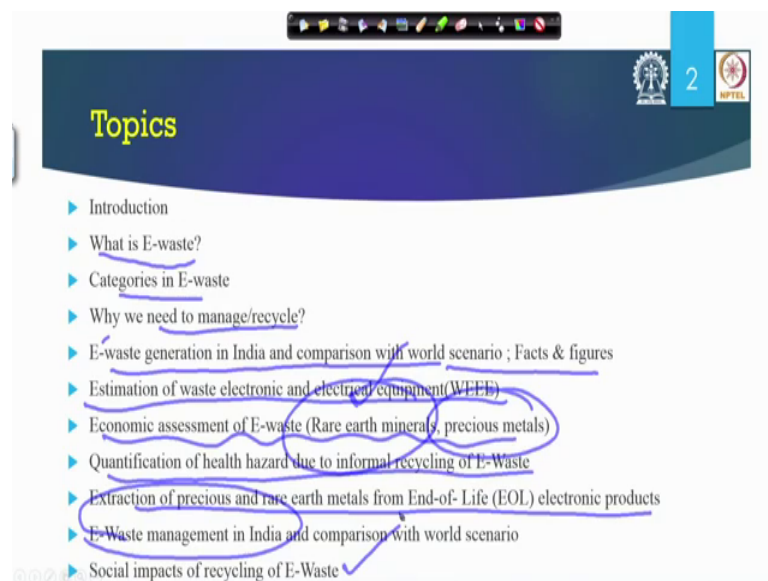


**Electronic Waste Management – Issues and Challenges**  
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**Lecture – 01**  
**E – Waste Overview**

Welcome to this first module of this course on electronic waste management. So, as I explained in the introductory video we will be covering diverse topics within this course it is a 4 week course, it is a smaller course than the other courses you might be taking and you may have taken on N P T E L. So, it is a 4 week, but again as explained in the intro video the format will remain the same there would be weekly quizzes, there those who want to take an exam they can take an exam at the end as well. So, let us get started.

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So, in this first video we will try to give you a this is the in the first week the plan is to kind of give you an overview of the different components which will go into the course and we will be looking at some of the basic definitions like; What is an E waste? What do you what the categories of the E waste? What is E waste, categories of the e waste? Why we need to manage or like why we need to manage or recycle electronic waste? Then it since, I am this is we will try to focus a little bit on the Indian context there are a lot of information out there you can find in fact several reports out there in the literature, when you see look at electronic waste especially in a global context, not much

information is available in from the Indian context and as most of the students I assume almost 100 percent of the students in this course will be from India.

So, we will try to find what we have tried to do what we have tried to do in this course is? Try to collect some information regarding the e waste in India and try to present it to you in a summary form, so that it becomes easier for you to understand what is going on in India what are the situations in India. So, we will talk about M S W management rules, E waste management rules which is we also came along with M S W management rules, we will talk about the E waste generation in India and compare with the world scenario how it in facts and figures, we will try to estimate that is one of the another thing.

If you have taken any waste course earlier or you know that to manage something first of all we need to know how much is off it is out there. So, in terms of electronic waste as well, so when we say E waste or electronic waste we need to know how much E waste is being produced in the country, any country for that matter or if you are doing it for a state or for a city we need to know how much electronic waste is produced say for is in; Calcutta or in Delhi or in Bombay or overall in Indian scenario.

So, how we get those numbers? So what does, so will do a case study of a study done in Kolkata, we did some study in for the focused on Kolkata in terms of how to estimate amount of E waste that would be produced from Calcutta in a year. So, that once we have that number we can do we can plan, so if you want to have a recycling plant how big the recycling plant should be what kind of waste the recycling plant can expect, so for that we need to know how much quantity?

So, there will be an estimation of we will talk about estimation of a waste electrical equipment. Then like how much money is out there? In terms of rare earth metals and precious metals you see precious metals or rare earth metals, how much money is actually there in terms of the electronic waste? Then quantification whatever the health impact; there is lot of informal recycling of E waste is happening, so how many in terms of the health impact, what is typical health impact for electronic waste? Then like a; how to do the extraction, we will talk about that then what is the present status of E waste management in India and socially social impacts of recycling and all that. So, this is just a kind of just to give you an idea of different topics will try to touch upon in this course and this is the and there are some more topics out there as well.

But in the first week and probably part of the second week we will be looking at these particular topics for now and then we will go into how to do the extraction of the rare earth metal, what are the technologies out there? We will also talk about the life cycle analysis part how to incorporate life cycle analysis in terms of the electronic waste management and all that. So, in 4 week since that course is only focused on E waste we will we will go much deeper on e waste management as opposed to if it was part of some other course.

