Plastic Waste Management
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Lecture – 07
Plastic Waste Sources (Contd.)

So welcome back. So, this is the second module for week 2. So, that becomes lecture 7. So, we will continue our discussion of lecture 6 on where we have talking about the Plastic Waste Sources. So, that discussion we will continue in this particular lecture as well.

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So, just to remind you in this week the focus is on looking at sources as well as the production of plastic waste and looking at the global and the Indian statistics. So, you saw this slide in the last video as well just I want to remind you that, that is the focus of this particular week.

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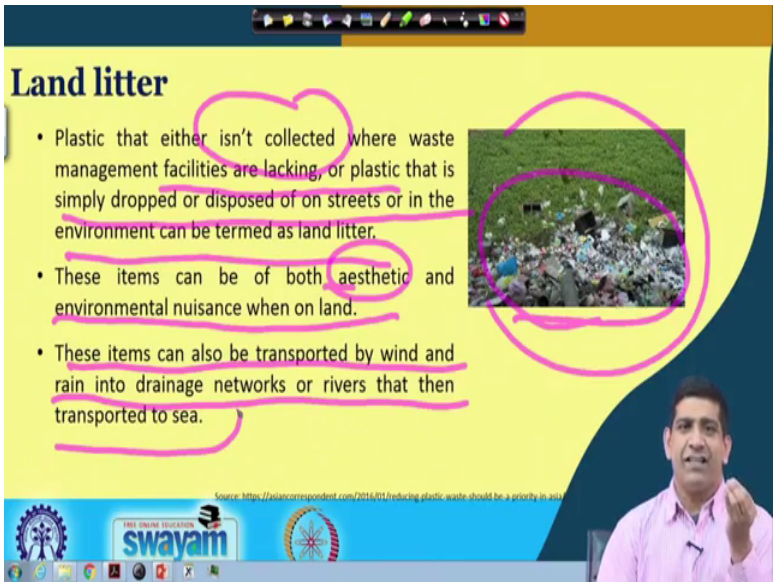

So, in terms of the sources we were talking about the plastic coming from municipal source, plastic coming from packaging industry like packaging and the industrial sources. And therefore, there were other sources out there as well which leads to certain impact. So, there are one of the impact is on land litter.

Now, what is land litter? A litter means when the waste is just thrown away and it is being unmanaged which see it we see it pretty much in many cities on in the country. And as you travel through the train unfortunate part is that, but if you when you travel through the train what you see out of the window many as you approach certain cities or you see that lot of garbage along the track and many times it is actually thrown from the train as well.

So, lot of packaging mostly chips and other packaging that comes with that [FL] and all those kind of stuff that you see so, that is litter. Litter means waste that is not being managed properly and that is what you see in this particular picture that waste is just thrown in the side of the road. Such a beautiful like a greenery on the back, but you see lots of waste on the side of the road that is that is the littering that we call about.

So, plastic that either is not collected where the waste management facilities are lacking, plastic that is simply dropped or disposed on it is streets in the environment can be termed as land litter. So, it is just getting into the land. So, it is an aesthetic problem because it does not look nice, but more importantly it is an environmental nuisance when

on land. Why does the environmental nuisance? Of course, it is just flow around and many times we see that animals especially cows and dog like cows, dogs and goats and other animals getting into that particular littered waste pile and try to eat some food waste which is actually wrapped in a plastic.

And, this consumed those plastic into their body just I think a year or a year before I do not remember exactly when, but a in India itself when in when they on a dead cow when this took that when the cow died for after like a as a old cow and it is died they were looking at the body inside the cows body. So, they basically did that dissection and if they found several kg's of plastic in the stomach.

So, what happens with this is this cows by mistake they consume this plastic especially those thin plastic and that that is stays in their body that does not really degrade in the body, that does not get digested. So, it stays in the body and later on since it is stays in your stomach they do not feel hungry and, but there is no nutrient value coming out of those plastic. And, if when they do not feel hungry and there is no nutrient source going into the body they gets weak although the stomach is full, but it is full of plastic.

