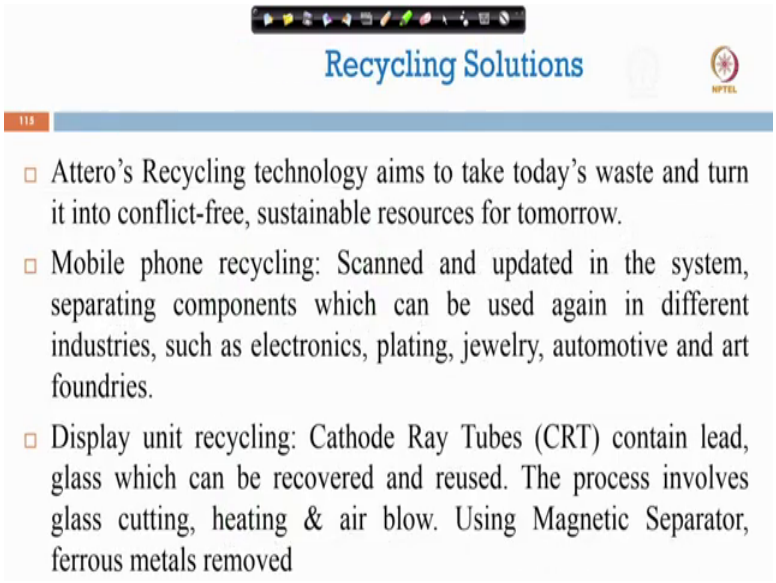

So, they do mobile phone recycling display unit recycling CRT recycling and all that necessary furnace removal.

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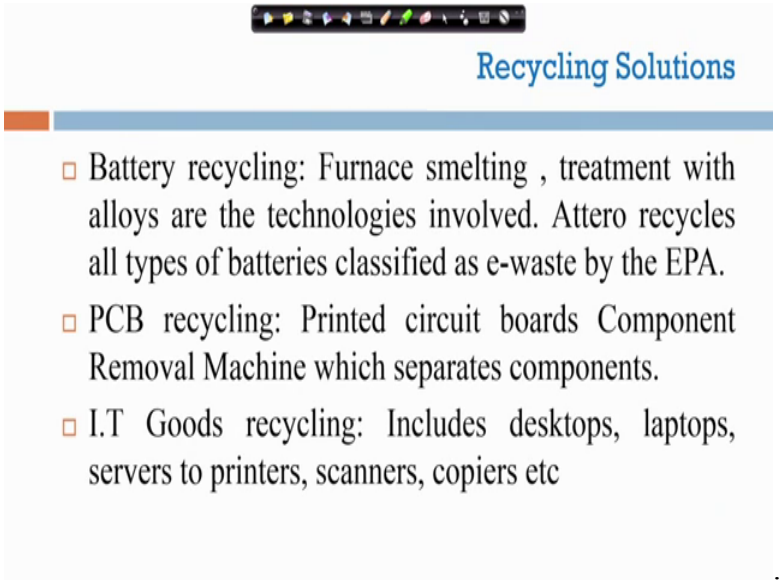

Battery recycling, printed circuit board recycling, it goods recycling. So, they use all those methods that we talked about earlier in terms of different leaching and other stuff. So, they are in Uttarakhand and they have.

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Collection centers in different places.

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Then you have another company it is you have like what it is called it is a they have this based in Bangalore.

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Another E- waste recycles company out there we recycle another one with different collection centers in.

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You have greens greenscape that is another one which is working on this area.

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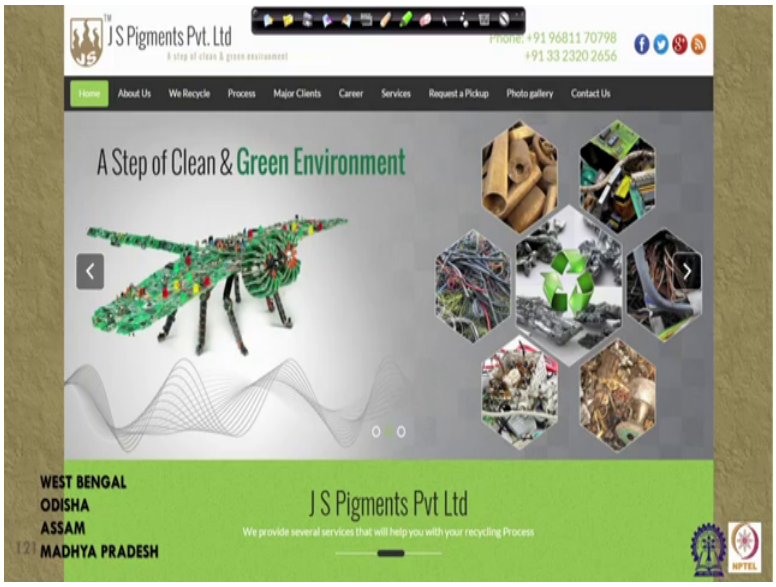

JS pigment which is in Kolkata west Bengal Odisha Assam and Madhya Pradesh and this area they are working.