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**Introduction**

- ▶ Waste is an outcome of product or a substance that is no longer suited for its intended use.
- ▶ Hazardous and non hazardous waste.
- ▶ Threat to human health and the environment if it is not handled properly.
- ▶ Industrial, biomedical waste, Electronic & electrical equipment are the examples categories.
- ▶ Highly Required to be disposed off as per national laws.

So, what is what is first of all; what is waste? if you have taken a course on waste management we had a N P T E L course last semester as well on plugin integrated waste management focused on a smart cities, but any waste management course if you have taken in your college or be bachelors degree masters degree you know that waste actually is something which no longer suited for it is intended use. So, when we say waste; it is it is an outcome, excuse me so waste when we talk about the waste it is an outcome of it is an outcome of product or substance that is no longer suited for it is intended use.

So, we do not want that anymore. So, it is an outcome of a product or a substance that no longer suited for it is intended use. So, once you are start once you are thinking of discarding the waste, if you are thinking of you had a product for example; if it will think about electronic waste you had an old mobile phone think about that Nokia 15200 rupees

phone which was pretty good actually I still have one. So, you charge it once and then you do not have to charge it for almost 4 or 5 days, but say I had you got tired of that those kind of phone and at 1.1.

Fine day you have decided to get rid of that, until you decided to get rid of that it is not a waste the day the moment you decide that I do not want it anymore you threw it in the trash can or you gave it to some person you basically you discarded it you may have given it to a Kabaddi wala or old you waste refurbishes. So, as soon as it lifts your position you have discarded that it becomes an electronic waste, so that is; so it is a product or a substance that is no longer suited for its intended use, so whatever what is intended use it is no longer suited, so you are just you for you it does not have any more value left, so that becomes an waste.

So, when we talk about waste, it could be a hazardous waste, it could be a nonhazardous waste, depending on the constituents which is there in electronics, if you just go by the presence of those heavy metals and other stuff and if you do this T C L P test which is done to find out whether a waste is a hazardous waste or not, E waste does fail T C L P for lead for most part and we will talk about that in this course as well I will give you an example of the different test that is being done, so E waste does failed to T C L P test. Now for the sake of promoting recycling of electronic waste, many countries including in India we have decided not to put electronic waste in the category of hazardous waste, because when you put something in a category of hazardous waste it has to it becomes very stringent rules and regulation.

So, if you want to promote E waste recycling, we want that industry to be a bit relaxed like not as they had does not have to go through all that the stringent regulation of hazardous waste management, so they have been put under a category basically exempted from the definition of hazardous waste, so it is to promote the recycling of different components which is present in electronic waste, but part of it could be hazardous and of course, any waste it could be hazardous it could be nonhazardous. And why we had? Would say if in the big picture when we talk about waste management or in particular on electronic waste management, the reason we are worried about that is because of the impact on human health in the environment.

Ultimately say recently if you had followed news just in just like a few like a couple of months ago where and that problem kind of persists over the winter period in many winters we see that, where in you will have issues of the smoke and fog getting together making a smog and if you remember in Delhi we had that even odd scheme, some people may have liked it some people may not, but that is a different matter but why we had to go for that a scheme is because of the air pollution issues, because of again this year as well like this part this winter as well we had that even in the month of November we started having the issues of this like a smoke ah.

If you remember just few months back in the month of November when we were in November 2017; the government in Delhi was saying that it is a public health emergency. So, why would say again do it is all since it is an impact on human health it is impact on environment when we say impact on environment it is impact on water, soil, air, land, so that is why that is that also relates to our human health or they help to us or help to plants, help to the vegetables and fruits that we will eat.

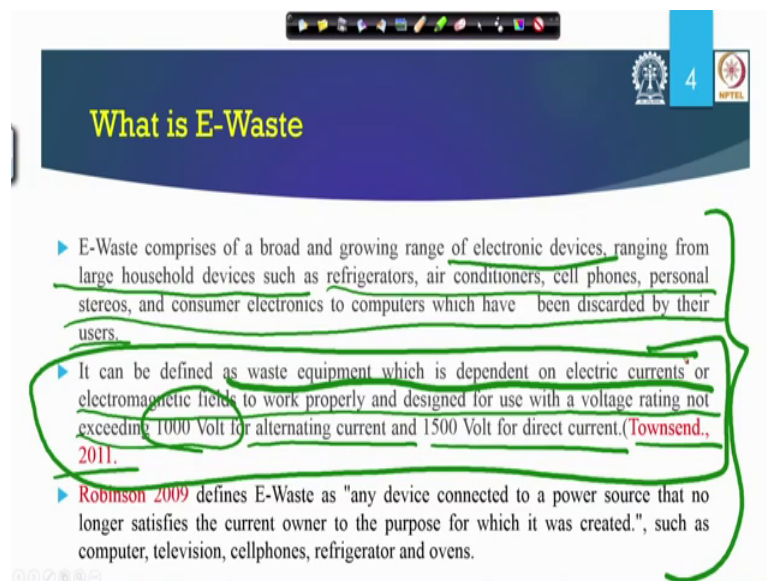
So, that is the reason why we are worried about it we do not want the earth to be polluted and the electronic waste has several heavy metals present in them which is a cause of concern. So, that is the reason why this course is? Why there if you as again in every course in every lecture that I take in the first few lectures I keep on stressing on to the students you should always try to understand why we are and why there is a course? Why we should even a study electronic waste management? So, once you have that clear then you will have developed a curiosity to learn more, you will be interested in this particular course otherwise do not take any course just for the sake of taking the course, if you are taking a course try to understand try to learn something.