So, it and plastic is not providing any energy. So, it kind of helps health leads to the health affect, leads to the animals getting weaker and losing life. And so, that is the that is a bigger problem although littering does not look nice, but at the same time it has lot of environmental nuisance. It gets into the water from this littered waste it per potentially can go from the stream to the river from the river to the sea. And, then it kind of keeps on churning inside the sea gets broken down to smaller pieces and creates problem over there as well.

So, these items suggest can be also be transported by wind and rain into drainage network rivers then transported ultimately to sea. So, that is what is one of the major problem plastics in ocean that is a big problem because, ultimately ocean acts as a sink most of the stuff after ultimately ends up in ocean. So, ocean is acts as a sink and that is creates most of this plastic does end up in ocean which we will talk about in this particular week. So, it is a big deal in terms of land littered plastic. So, can you think about that any the waste that is there on your on the on the road along when you drive to your home or bike to your home you see lot of littered plastic the same plastic maybe in ocean say few months or down the line.

So, it does get transported and when it is ocean it can affect fish lives. If you enjoy eating seafood then you may have this plastic coming back on your dinner plate one day in small pieces. So, of course, you will not like that. So, but that is that is why it is very very important to manage this plastic properly. So, that we do not have those situation. So, that is in terms of land litter.

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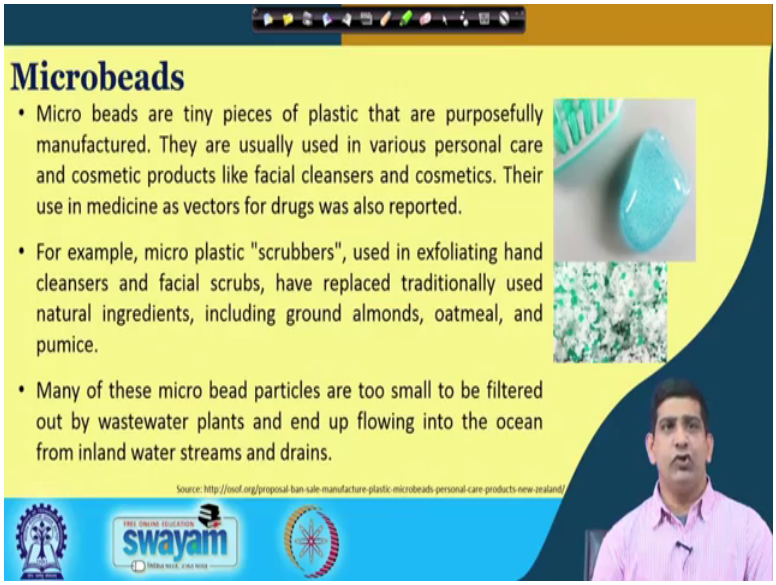

So, microbeads another area microbeads it is tiny-tiny pieces of plastic. If you have used it is scrubber which we try to do our face try to for earlier most of these scrubbers were used it will be naturally stuff like ground almond; almond so, costly now. So, or oatmeal or pumice stone that would be used for these as a microbeads for scrubbing which is trying to take the dead cell out of your skin mostly used in many countries. And, meant like many societies that is common to use those scrub and were if you go to any like a you go foot for any kind of his getting your ready for some big function or other stuff you do that.

So, these are now since rather than using these natural stuff people are moving towards using the microbe tiny bits of plastic. Some of you may not be aware, but this is what is it is they are used in various personal care and cosmetic product; like facial cleanser and cosmetics they are used in medicine as vectors for drug was also reported. So, it is so, micro plastic scrubbers we used in when you try to explore head hand cleanser or facial scrubs have replaced the traditional used natural ingredients which just I mentioned may.

So, many of these microbead plastics are too small to be filtered out of a wastewater treatment plant.