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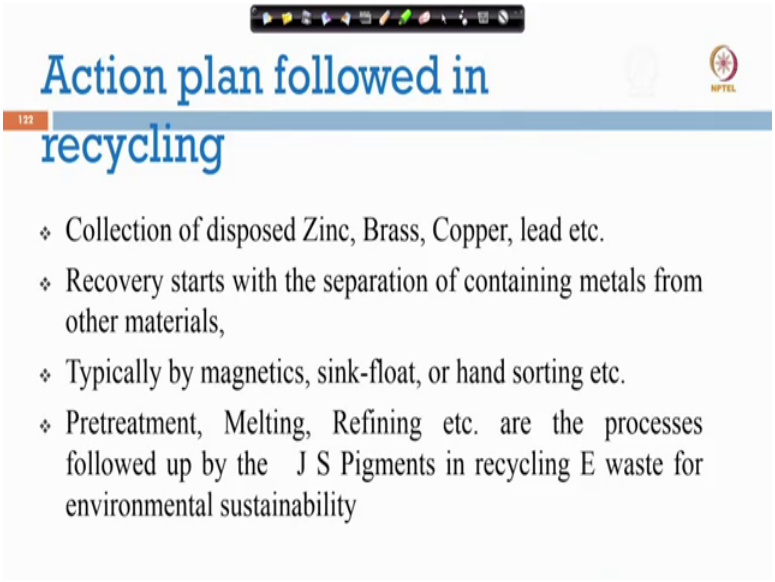

So, all these in this this particular company J S pigment they are working on zinc brass copper lead etcetera, recovery of metals typical magnetic sink float hand sorting all those things that we talked about.

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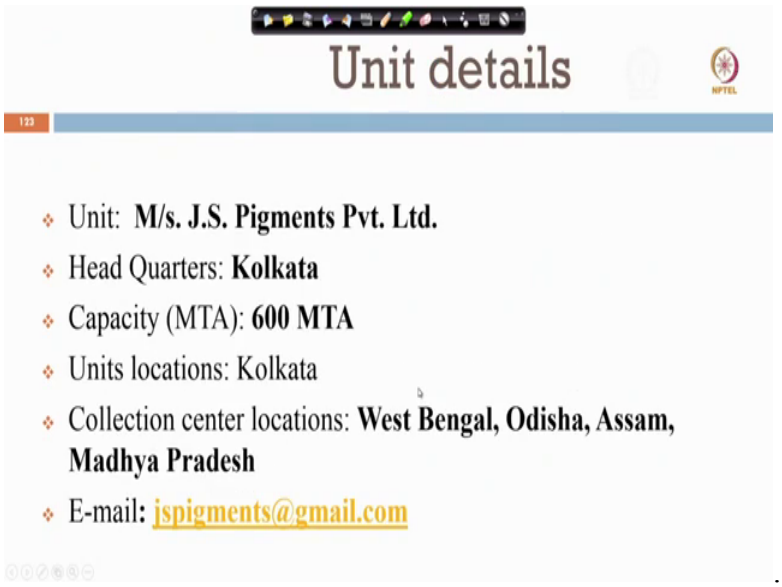

So, their headquarters in Kolkata collection centers in Bengal Odisha Assam Madhya Pradesh at different places they have.

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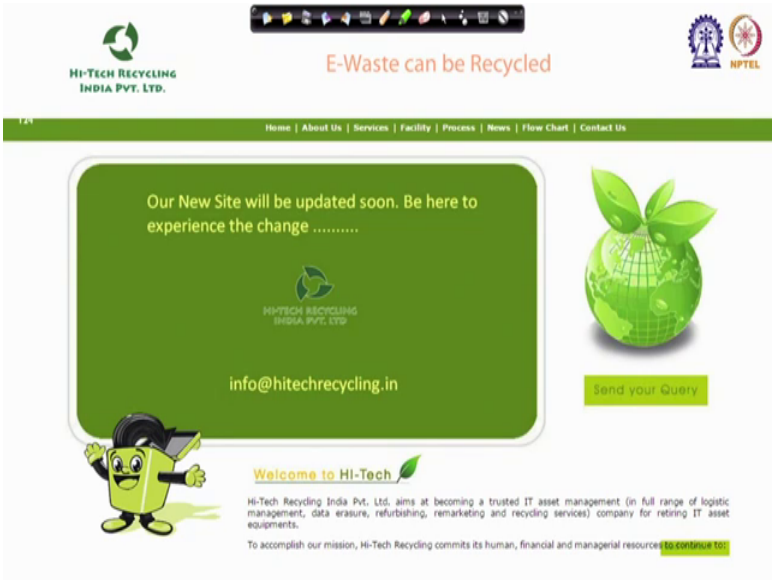

Then high take recycling India private limited similar stuff they have a removal of copper removal of cable assembly rear panel.