So, the reason we are interested in electronic waste is because, electronic waste management if done in a improper way may lead to several contamination; in terms of air pollution, in terms of water pollution, in terms of soil pollution and all these is going to affect us which is the human health and also the environment, when we say environment it is all the floor of you now biodiversity and all that that we talk about. So, that is an then big picture global warming climate change and all those things, but we will we will not go to this right now maybe in the fourth will talk about when we talk about this life cycle analysis and all that.

So, if we do not handle it properly it has a threat to human health and environment that is what I was trying to explain. And there are several waste categories we have industrial wastes, we have biomedical waste, we have wastes from so we have industrial, biomedical, electronic and electrical equipments they are the example of the categories which could be harmful and then there is say there are national laws.

So we have the electronic waste law as well may we have the E waste law which we need to follow. So, electronic waste law is there which we will be talking about in the class we had a E waste rule earlier and in which was revised recently last year in 20 say 2 years ago at 2016, a 1 and half year ago 2016 it was revised so we will talk about both to the previous law as well as what was the new things which was added to the revision we will talk about that in this particular course.

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The slide is titled "What is E-Waste" and features a dark blue header with a white number "4" and the NPTEL logo. The main content consists of three bullet points, each preceded by a blue arrow. The text is highlighted with green lines and a large green bracket on the right side. The first bullet point describes E-waste as a broad range of electronic devices. The second bullet point provides a technical definition based on Townsend's 2011 work. The third bullet point cites Robinson's 2009 definition.

- ▶ E-Waste comprises of a broad and growing range of electronic devices, ranging from large household devices such as refrigerators, air conditioners, cell phones, personal stereos, and consumer electronics to computers which have been discarded by their users.
- ▶ It can be defined as waste equipment which is dependent on electric currents or electromagnetic fields to work properly and designed for use with a voltage rating not exceeding 1000 Volt for alternating current and 1500 Volt for direct current. (Townsend, 2011).
- ▶ Robinson 2009 defines E-Waste as "any device connected to a power source that no longer satisfies the current owner to the purpose for which it was created.", such as computer, television, cellphones, refrigerator and ovens.

So, what is so be is kind of I gave you some idea of what is electronic waste for now, let us look at what the different literature defines electronic waste. So, we will look at what is the definition from the European Union? What is the definition from some of the other researchers who have been working in this field? So, let us look at what are the definition and we will look at some of the examples in next few slides will talk about definition and example.

So, when you look at these slides do not worry too much about having the reason, see there was I was thinking about when we were preparing these slides should I include all

the details here or just I put some bullet points and leave it at there and just talk about it, the reason I decided to put a more detail over here as you can see on this particular slide is unfortunately there is not many books out there on electronic waste and I want you to get some information on electronic waste, so I put some more text here I am not going to read this text in the in this lecture video, I want you to read it so we will make these slides available to you, so that you can go over these slides as a reading material as well.

So, since I will provide you some additional reading material too, but these slides will be provided to you as a reading material, so but if you think about what is electronic waste? It is essentially coming from the electronic devices, it could be large household appliances such as; refrigerators, air conditioner, cell phones, personally studios, consumer, electronics, computers which have been discarded by their user, so it is a broad category, if you think about the European union anything which is a circuit is an electronic waste, anything which has a electrical circuits is a electronic waste.

So they include; refrigerators, dishwashers, washing machines, everything is there, if you go to you north America in the U S definition U S in Canada definition electronic waste does not include these white goods, what are white goods? White goods are your refrigerators, the fridge that we call it or the fridge or refrigerator or dishwasher and all those like a microwaves and other stuff they are called white goods. Why they are called white goods again? For everything ask the why question one thing I really I would write like to stress again and again you will probably hear me saying that many times over these 4 weeks is that always ask questions, do not get do not just take things the that way they are somebody has said that part is it has to be like that and that is true for anything in your life always ask questions.