So, what will happen to all those? See if I put a put that is scrub on my face with lots of microbead plastic then I wash my face so that microbead plastic is gone to my sink, from the sink it goes to my like a wastewater treatment system and it ends up in the wastewater treatment plant. Wastewater treatment since these are very tiny particles wastewater treatment plant is not designed to trap these particles. So, it will end up potentially in the affluent or in can go into the ocean from inland waste water streams or drains and when it goes to the ocean again it will start building up over there it will go into the food chain in for the for all the species present in ocean.

And if you are taking soils like salt if you make salt from those area then it may show up in your salt as well. That is why when research was done looking at mashkov plastics in the salt we found them. So, that is it is, that is why it is a base microbeads are actually very very nasty stuff. Many many countries around the world in Europe and other places there started trying to phase out they do not want us to use this microbeads, but it is very popular in Indian context you see all those gluey like a glowy stuff many times when you use them it gets a all over your body you use it for some decoration and others stuff and those are microbeads those are microbead plastics. So, that is you are using you many times we use it without realizing that we are using it.

Even some of these micro plastics are also there in some toothpastes which is kind of have a roughness in there which helps in your gums and other stuff, but then it creates problem when it goes for in the wastewater treatment plant and it could be potentially toxic to the bacteria which is present in the wastewater treatment plant. So, it can have lot of lot of impact on the environment and human health.

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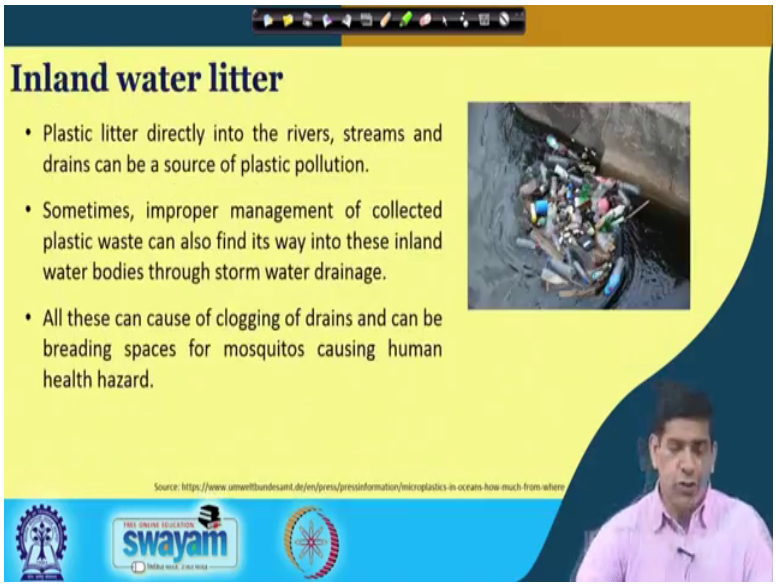

So, then many times you see that you have plastics getting into the water it is not collected properly. So, it will go into the river, the streams and drain and that creates plastic pollution. So, it is this and this plastic improper management of collected plastic waste can also find way into these inland water bodies through storm water drainage.

And, all these can cause clogging of the drain you may have clogging of drain can be breading source for the mosquitoes as well causing human health hazard. So, that is another problem in terms of inland litter that you see happening water plastic getting into the water and creating a problem.