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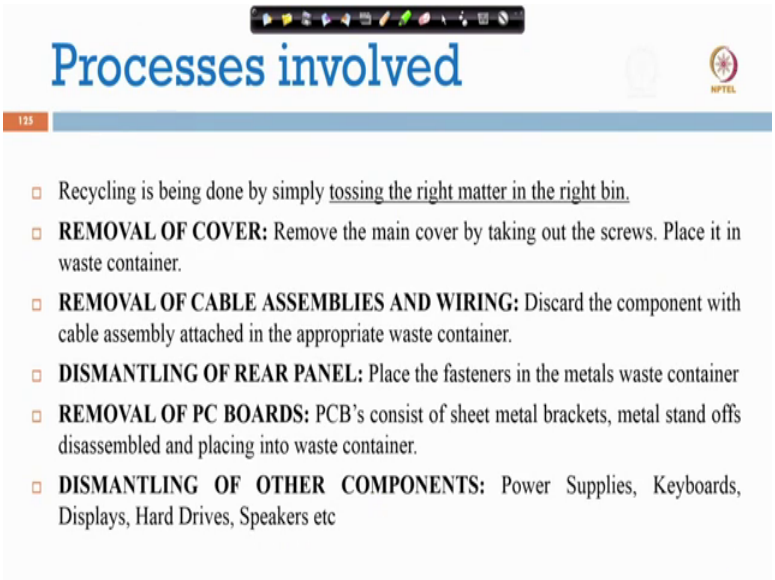

So, most of these you probably you to have I do not know of anywhere I do not think any one of these goes all the way to gold recycling and precious metal recycling. So, earth E-wastes private limited again sorting identified dismantling segregation treatment disposal it is in Gujarat.

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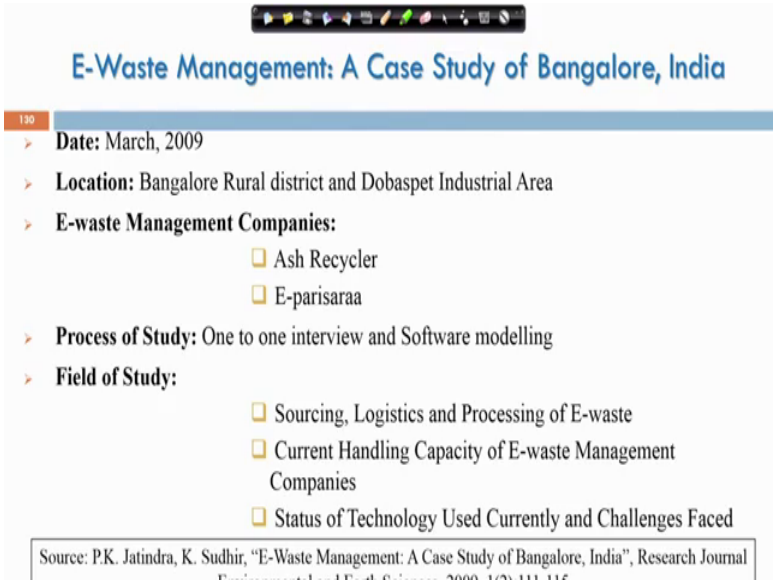

So, let us. So, these are some of the companies just wanted to show you and then we look at a case study of Bangalore India, which we are from this will it start the next week where how the waste is being managed.

So, this is one example of Bangalore the case study has been done this was a study was done in Bangalore just few like a almost now 7 9 years ago and we will talk about that in the next video. So, we will start from here.

So, far again I those companies that are listed it is just for your information process no advocacy of any company here, I just wanted to let you know that there are. So, many companies working in E- waste factor and at these the not the complete list there as Eko Rico I think I was not captured here Eko Rico Mumbai another big one working there.

So, essentially what I am say if there are we looked at the different metallurgical process extraction process, then we talked about rules very briefly rules you should be able to find it in Google we will upload it as a reading material as well for you. So, it should be there and then we will have a question here additional question here just to get your feedback on the rule.

So, with that I think let us close this video and. So, we 75 percent of the course is over next 20 5 percent will be the fourth week and I will look forward to seeing you in fourth

week and hope you are enjoying the course any questions concern contact us through the discussion forum.

Thank you.