For example why? Say I said this North America calls it white goods. How? Why white goods? What is because if you remember; refrigerators, dishwashers, microwaves your washing machines when they came to the market for the first time all of them were white in color, so that is the reason they are called white goods it is, so simple is not a kind of thing it is a trivial, but it many times we just say maybe they say that there may be some reason but we should know that too is it always better to know, as a child always we have lots of curiosity when a small child will ask you have if you have a small child at your home or your like a nephew niece or in a neighborhood you see that he or she will ask you lots and lots of questions.

Unfortunately our schooling system is such a way that by the time we go to the primary school and secondary school we stop asking questions, especially in the u g undergraduate students do not ask any questions because they are so much pressurized they think that if I ask questions and if it is a dumb question what impression I will have? especially if it is a coed school people are worried about what that somebody else will think about me they will think that I am a dumb forget about that, if you want to learn something ask question, even asking dumb question is not bad, just ask questions so that you can learn. So, when I am saying ask questions here since it is a video lecture it is an online course for you to ask question go to the discussion forum, so we will have it as we have discussion forum as I explained to you in the intro video as well go to the discussion forum ask questions.

So, I promise you that discussion forum questions will be answered within 24 hours, we will try our best to answer you in 24 hours, maybe someday we may be a little bit late here and there depending on if a lot of other things are going on, but in general we will get back to you within 24 hours if you had a question on the discussion forum, it could do not worry if it is a dumb question ask the question and you may be thinking it is a dumb question, but it may not be it may be very good question. So, go ahead and ask question that that will help you to learn and that is why we have a T A helping with this course as well to help with the logistics of taking care of discussion board and other things. So, go ahead and you do not worry about asking too many questions that is we will be happy if you ask many questions.

So, coming back here, so it is defined as even though any waste equipment, which is dependent on the electric current or electromagnetic field to work properly and for the voltage rating not exceeding 1000 volts, if it becomes more than 1000 volts it becomes a heavy duty machine, so we do not usually we do not manage it in a regular electronic waste that becomes like an a special item. So, 1000 volts for the A C current and 1500 volts for D C and that is the from terms in 2011 which is a review paper very nice review paper it is in the air and waste management association journal, which this review paper you can find it over there so this is how and this kind of follows more of a European union definition here, so anything which has electrical current or electromagnetic field to work with is an E waste.



Now, there was another definition which came out as well, which says in Robinson in 2009 defined E waste as any device connected to a power source that no longer satisfy the current owner for which it was created. So, again kind of combination of the first bullet and the second bullet here, where it says any device which of course works with the power source which is kind of talked about in this one and then which is no longer current owner does not requires it so you are basically trying to discard that, so when you try to do that it becomes in electronic waste as I was explaining to you in the previous slide as well.

So, electronic waste could be broader, since it is a newer waste stream yeah in waste management in general the definition other than for the hazardous waste for non hazardous waste the definition and categories what makes a electronic waste what does not under comes under electronic waste it actually differs from country to country. So, when you are looking at different papers those of you who are I am assuming that, since it is a kind of a specialized course most of my students would be like finally year like B tech or masters students or maybe P H D students or professors working at a different universities.

So, different colleges; so it is a specialized area so when you if you are trying to go into any research in this particular area, so when you for doing any research you need to learn you need to read a lot of literature, so when you read a lot of literature, be sure of where that literature is coming from? If it is coming from the European Union it will follow a different definition of electronic waste, if it comes from India it will follow a different definition of electronic waste.

India is trying to match with the electron European Union definition and if you are in North America the definition may be different so be careful with what definition you are looking at? Because the definition might vary from one paper to another paper and then if you are try to compare this different papers together, you may not be comparing the same thing it may be different things so it is not a what we call not a apple to apple comparison. So, you may be unfair in making those comparisons, so make sure you understand where this study was done and how to take care of those let the details.

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**What is E-Waste (contd..)**

- ▶ With the presence of deadly chemicals and toxic substances in the electronic gadgets, disposal of E-Waste is becoming an environmental and health nightmare.
- ▶ Globally only 15 – 20 percent of E-Waste is recycled while the rest is dumped into developing countries such as India, China and Nigeria.

By 2017, people around the world will be discarding 92 billion pounds of e-waste per year, equivalent to the weight of **126 EMPIRE STATE BUILDINGS**

**E-WASTE**

So, that is what we were looking at in terms of the electronic waste, now, to continue a little bit further we will look at some of the examples as well. So, it is the why again it kind of goes into why we should look at with the because of the presence of deadly chemicals and toxic substances in the electronic gadgets, it is disposal of e waste is becoming an environmental and health like a; when we say health? It is a human health, you are talking about the human health, so it is a human health nightmare.