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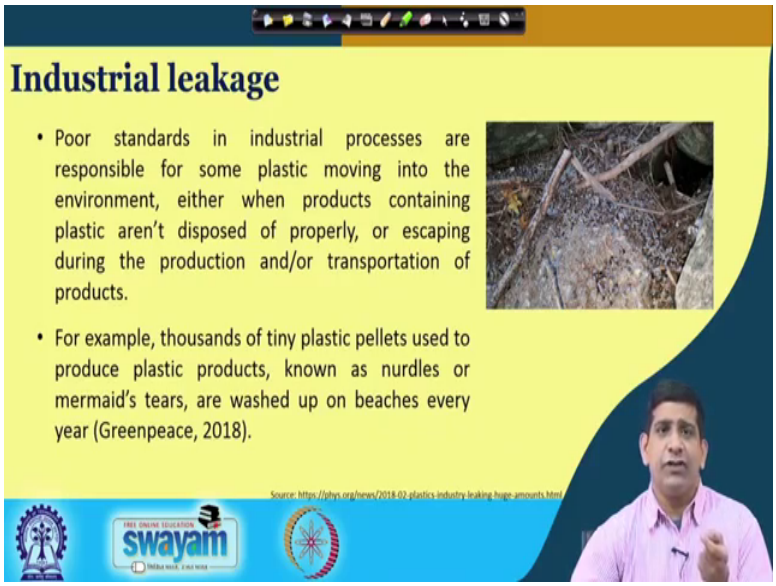

So, industrial leakages where poor standards in industrial processes; so, where you have plastic moving into the environment either when products containing plastic are not disposed of properly or escape during the production where your product producing you use you lost some plastic along the way thousands of tiny plastic pallets used for produce plastic products known as nurdles or mermaids tears are washed up on beaches every year.

So, they are they are basically gets into the beaches every year. So, that is a again these are very very tiny plastic pallets. So, those are your industrial leakages getting into the getting into the ocean.

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Marine litter which is a big deal; so, it is a that is this is how the plastic pollution got attention almost I would say 10 years ago now. So, if you if you were as you have registered for this course if you are taking this course one thing I you should there are so many information out there YouTube has lot of videos out there, but go and look at great pacific garbage patch which we will talk about in this course. But I want you to look at that video from the YouTube it is around 10 12 10 to 12 minutes video which was one of the first video that came out great pacific it is on Pacific Ocean garbage patch.

If you go on your YouTube and just type this or Google and type this great pacific garbage patch you will find several videos out there. One of the initial ones done by a chemist actually who has a I would say rich chemist from South Florida who wanted to really he was he was he used to love fishing.

So, one day when he went out to fish he starts seeing lots of plastic in ocean. So, he thought that we need to really do something about that and he would do something about that the first thing he wanted to know is how much plastic is really out there. So, he kind of started tracking that plastic having his own vessel started tracking the plastic and then also did a stents in a study in Hawaii beaches very pristine beaches. So, called it has to be pristine beaches where not many people are going there, but a still plastics are showing up because the plastic is getting into the ocean and then finally, getting into the shore of those Hawaii island beaches. So, that raised lots of alarm all over the world that

we are not managing this plastic waste properly and they are getting into the ocean they are getting into everywhere and that is going to create lot of new cells.

So, what is marine litter? Again the waste which is litter itself means that waste that is being not managed properly just thrown away just it is littered away, so, that littering and. So, marine litter is human created waste that has been deliberately or accidentally. It can happen deliberate or accidentally were released into the sea or ocean during shipping fishing or aquaculture. So, when you go for holidays when you go for visiting beaches you go for this you can dispose disposing of bottles and food packaging on the sand also directly contributes to plastic getting into the ocean.

So, when we started thinking about marine litter people thought that maybe it is all the people all the when we go for beach here we should collect all that garbage we should not let that garbage go into the ocean that is a very good thing to do. And, that should be done we should not leave the waste on the beaches so, that it gets like sucked into the sea. When we have high tide, when the water is coming into those especially during the evenings when you see the water actually coming inland you many of those waste will go into the ocean. So, that is we should not let that happen.

But even if you do not even if that does not take place it is still because of improper management of plastic globally in many developing countries and leakages from developed countries as well plastic does end up in the water bodies and as we know most of these surface water rivers and other stuff ultimately drains into the sea. So, that is where the plastic ends up. So, plastic and sea act as a sink for this plastic waste.