So, and the other big problem that we are having right now is; globally only 15 to 20 percent of E waste is recycle, only 15 to 20 percent of E waste is being recycled while in while the rest is being dumped into many developing countries such as; India, china, Nigeria. So, there is an illegal dumping of E waste in the name of recycling in the name of sending old electronics, old computers for the poor schools in developing countries we are getting lot of electronic waste coming into the country.

So, it is there is a check on that china now is actually put putting a more check India is also with there are a lot of N G O's and we are now people are more try more vigilant in terms of these activities, but there are people within our country who wants to get these electronic waste to process them and try to recover some of some money out of there. So, there is a lot of E waste coming in and I will talk about that how E waste travels globally?

So, by this year by the last year which is a 2017; people it was say that people will people have discarded may have this study was done a little while ago so that is kind of projects that, so it is 92 billion pounds of E waste per year equivalent to that 126 empire state building, so that is so much of electronic waste. So, if you took the electronic waste of the world and put it in empire state building you will need 126 of them, so that is a lot of buildings you will require.

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The slide is titled "Classification of E-waste (A)" and lists three categories of e-waste. The first category, "Temperature exchange equipment's such as cooling and freezing equipment (refrigerators, freezers, air conditioners, heat pumps)", is circled in blue. The second category, "Screens, monitors (televisions, monitors, laptops, notebooks, and tablets)", is underlined in red. The third category, "Lamps such as straight fluorescent lamp, compact fluorescent lamp and LED lamps etc.", is also circled in red. The slide includes a navigation bar at the top and logos for a university and NPTEL.

E-Waste can be classified as:

- ❖ Temperature exchange equipment's such as cooling and freezing equipment (refrigerators, freezers, air conditioners, heat pumps)
- ❖ Screens, monitors (televisions, monitors, laptops, notebooks, and tablets)
- ❖ Lamps such as straight fluorescent lamp, compact fluorescent lamp and LED lamps etc.

So, E waste it is a big problem and it is a lot of things needs to be handled in terms of electronic waste, so let us will cut off in terms of we will try to look at, how to classify? So it is a big problem I think you understand by this time, I try to give you some definition of electronic waste, some of the why it is big problem there are lot of toxic chemicals and we will try we will go into details of each one of those subsequently. But in terms of before we get into the problem always you have a big problem you try to divided it into a smaller, so that is called classification.

So, you are trying to put it into different categories, so here we will be try to classify electronic waste as some only one is a temperature change, you are trying to change the temperature; that is a temperature change equipment, that is a one such as; cooling and freezing equipment's the refrigerators, freezers, air conditioners, heat pumps so that is your temperature and cooling equipment right there, then you may have a; screen,

monitors, television, laptops, tablets so that is another things in there like it is that is your display devices.

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**Categories of E-waste (Contd..)**

- ❖ Large equipment such as washing machines, clothes dryers, dish washing machines, electric stoves, large printing machines, copying equipment and photovoltaic panels.
- ❖ Small equipment comprises of vacuum cleaners, microwaves, ventilation equipment, toasters, electric kettles and electric shavers.
- ❖ Small IT and telecommunication equipment. For example, mobile phones, GPS, pocket calculators and routers etc.

Lamps such as; fluorescent lamp, compact C F L, L E D lamps so those are also electronic waste, so these are all different classifications of E waste. And going further you can even classify it as a large equipment, we can call it a large equipment it could be a large equipment such as; washing machine, clothes dryer, dishwasher, large printing machine, copying equipment, photovoltaic panels, there could be a small equipment, vacuum cleaner, microwaves, ventilation, you walk into any house today you find lots and lots of gadgets and most of it is electronics.

You go into a kitchen; there will be a microwave, there will be a there might be a many times separate microwaves, separate oven toaster griller, what we call? O T G, there might be some blenders, you will have a mixer and of course, your some other stuff over there as well juicer and food processor and so when some grinders, so you just in the kitchen and then you go down the kitchen go to the drawing room again several things; TV, computers, P D A's, laptop, I pad, mobile phones, several mobile phones, conditioners.

So, you think about that; we use electronics like the media that I am using right now, like I am teaching you from a using a computer, so that is an electronics. Which is this is getting recorded on a camera, which is an a another electronics and things would be

processed on electronic equipment and it would be put on you are watching it on an electronic product to you, whether it is your laptop or your desktop or so it is we are using lots and lots of electronics and that is the way the life is, we cannot just go back and not use any electronics.

So, what is needed is let us try to manage so that when that life of the electronics goes away the and that unfortunately the life is also getting decreasing, earlier if you buy a computer you try to hold on to it for a longer period of time, but these days because of the change in technology new; once you have windows 10 then there will be new windows, the new sign of software's, older system will not work you need more Giga ram you more ram more hard disk, so all these things force us to buy new camp new computers pretty soon.

So around 2 to half to 3 years it is kind of what is estimated a typical life of a laptop or a desktop, even laptop would be currently maybe lower than that and the cell phones is even much lower than that. So, it is so with this will leading to more and more production of electronic waste and because of presence of all those heavy metals which we will talk about, we have to manage it properly it is a human health impact, environmental impact and as well at the same time it is a good resource we can use that electronics waste and recover a lot of have lot of material from there which could be a good job making a industry in the country.

So, coming back to here in terms of the category that we were looking at; so we have the we talked about the logic equipment there are a small equipment, then you may have a small I T and telecommunication for example; mobile phone, G P S, pocket calculators, routers and all those things that we use for our day to day the working.

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So, same thing just presented in some sort of pictures for you to understand a little bit quicker, so we will go over these slides a little bit faster next three slides. So, it could be large household appliances as you can see over here you can have large household appliance, so this is your large household appliances where refrigerators ma this those like a oven that washing machine, microwave, freezers so those are your large equipment.

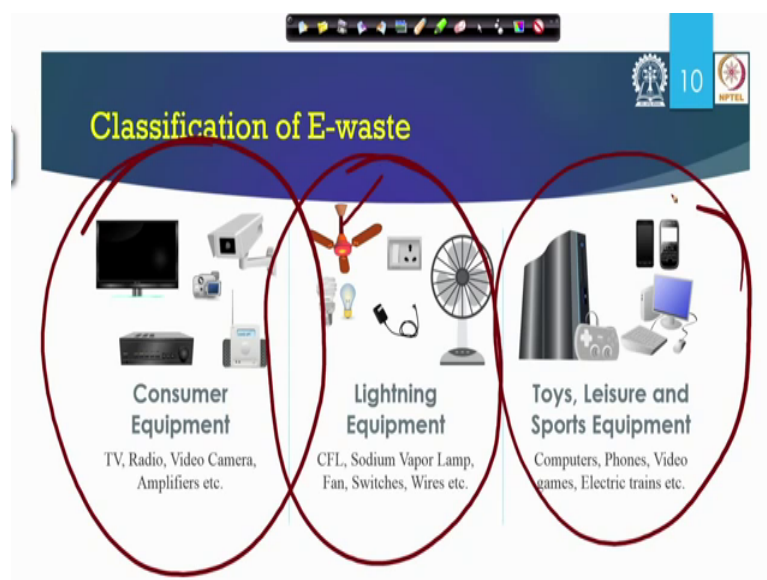
Then you may have I C T what is; we hear a lot about I C T information and communication technology equipment, so you have all these stuff computers, computer peripherals, video games, consoles and all those things are your copying equipment those are our information and communication, then we can have consumer electronics which would be your saver your clock some projectors, pointers, cameras, so those coffee machines, clocks, watches, hair dryers, savers, so they becomes consumer electronics, so there are different again different types of electronic items and when they are discarded they become all of them will become part of the waste.

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Next it is if you look at another classification is could be we have large household appliances, the small household appliances, then we can have electrical and electrical toys so that is another way of defining is we have electrical and electronic toys. So, that is your where we have drills, saws, swing machines, those are our other category out there.

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Then we can also define them in terms of consumer equipment; so T V, radio, video, camera, so this is our consumer equipment's. Then we could have some lightning and

also as well as fans and other stuff, toys, lasers and sports equipment's, so you can divide you can put it into a different classification again it depends on how you want to categorize them? Same item can be put in to different categories. So, in term here we have; C F L, sodium vapor lamp, fans, switches, wires, so those are your lighting equipment toys laser computers phones again videos.

Here also you can have video cameras, amplifiers, T V and radios you can put them into different categories and that is what you will see when you start looking at different literature, when you when will supply you will some information on electronic waste which you will see the different reports from different parts of the world, you see the definitions classification do change that is why I wanted you to see these examples so that you do not get surprised when you see that some report calls it a one way the other report calls it the other way it is just the way people want to put it.