So, we see floating ocean debris tend to accumulate at the center of guys and coastlines frequently washing around for when it is known as beach litter or tide rack whatever. So, it is a that is what the marine litter is all about we get lot of marine waste especially lot of plastic is showing up there you go again. Go and Google and look at marine litter look at the marine plastic problem you will find lots of pictures lots of videos out there.

And you should watch those videos and it is and then try to get more information because, not we cannot play those videos in this at the part of this course; I am you need to go and look at those and if you find some good video post it on the discussion board the link for it. So, the others can enjoy others can see it and others can learn from that as well.

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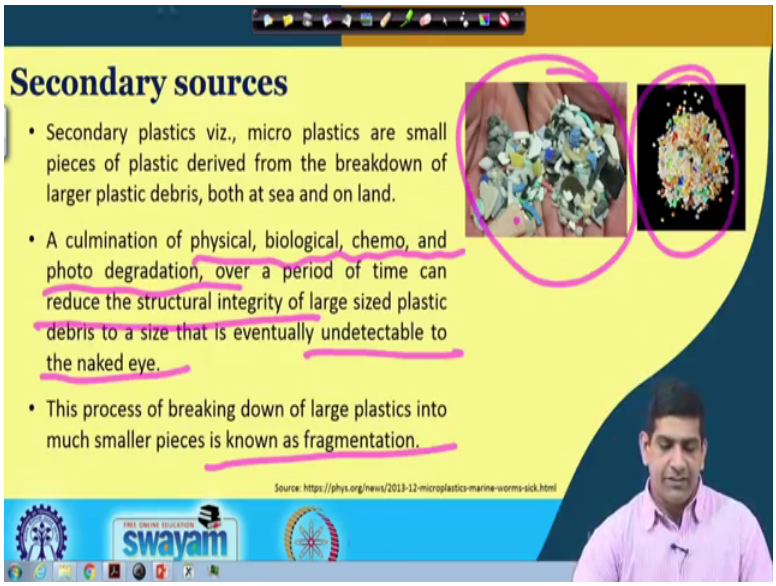

Then there are certain secondary sources. Now what is secondary sources? Secondary sources are the micro plastic they are the small pieces of plastic derived from breakdown of large plastic debris it could be both at the sea in the land. So, because of the disintegration of plastic over time you are getting smaller plastic that are being made as you can see over here in this particular picture you have lots things have broken down the you can see small-small pieces of plastic.

Similarly here as well you see that is smaller pieces of plastic after the bigger plus b from the b it is basically derived from the bigger pieces after breaking down that could be because of physical biological chemical photo degradation over a period of time. So, because they that leads to reduction in a structural integrity of the large sized plastic and eventually it becomes a smaller and then it gets into the size which is undetectable to naked eye and. So, that is then it becomes really a problematic because we do not know it is there.

So, this process of breaking down is known as a fragmentation which we to use the term earlier as well where the large plastic gets into the smaller pieces and it is smaller the pieces more the surface area more and it can get into say if it is smaller pieces of plastic is there in our ambient air which we cannot see with the naked eye it can get into my body as well. So, a smaller pieces of plastic can get into the water that I am drinking oh

so, that is that is those are because, it cannot be filtered out it is a very very tiny pieces. So, that is that becomes a really a nuisance that becomes really a health hazard.

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So, let us look at some this particular will I spend some time on this particular picture and I will try to explain this to you unfortunately the picture is some of the text is too small, but I will read it and then I will try to write it on the side as well and you will have these slides. So, you when you watch this video I would also encourage you to look at the slide at the same time and will have full picture for like a full one slide per page PDF uploaded for each week. So, you will have those with you as well.

So, when how the plastic is flowing from land to ocean? So, that is the whole process we are trying to explain using this graph and this was done as part of a report done in UK very nicely done. So, we thought we will just use that. So, here is the source and again I would like to highlight that for every for every lecture videos for every lecture every week we have used lots of pictures and many of those pictures are not our own pictures. So, we have put the sources at the bottom here which you should do in whenever you are doing any presentation since this we are using it for educational purposes, it is if I am using it for commercial purposes I may have to pay as well to these reports.