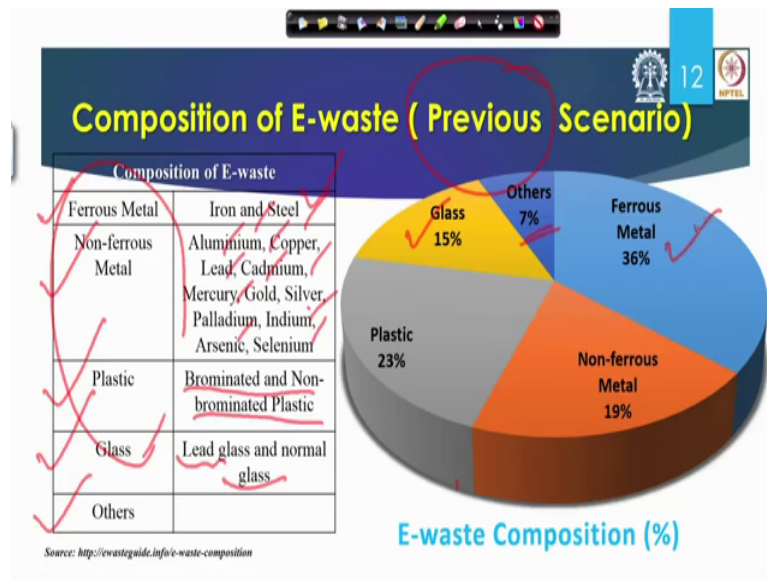
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So, another medical devices we did not have talked about that, so medical device so all the we walk into any hospital these days I C U and all there are lots of things that is being used in those well medical places like; hospitals and other places like radiology, cardiology, neurology, dialysis all these equipments are electronics. Then we have some monitoring equipment like; fire alarms, smoke detectors, thermostats, A T M, coffee vendors, so all these are again another category so those things are all part of electronics and when they get discarded they have all will become part of electronic waste.



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So, in terms of composition of electronic waste and this composition is from the electronic waste produced in India. So, we are looking at; we collected some data from the Indian scenario and this is a slightly older data so I think the in next slide will show you the newer data. So, that is why we are calling it this as a previous scenario, when we say a previous scenario actually this is the data which is from the older literature. So, you will see when you see the both slides and then you will understand why I am calling it previous and what do why I am calling it newer.

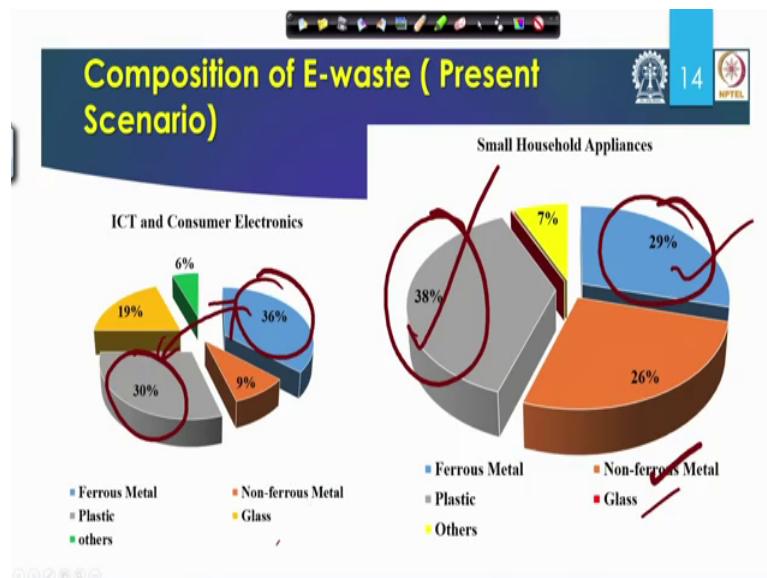
So, if you pay attention to this table and then will look at the pie chart, let us look at the table. So, here we are talking about different categories like; ferrous metal, nonferrous metal, plastics, glass and some others which is present. So, others mean which does not does not include in these categories over there, so ferrous is; iron and a steel, nonferrous of course; aluminum, copper, lead, cadmium, mercury, gold a lot of thing arsenic, selenium, palladium all those things, plastic; there could be a brominated or non brominated, brominated plastics is where the brominated flame retardants, which is to keep it not getting heated not getting catch fire.

Because when you look even if you are worked with your laptop putting in your lap you may have felt that after half an hour or 40 minutes it gets really hot sometimes, if it gets hot the things inside may catch fire, so those plastics may catch fire which is there inside, so there is brominated flame retardant containing plastic they keep the it is a fire

retardant, so it is a it does not let the fire to propagate, so that is it keeps it low. So, that is the reason why it is a brominated or non brominated depending on where the plastic is being used it could be either of either one of those, glass it could be leaded glass where led is also part of that or normal class so those are all these different compositions.

So, now you understand what is the different category? So let us look at the pie chart. So, when you look at the pie chart when we say; glass is around 15 percent, others is 7 percent, ferrous metal 36, non ferrous 19 and plastic is 23. So, now, remember the these two numbers; ferrous metal 36, plastic 23 and with this two numbers keeping that in mind let us look at the next slide why and you will understand why I wanted to look at the next slide keeping those two numbers in mind as you can it is I.