If I am selling there I cannot sell this picture so, but since we are using it for educational purposes it is ok, but it is always you it is not it is its actually kind of mandatory that you have to list the source. So, every slide we have the source at the bottom wherever there is

a picture used which is not our picture which our means developed by me or my TA in the in our department here at IIT Kharagpur. So, those sources are there I you need to if you do not have the few if there are certain things on this picture which you do not understand go on the source that this most of these as are coming from reports. And that report explains it in more detail how these pictures will derive we will try to do that here.

But if we miss something you of course, put it on discussion board even after that you do not you want more information go at these like a as websites and look for more information. So, that will help you. So, coming to the topic here; so, plastic waste flow from the land to ocean. So, in so, here the focus is where do the plastic come from and where do they go. So, that is what. So, here we have some land based the inland sources are there. So, land based sources this much you have land based which is coming from day to day activities wastewater treatment plant and all that then there are some land based coastal a sources where people going to the beaches. So, here you have 9 million tons per annum. So, it is estimated that 9 million tons per annum of plastic waste is going into the ocean.

From the beach activities that is happening globally so that much plastic is going into the ocean from land based it is around 0.5 million turn for annum. So, from the land based sources from the inland sources we are getting 0.5 million tons which is much guy comparatively is less than I would say compared to if you look at the coastal activities. It is much less there is even less than 10 percent of that, but it by itself it is a significant amount as well 0.5 tons per annum.

Now, total and then we have at sea what is the source? It could be the fishing litter. So, when you go out for fishing many times you are things breaks down you just leave your there you have a big fishing net you think you just somehow you lost it some accident and you could not you do not bother it to take it out from the ocean you just leave it there. So, that is your fishing litter and the other is your shipping litter when you are sipping the through you just through lot of stuff lot of packaged food and other stuff that you are using on the ship you are just dumping into the ocean. So, with so, many shipping containers now going over the ocean from different parts of the world around 0.6.

So, if you look at that number actually sipping litter is more than what we are getting from the land based litter. So, think about that 0.6 million tons per annum which is point ten more 0.10 more then what is coming from the land based litter. So, this is 0.6 value over there and then this was your 0.05 million tons per annum. Then you have some beaches we have total how much beaches it is around we are getting a lot of stuff which is coming from 2000 kg per kilometer square like 5 percent of the total.

Then we have ocean surface which is around 18 kg per meter square kilometer square 1 percent of the total that is what the concentrations are. So, this these are on this side is what is the concentration of where it is where do they go here in this side we have where do they come from on say if I can draw a line here I think something like that may not be, but anyway. So, on the left is what is where do they come from on the right is where they are going. So, they are in they are in the beaches around 2000 kg per kilo meter square, 5 percent of the total is ends up in the beach soil that you get over there, ocean surface is getting around 1 percent of the total which is 18 kg per kilometer square.

What you see in the ocean surface which is actually bad for this for the fish and other stuff, because many times when these plastics are broken down it is there on the surface fish things that it is a food. And, they eat those plastic because the thing that it is like a small fish, because there becomes a shiny small particles. And, then the bigger fish eats the small fish that is how plastic keeps on going up the food chain.

Then at the seafloor which most of the sea flow. Seafloor is actually acting as a sink we seafloor the concentration is 70 kg per kilometer square. So, that is what is there in the seafloor lots of plastics on the seafloor. So, 70 kg per kilometer square which is considered which is close to 94 percent. So, 94 percent of the plastic is ultimately is getting into the seafloor on the seabed where we have this plastic just sitting there then we have primary micro plastics as well if you look at the we will talk about that in a minute. So, in terms of so it, so, we if you with the focuses where do they come from and where do they go.

So, total plastic entering the marine environment is 12.2 million tons per annum; so, 12.2 that is the data right here. So, 12.2 million tons per annum is coming into the environment and ultimately into the marine environment. And, the which is kind of gets distributed in summer stays in the beach some goes onto the ocean surface and the

different layers of the ocean. And finally, at the bed of ocean you have 94 percent and rest of 6 percent is kind of divided as in a point. But 5 percent was on the beach and 1 percent is in the ocean. So, in the waters so, 5 plus 1 6 and the 94 percent in the bed so, total 100 percent. So, that is what the distribution that based on the data collected source that that is a where.

So, it is mostly plastic mismanage plastics are ultimately ending up in the ocean. So, that is why we are worried about in terms of it is a lot of its a huge impact on plastic pollution on ocean. That is why national geographic if you have followed national geographic recently in June of this year on the world environment day around they did a plastic in ocean like plastic or planet that that report is also out there. And, they are also planning to do some work in Indian contest which I will be involved as well will do some work will do. So, actually will go along river Ganga and that is part of my research and hopefully if I can share some experience from there hopefully it that most likely will happen after this course is over.

But those of you are interested we can talk about that later, but that is a that is where we will be tracking plastic getting into Ganga from all the way from Rishikesh Haridwar to Howrah to where it they like Hooghly river. We will try to quantify how much plastic is getting into river Ganga from mismanaged sources of the municipal solid and other sources that we that we have along the river Ganga. So, that is a huge project it will be done starting sometimes in February march of 2019, we will start that and then it will continue as probably for a year or it most slightly to be a 2 year project we are still working on details on that. So, you saw that how where the plastic is being produced and where it is end up plastic waste.

Then one of the component of was the primary like a micro plastic. So, how much let us look at some of these micro plastic which is very very important in terms of source of this micro plastic we have in terms of let us make a new one. So, that is the micro plastic we are looking at. So, it is around point nine five million tons per annum. So, since they are micro its sizes are small. So, weight is also small all the data is as per weight. So, 0.95 million tons per annum of micro plastic that is getting into the into the environment out of that we have some what are the sources we are getting cosmetics we have some marine plants which has some plastic as well.

We have road paint, building paints, textiles many textiles use plastics pallet spills vehicle tire dust. So, vehicle tire dust is actually there and they are all in 1000 tons. So, vehicle tire dust is 2070 tons then pallet spills is 230 then we have textile is 190 190000 tons they are not in million they are in 1000 and then we have building paints road paint cosmetics. Cosmetics 35000 tons; 35000 tons of prime micro plastics are used in cosmetic industry and these are all per area.

So, this is per year figure. So, think about that if you whenever you use some cosmetics you are actually you possibly are using some micro plastics. So, look at that label a bit carefully. Then you have the marine paint which is also carried marine paint means the paint which is used for those boats and other stuff from the board from the whole big-big ships, the ships that we have they are all painted and that that will have little bit of plastic like microbeads micro plastic which will leach off into the ocean. So, that is kind of another sources.

So, this is kind of gives you a how the plastic waste is flowing from land to ocean and which is leading to all those great pacific garbage patch and other stuff which will be talking about in the coming weeks so, in the coming videos as well. So, that is a kind of they will continue this discussion with some other studies this is the one study based in UK. So, we will what will do is we will continue this discussion in terms of where how the plastic is moving globally and that that will continue looking at that in the next video as well.

So, in this particular video the focus was in the first it so, this say I am trying to summarize every video just for if like a minute or so, to give you a good idea. So, in week two we are looking at plastic waste sources how the plastic is moving the plastic waste is moving. So, in the first video we talked about the sources in the second video we started looking at like a movement of plastic waste globally how the plastic is getting from land to sea and water and different species.

So, we will continue that discussion in the next one and then we will start looking at some more details some more global reports. Again look at the discussion board and answer put the questions out there put any and we will be happy to answer that any questions any concern let us know.

Thank you and I hope, you are enjoying this course so far.