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Let us look at this first and then we will come back to that slide before because I want you to see this slide. So, if you remember there are from the earlier ferrous was higher and plastic was less, now if you look at the in terms of the small household appliances this is the latest data, when I say present scenario like it is also like almost 2 years old, so here if you look at the ferrous metal is 29 percent and plastic is 38 percent, here the ferrous metal is 36 percent and the plastic is also catching up at 30 percent, so it is if you look at the difference between the plastics here plastic has already overtaken ferrous metal and here the difference has narrowed down. So, what is happening is? We are

replacing this more ferrous metal by different kind of plastic that is why the electronics are getting lighter.

Now, why it is important? It is important because when we will when we will looking at the lead chemistry, looking at the heavy metal chemistry between the presence of iron the heavy metal chemistry the other heavy metals which is present in electronics it is a bit different when the iron is not present, their chemistry gets little bit chemistry changes a bit.

So, we will talk about that in a later probably in second or third week, but remember that the newer electronics is having less ferrous more plastic and that is why it is becoming lighter as well it becomes much less heavy as compared to others and we have other categories in terms of we have ferrous plastic, then we have a non ferrous we have glass similarly here we have non ferrous and glass as well.

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Material	Large Household Appliance	Small Household Appliance	ICT & Consumer Electronics	Lamps
Ferrous Metal	43	29	36	-
Non-ferrous Metal	27.67	26.19	9	14.3
Plastic	19.31	37.75	30	3.7
Glass	0.02	0.16	19.3	7.7
Others	10	6.9	5.7	5
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

Source: "E-WASTE IN INDIA", RESEARCH UNIT (LARRDIS), RAJYA SABHA SECRETARIAT, NEW DELHI, JUNE, 2011

So, we skipped one slide so let us go look at and look at that slide and then will close this particular module, so let us go back there and this is let us yes we missed this one. So, in terms of composition of E waste in terms the same thing that you looked at earlier, so if you look at different types of product; so large if you ferrous again we are looking at the same category ferrous nonferrous, plastic and glass. So, large household appliances more ferrous kind of make sense so you when you compare to a small household like; large household appliances and big more steel, more iron there and I C T also has that,

nonferrous is pretty much the same in these two categories it is much lower here and also lamps has nonferrous as well, plastics small household appliances has more plastic compared to the large household, large household as may be it is a bigger mat it is a bigger structured so it needs more stability, so that is why you have more metal that is why you have more ferrous there and then we have a 30 percent and then 3.7 in lamps not much plastic over there.

But most lamps mostly it is a glass; 77 percent glass, here we have around 20 percent glass and then glass is much lower in these two categories, then there are some others category totally it adds up to around hundred percent, so this work was done in June 2011 that is why it was part of that previous scenario not the latest scenario, the latest data that are produced that I showed you into the next slide just slide before this one this slide it is actually data collected over the last 2 years.

So, things are changing our electronic product is changing. So, in this module if you have what is the take home message? So, after every video this in this particular course I will try to summarize it in a briefly in a minute and to basically like a, what is the important point? And the important point for this particular video is we have looked at what is electronic waste?

How to define it? Definition changes depending on where you are in which part of the globe European Union, North America, India definition may dif may differ may differ, so you need to look at the is you need to be careful about that and the nature there are you can classify electronic waste into different categories and once you classify into different the how you do the classification that is also there is no uniformity people may do it in a different way and then at the same time ah.

But the bottom line is that all these electronics the reason why we are worried about them? Because of for the presence of large amount of heavy metals and with the heavy metals could be recovered and could be brought back to economy, so that will be a one option. And if you do not reach that is called like a recycling and recovery and if you do not do it we would put it in a dump site or put goes in an informal sector, where things are not managed properly we have we may end up damaging lots of environmental damages, human health damages and that is why the concern in terms of the electronic waste.

Electronic products are changing, becoming more lighter and lighter more plastic less and less metal and of course, the product leads to discarded products is the waste, so the waste composition is also changing the waste composition is also dynamic as you will see like a even if you just think about your cell phone because everybody re can relate to their cell phone the cell phone design cell phone things keeps on changing so fast. So of course, when it 3,4 years down the line when the cell phone comes into the disposal stream it will again it will have an impact on what how that composition of disposal stream will be; number one product in terms of disposal stream for electronic waste in few years from now is going to be cell phone.

So, right now it could be the C P U's or the laptops which is leading the pack, but down the line 3,4,5 years down the line the prediction is the prediction is that it is the cell phone which will be the number one component in terms of the discarded electronic products.

So, with that let us close this video I will see you again in the next video, again discussion board is there ask questions and we will be more than happy to answer and I look forward to seeing the receiving your comments queries and other stuff through the discussion board.

Thank you.